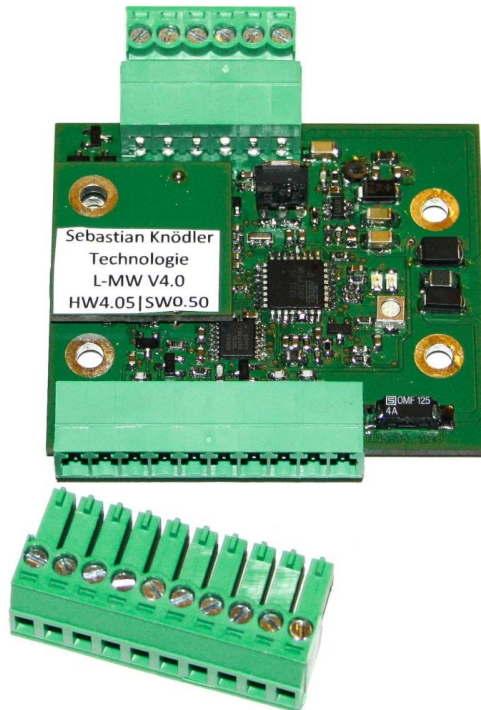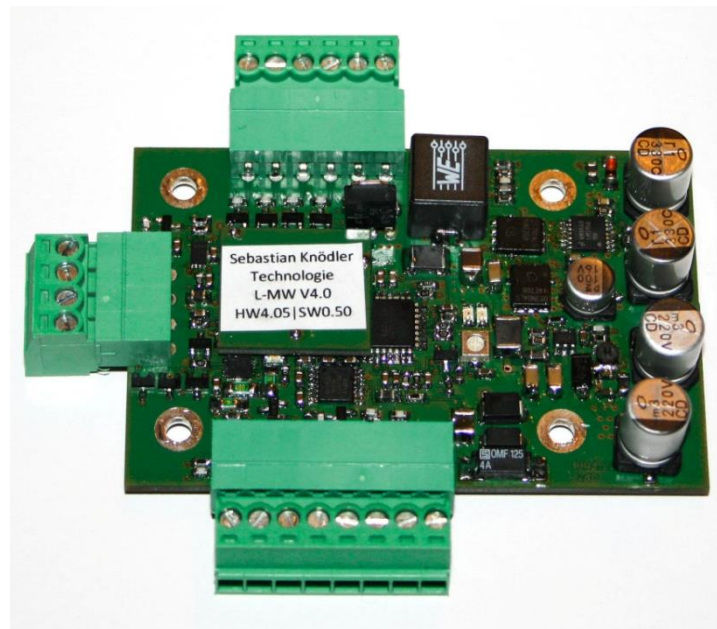# Lambda-Messwandler Version 4.x

L-MW V4.0 and V4.1

12 Volt Version:

24 Volt Version:

Common hints regarding this manual

Please note that this manual is only valid for the Lambda-Messwandler Version 4.0 and 4.1.

The Lambda-Messwandler has been strongly improved compared with the predecessor Version 3.x. Therefore neither the connection scheme nor the software features are common with the new Version 4.x.

If you are not sure, which version of the Lambda-Messwandler you own, please contact the support (details in Chapter 13).

Document history

Date of change	Responsible	Description
14.09.2017	Knoedler	Translation into English

Content

1   Lambda-Messwandler

This chapter should bring you a brief overview over the features of the Lambda-Messwandler V4.x.

Connectors, LEDs and potentiometers placed on the controller are explained here. Furthermore the differences between 12 Volt and 24 Volt Messwandler shall be listed.

1.1   Overview

Following functions are available in 12 Volt and 24 Volt Versions:

- **Measurement of Lambda value**
  The main function of the Lambda-Messwandler is to control a Wideband Lambda Sensor and to give it out over an interface.
  It is an analog (voltage and current) as well as a digital (serial interface RS232) interface available.
  For operating the Lambda-Messwandler there is no connection to a PC necessary. For starting the measurement a simple jumper is sufficient.

- **Ideal and save operation of the Wideband Lambda Sensor**
  To ensure a long lifetime of the used Wideband Lambda Sensor several protection mechanisms are implemented into the software.
  The operation and heating up of the Sensor is done strictly as specified by Sensor manufacturer.
  To reduce the risk of damage due to thermo shock caused by water droplets the Sensor is preheated with small heating power until no water is contained in the exhaust gas at the sensor position anymore.

- **Provide an adjustable Narrowband Sensor Signal**
  The Lambda-Messwandler can emulate a Narrowband Lambda Sensor signal. Depending on the measured Lambda value a voltage is given out which equals the voltage of a Narrowband Sensor.
  The point where the voltage drops from "Rich" to "Lean" can be adjusted with a build-in potentiometer.

- **Extensive diagnosis of Lambda Sensor and electronics**
  Short circuits on the sensor lines, wrong operating conditions and extreme environmental influences are read by the Messwandler and given out with so-called error codes over the serial interface.

1.2   Comparison 12 Volt and 24 Volt variant

The Lambda-Messwandler in Version 4.x is delivered for two power supply voltages (12 volt and 24 volt).

The 24 volt variant is optimized for the operation in industrial environment (e.g. co-generators CHP, heating stations, etc.).

Parameter	12 Volt	24 Volt
Power supply voltage	11 to 16 Volt DC	22 to 28 Volt DC
Digital Interface	Serial (RS232)	Serial (RS232)
Analog Interface	0 – 5 V Output	0 – 5 V, 0 – 10 V and 4 – 20 mA Output
Emulation Narrowband Sensor	✓	✓
Start-Input 24V compatible	✓	✓
Error-Output voltage	5V, 12V or Open Collector (NPN)	5V, 24V or Open Collector (NPN)
CE conformity	✓	✓
RoHS conformity	✓	✓
EMC conformity	Better than: EN-61000-6-1 EN-61000-6-2 EN-61000-6-3 EN-61000-6-4	Better than: EN-61000-6-1 EN-61000-6-2 EN-61000-6-3 EN-61000-6-4
PCB dimensions	From Dec. 2015: 54mm x 48mm Until Dec. 2015: 54mm x 46mm	72mm x 48mm

Table 1: Comparison 12V and 24V variant

The differences in the variants are only related to connectors and hardware. Software features are identical in all variants.

1.3   Connectors

On the Lambda-Messwandler PCB are following connectors available:

- 6-pole connector for Wideband Lambda Sensor
- 12V variant: 10-pole connector for power supply, in- and outputs, 0-5V analog output and Narrowband Sensor emulation
- 24V variant: 4-pole connector for Narrowband Sensor emulation, analog 0-10V and 4-20mA output
- 24V variant: 8-pole connector for power supply, in- and outputs and 0-5V analog output

The connectors are realized as pure soldering pads or with variable screw terminals.

1.3.1   Connectors, LEDs and potentiometers: 12V variant

Abb. 1: 12 Volt variant

| Analog output: 0-5V; Narrowband | Start Error | RS232 connector | 11 – 16 Volt power supply |
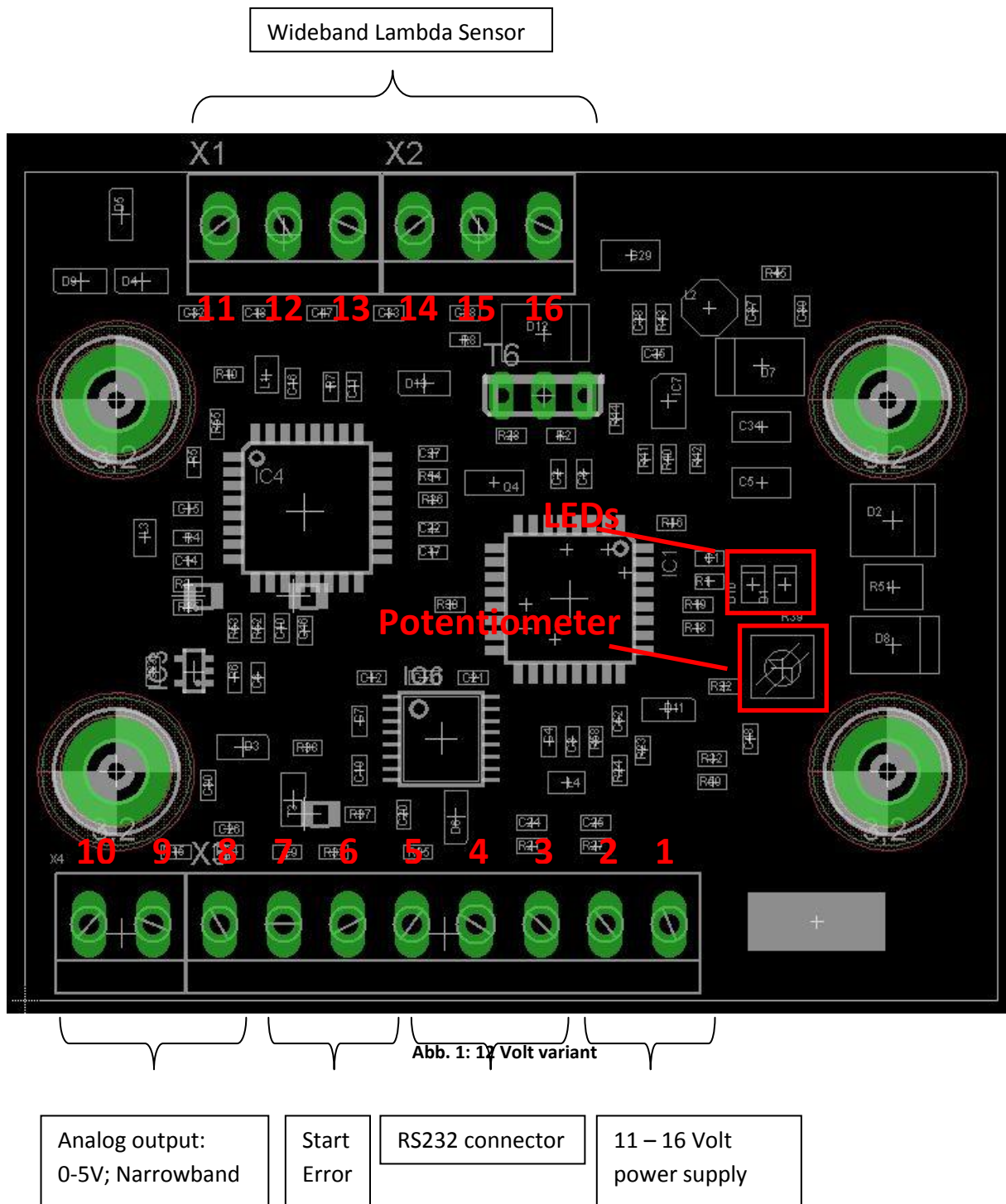
LEDs: Two LEDs are available on the PCB of the Lambda-Messwandler. One green and one red:

The green LED has three different states:
On – The Lambda-Messwandler is connected to power supply and is in Stand-By Mode.

Flashing fast – The measurement has been started over the start input or over the digital interface. The Lambda Sensor is now heated up to operation temperature.

Flashing slow – The measurement has been started over the start input or over the digital interface. The Lambda Sensor has reached its operation temperature and the measured values at the interfaces are valid now.

The red LED is only on if an error has been detected. The operation of the Messwandler is not possible as long as the error is existent.
Typical errors and their fixing are described in Chapter 10.

Potentiometer: The potentiometer (= adjustable resistor) is used to control the Narrowband Sensor emulation.
With the potentiometer the "jumping point" of the Narrowband signal can be adjusted. This point is for Narrowband Sensors at $\lambda = 1$ (AFR 14.7). With the potentiometer this point can be shifted into rich ($\lambda < 1$) or into lean ($\lambda > 1$).
The shifting can be done within the range $\lambda = 0.85$ to $\lambda = 1.15$ and AFR 11.6 to AFR 17.8.
The specific range depends on the used software.

Abb. 2: 12V Potentiometer

1.3.2   Connectors, LEDs and potentiometers: 24 Volt variant

Abb. 3: 24 Volt variant
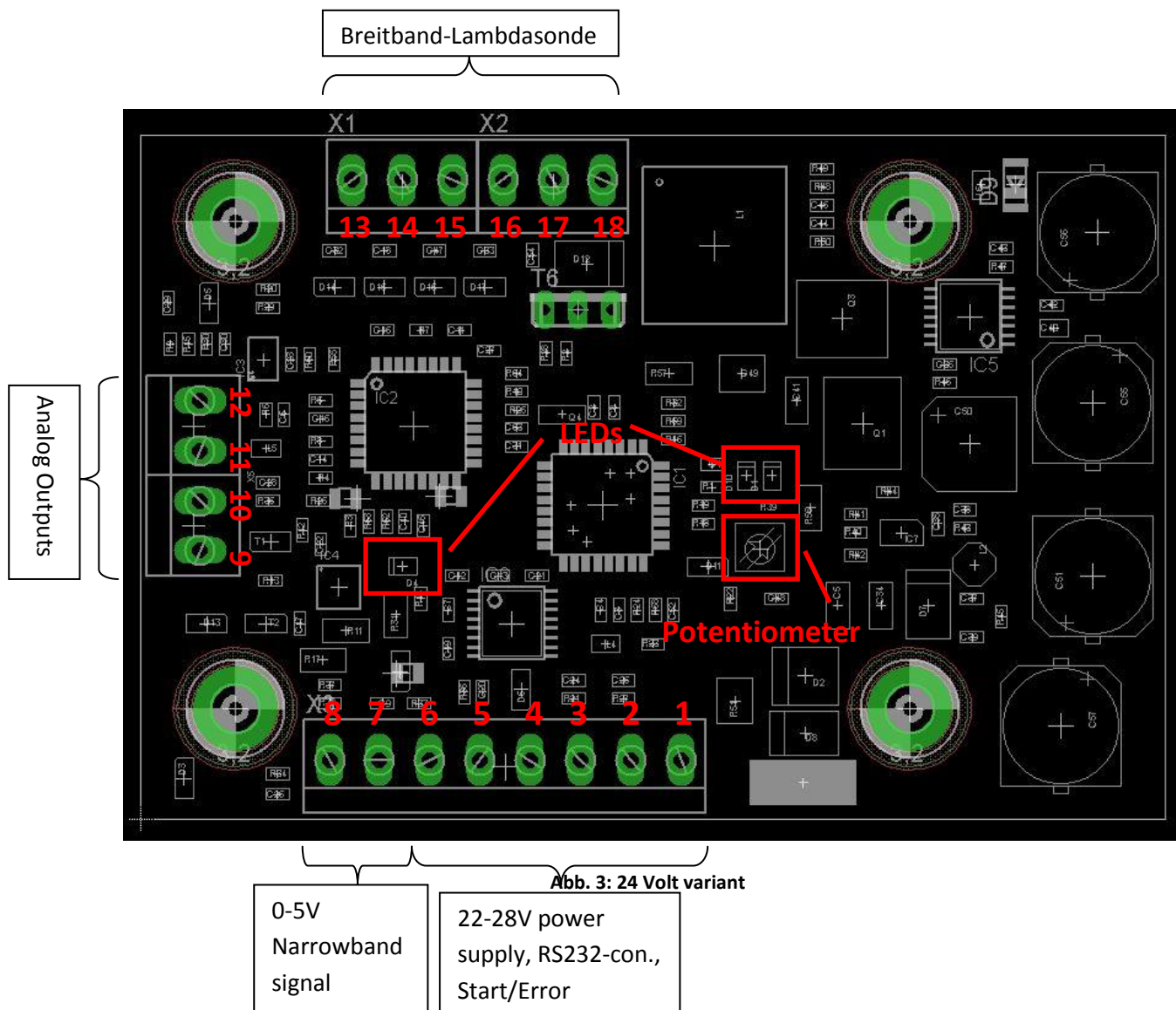
LEDs: Three LEDs are available on the PCB of the Lambda-Messwandler. One green and two red:

The green LED has three different states:
On – The Lambda-Messwandler is connected to power supply and is in Stand-By Mode.

Flashing fast – The measurement has been started over the start input or over the digital interface. The Lambda Sensor is now heated up to operation temperature.

Flashing slow – The measurement has been started over the start input or over the digital interface. The Lambda Sensor has reached its operation temperature and the measured values at the interfaces are valid now.
The red LED near the green one is only on if an error has been detected. The

operation of the Messwandler is not possible as long as the error is existent.
Typical errors and their fixing are described in Chapter 10.

The second red LED is located right from the 4-pin connector. Is this LED on then there is an Error within the 4-20mA current output.
Typical errors and their fixing are described in Chapter 10.

Potentiometer: The potentiometer (= adjustable resistor) is used to control the Narrowband Sensor emulation.
With the potentiometer the "jumping point" of the Narrowband signal can be adjusted. This point is for Narrowband Sensors at $\lambda = 1$ (AFR 14.7). With the potentiometer this point can be shifted into rich ($\lambda < 1$) or into lean ($\lambda > 1$).
The shifting can be done within the range $\lambda = 0.85$ to $\lambda = 1.15$ and AFR 11.6 to AFR 17.8.
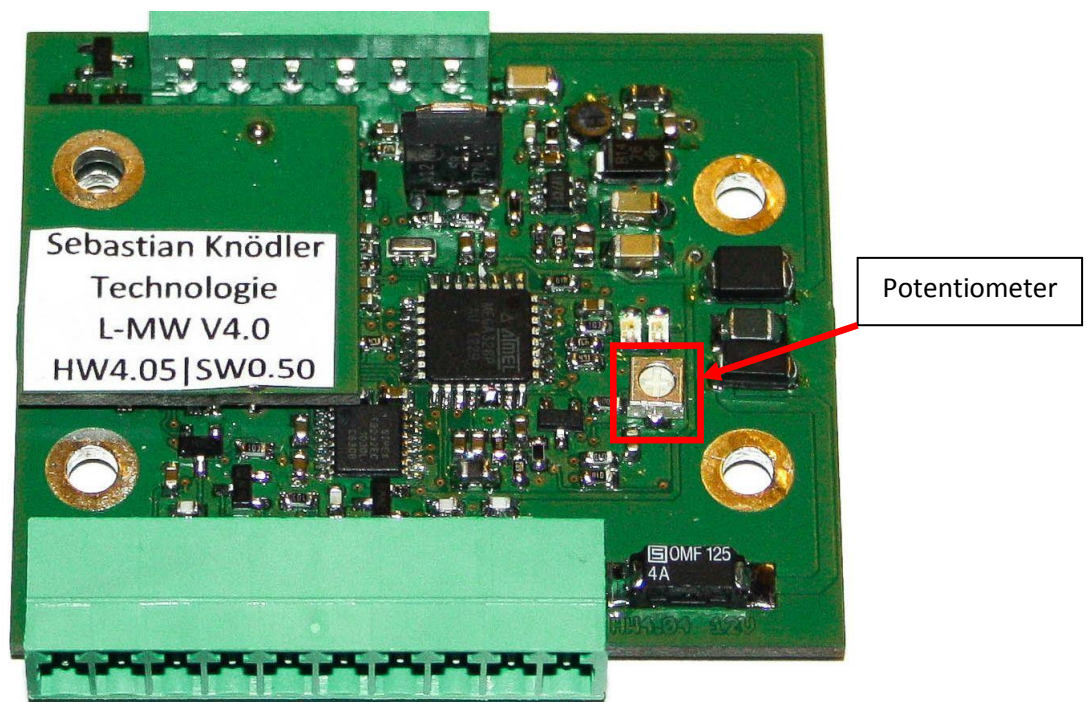The specific range depends on the used software.
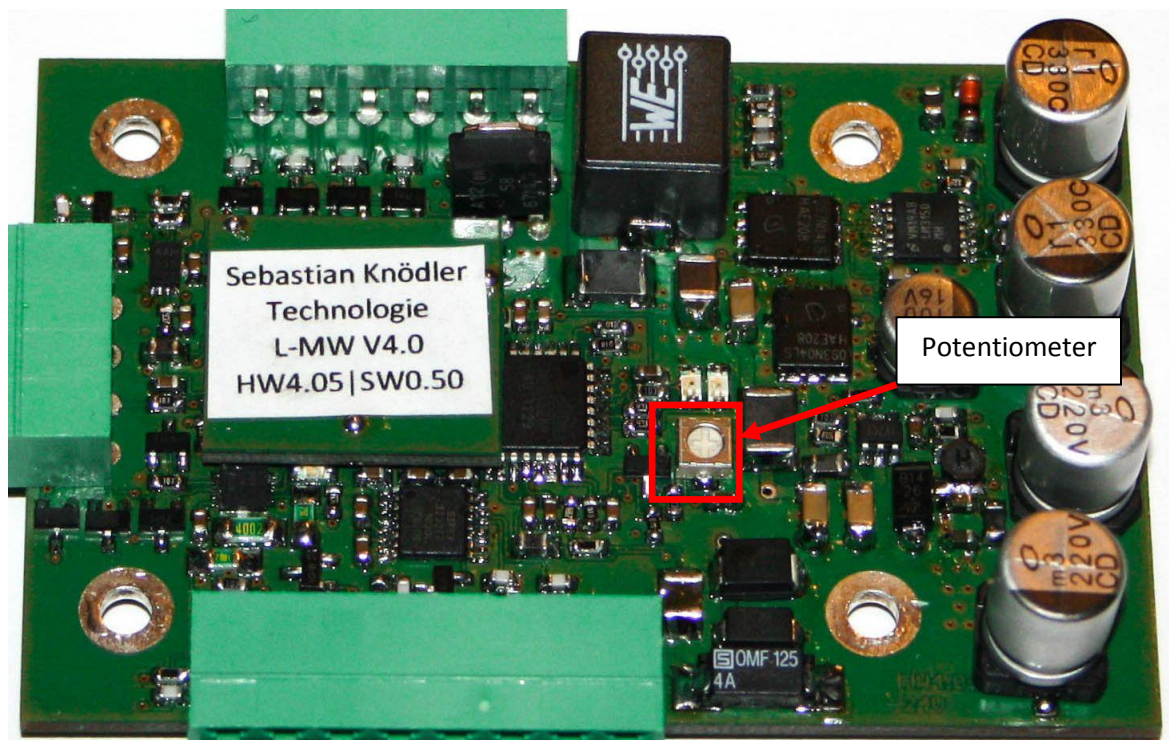
Abb. 4: 24V Potentiometer

2   Before first operation

Please check following points before using the device the first time:

- Did you receive all parts?
- Are all preconditions fulfilled for safe operation of the Lambda-Messwandler?
- Please read the Chapter 2.3 – Safety and operation

2.1   Scope of delivery

Following parts are scope of delivery:

- One circuit board "Lambda-Messwandler V4.x"
- Short manual for first operation
- Optional: Cables and connectors for Wideband Sensor type Bosch LSU4.2 or LSU4.9
- Optional: installation material

2.2   Necessary equipment

For operating the Lambda-Messwandler following parts are necessary:

- Power supply
  - For 12 volt variant: 11 – 16 volt, at least 3 ampere
  - For 24 volt variant: 22 – 28 volt, at least 2 ampere
- One Wideband Lambda Sensor type Bosch LSU4.2 or LSU4.9
- One matching connector for your Wideband Lambda Sensor
- Connection cables
  - Basis variant with soldering pads: max. wire cross section 1.2mm² (AWG 18)
  - Screw clamp terminals: max. wire cross section 1.5mm² (AWG 16)
  - Detachable terminals: max. wire cross section 1.5mm² (AWG 16)

For using the serial interface, you need additional parts:

- PC with RS232 interface, alternatively a PC with USB interface and USB to RS232 adapter
- Terminal program to receive and transmit data over RS232 interface
- Matching 9-pin SUB-D connector

2.3 Safety and operation

Please read this chapter before installing and operating the Lambda-Messwandler:

- Please install the Messwandler at a protected place. High temperatures and humidity can influence the electronics negatively.

- Don't install the Messwandler near strong sources of disturbances, e.g. ignition systems, powerful electric motors or electric actuators, frequency inverters or similar devices.

- Avoid any contact of the circuit board with any liquids. This can lead to the destruction of the circuit board.

- Install the circuit board in this way that no mechanical damages can occur. Please be careful to not damage any circuit traces or components on the circuit board (e.g. due to slip of screwdriver).
  Improper installation or repair can lead to short circuits and can cause fires! If you are not sure if the Messwandler can be operated safely, please contact the customer support.

- The position of the Messwandler can be in any order.

- Please use cables which are as short as possible. First of all the connection cable between Messwandler and Sensor should be as short as possible (in all cases shorter than 3 meters / 10 feet).
  Route the cables as far away as possible from all sources of disturbances, e.g. ignition systems. That could lead to an instable operation an wrong measurement data.

- Treat the Messwandler carefully. The circuit board should only be touched at the edges. Only that can ensure a long lifetime.

- Install the Messwandler at a place where good ventilation is given. Heat accumulation can lead to deactivation of the device.

3   Connecting the Lambda-Messwandler

Please disconnect the power supply before you start working at the Lambda-Messwandler. Unintended short circuits and defects can be avoided.

3.1   Power Supply

The Lambda-Messwandler is available in two variants which differ in the used supply voltage:

	12 Volt variant	24 Volt variant
Supply voltage range	11 – 16 Volt DC	22 – 28 Volt DC
Maximum current	3 A	2 A
Average current	0,8A	0,6A

Table 2: Requirements to power supply

For 12 Volt variant please note that the power supply device must be capable to deliver up to 3 ampere without dropping the voltage below the mentioned supply voltage range.
The 12 Volt variant is capable to be operated at an automobile supply system.

Please note generally that the power supply lines should kept as short as possible. Please use a cable cross section which is as large as possible to avoid high voltage drops which could lead to improper behavior.

Connect the power supply as described in the following table:

	Pin 12 Volt variant	Pin 24 Volt variant
Positive line (+)	1	1
Negative line (-, Ground)	2	2

Table 3: Connecting power supply

3.2   Wideband Lambda Sensor

The Wideband Lambda Sensor type Bosch LSU4.2 or LSU4.9 is connected to the circuit board with the upper 6-pin connector. The pinning of the two Sensors is NOT identical!
It is very important to connect the sensor in the correct way. Swapping the lines can lead to damage or destruction of the Lambda Sensor!

In the tables below the function, cable color and pin number is mentioned in brackets. Normally the cables with same colors have same functionality, independent from the Sensor type.
In the middle and right column the target pin of the Messwandler is given.

Important: Never remove the original connector from the Lambda Sensor. Use the matching connector to connect the Sensor to the Messwandler.
Background: Inside of the Lambda Sensors connector a calibration resistor is placed. This resistor is calibrated for each Sensor individually. Without this resistor the measurement values are strongly falsified.

Important: The original settings for the Lambda-Messwandler are set for using a Sensor type Bosch LSU4.2. Please refer to the sticker at the packaging, there the current configuration of the Messwandler is written on.
To operate a LSU4.9 Sensor the configuration has to be changed. The software must be configured and two solder jumpers must be changed (see Chapter 9).
If the settings are not configured correctly, the Lambda Sensor can be damaged or destroyed!

Important: The maximum cable length between Lambda-Messwandler and Lambda Sensor is 3 meters / 10 feet.
It is recommended to use a cable which is as short as possible.

Please refer to the pin names in Chapter 1.3.1 (12 Volt variant) and Chapter 1.3.2 (24 Volt variant).

3.2.1   Bosch LSU4.2

Pin-Description (Color, Pin)	Pin 12 Volt variant	Pin 24 Volt variant
VM (Virtual Mass, yellow, Connector-Pin 5)	11	13
UN (Nernst voltage, black, Connector -Pin 1)	12	14
RT (Trim-Resistor, (green), Connector -Pin 2)	13	15
IP (Pump current, red, Connector -Pin 6)	14	16
H- (Heater -, grey, Connector -Pin 3)	15	17
H+ (Heater + U Batt, white, Connector -Pin 4)	16	18

Table 4: Pin-Assignment Lambda sensor LSU4.2

Caution: The colors of the cables and their description can differ depending on part number. The shown description refers to Lambda sensor with the part number "Bosch 0 258 007 057".

3.2.2   Bosch LSU4.9

Pin-Description (Color, Pin)	Pin 12 Volt variant	Pin 24 Volt variant
VM (Virtual Mass, yellow, Connector-Pin 2)	11	13
UN (Nernst voltage, black, Connector -Pin 6)	12	14
RT (Trim-Resistor, (green), Connector -Pin 5)	13	15
IP (Pump current, red, Connector -Pin 1)	14	16
H- (Heater -,grey, Connector -Pin 3)	15	17
H+ (Heater + U Batt, white, Connector -Pin 4)	16	18

Table 5: Pin-Assignment Lambda sensor LSU4.9

Caution: The colors of the cables and their description can differ depending on part number. The shown description refers to Lambda sensor with the part number "Bosch 0 258 017 025".

Tipp: Some Lambda sensors of the type "Bosch LSU4.9" can have interchanged Connector-Pins 3 and 4 (grey and white). The connection should then be done referring the cable colors.

3.3 Interface

The Lambda-Messwandler is equipped with two different interfaces:

- Analog interface: 0 – 5 Volt, 0 – 10 Volt, 4 – 20 mA and Narrowband sensor emulation
- Digital interface: Serial RS232 interface for connections to a computer
- Additionally there is a Start input and Error output available. With these the Lambda-Messwandler can be operated without computer.

Following inputs and outputs are used for the interfaces:

	Pin 12 Volt variant	Pin 24 Volt variant
Analog: 0 – 5 V	8	7
Analog: Narrowband sensor emulation	9	12
Analog: 0 – 10 V	-	11
Analog: 4 – 20 mA	-	10 (+), 9 (-)
Analog: Masse	10	9
Digital: RS232 (RXD)	4	4
Digital: RS232 (TXD)	3	3
Digital: Start-Input	5	5
Digital: Error-Output	6	6
Digital: Masse	7	8

Table 6: Pin Assignment Interface

Please take care that all connected devices use the same ground potential. But avoid unnecessary ground connections to avoid ground loops which can cause distortions.

How to use the interfaces is described in detail in Chapter 4 (analog interfaces) and Chapter 5 (digital interfaces).

4   Use the analog interface

The complex control of the wideband Lambda sensor is done completely by the Lambda-Messwandler. The measurement values are then provided by different, easy to use interfaces. The evaluation with the analog interface is especially suitable for stand-alone use without additional computers or processor/controllers.

All analog interfaces refer their output to ground and are not isolated.

4.1   Analog voltage interfaces 0 – 5 V, 0 – 10 V

At the voltage interfaces a voltage is outputted which equals the currently measured Lambda-, AFR-Value or Oxygen content.

In the Stand-by mode and while the Lambda sensor is heated up, no valid measurement values are available. While this time the output voltage is set to the maximum (5V / 10V).

4.1.1   Measurement ranges

By default there are four different measurement ranges available:

- λ=0.7…1.3: This measurement range is suitable for petrol engines (without lean burn technology).
- λ=1.0…10.0: This measurement range is suitable for diesel engines.
- AFR=10…20: Some general purpose EFI controllers use this setting as a standard.
- Oxygen content=0…21%: This measurement range can be used for all exhaust gasses which contain oxygen (e.g. heating plants). In this case displaying Lambda values is not reasonable.

Switching between the measurement ranges can be done at all time. Details for how to switch the measurement range can be found in Chapter 8.

The conversion from output voltage to measurement value can be done as following:

	m (0-5V)	m (0-10V)	b
λ=0,7…1,3	0,12 λ/V	0,06 λ/V	0,7 λ
λ=1,0…10,0	1,8 λ/V	0,9 λ/V	1,0 λ
AFR=10…20	2 AFR/V	1 AFR/V	10 AFR
O$_2$=0…21%	4,2 %/V	2,1 %/V	0 %

Table 7: Conversion Voltage – Lambda / AFR / Oxygen

For the calculation the linear equation is used:

$$y = m \times x + b$$

4.1.2   Example for calculation

Example 1:

Measurement range λ=0.7…1.3 at 0 – 5V output: m=0.12λ/V

                                                                                 b=0.7λ

Measured voltage: Voltage = 1.5V

$$Lambda = m \times voltage + b$$
$$Lambda = 0.12λ/V \times 1.52V + 0.7λ$$
$$Lambda = 0.88λ$$
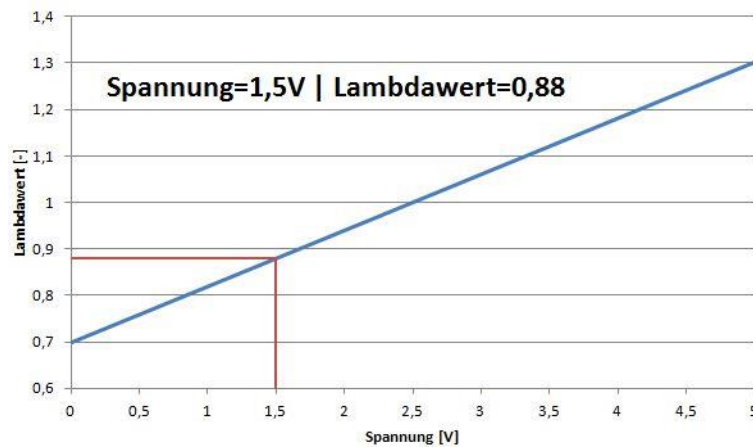
Abb. 5: Example Measurement range Lambda 0.7-1.3

Example 2:

Measurement range O_2=0…21% at 0 – 10V output: m=2.1%/V

                                                                                 b=0%

Measured voltage: Voltage = 7.3V

$$Oxygen = m \times voltage + b$$
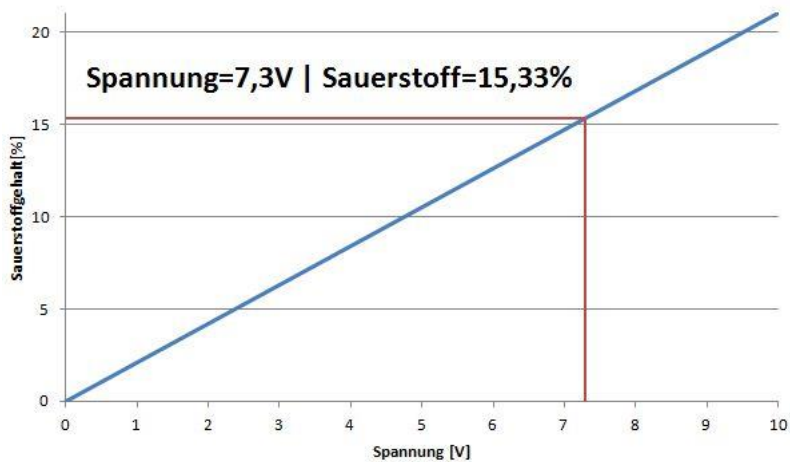$$Oxygen = 2.1\%/V \times 7.3V + 0\%$$
$$Oxygen = 15.33\%$$

Abb. 6: Example Measurement range Oxygen 0-21%

4.1.3   Electrical properties

The analog interfaces are not galvanically isolated and refer to ground.

The electrical inner resistance of the voltage source is 2.2kΩ at the Lambda-Messwandler V4.0 and 1.0kΩ at the V4.1. To avoid falsification of the measured voltage, the load of the voltage source should be as low as possible. Therefore only measurement devices which have a high inner resistance should be used (e.g. PLC or digital multimeters).
Analog meters often have a too low inner resistance and can cause falsifications of 10%.

It is recommended to use devices with an inner resistance of >500kΩ but at least 100kΩ.

4.2   Analog current output 4 – 20 mA

At the 4 – 20mA current interfaces a voltage is outputted which equals the currently measured Lambda-, AFR-Value or Oxygen content.

In the Stand-by mode and while the Lambda sensor is heated up, no valid measurement values are available. While this time the output voltage is set to the maximum (20mA).

4.2.1   Measurement ranges

By default there are four different measurement ranges available:

- λ=0.7…1.3: This measurement range is suitable for petrol engines (without lean burn technology).
- λ=1.0…10.0: This measurement range is suitable for diesel engines.
- AFR=10…20: Some general purpose EFI controllers use this setting as a standard.
- Oxygen content=0…21%: This measurement range can be used for all exhaust gasses which contain oxygen (e.g. heating plants). In this case displaying Lambda values is not reasonable.

Switching between the measurement ranges can be done at all time. Details for how to switch the measurement range can be found in Chapter 8.

The conversion from output voltage to measurement value can be done as following:

	m (4-20mA)	b
λ=0.7…1.3	0.0375 λ/mA	0.55 λ
λ=1.0…10.0	0.5625 λ/mA	-1.25 λ
AFR=10…20	0.625 AFR/mA	7.5 AFR
O_2=0…21%	1.3125 %/mA	-5.25 %

Table 8: Conversion Current – Lambda / AFR / Oxygen

For the calculation the linear equation is used:

$$y = m \times x + b$$

4.2.2   Example for calculation

Example 1:

Measurement range λ=0.7…1.3:   m=0.0375λ/mA

b=0.55λ

Measured current: Current = 8mA

$$Lambda = m \times Current + b$$
$$Lambda = 0.0375λ/mA \times 8mA + 0.55λ$$
$$Lambda = 0.85λ$$
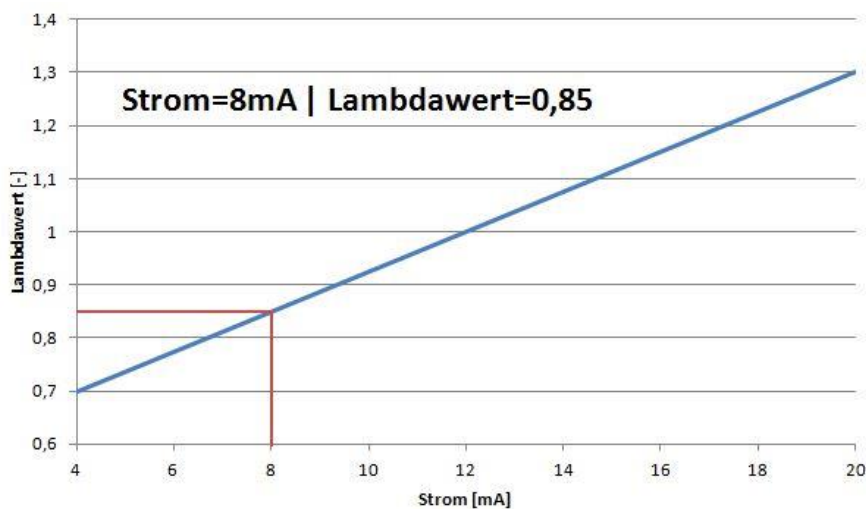
Abb. 7: Example Measurement range Lambda 0,7-1,3 with 4-20mA output

Example 2:

Measurement range O_2=0…21%:   m=1.3125%/mA

b=-5.25%

Measured current: Current = 12,5mA

$$Oxygen = m \times Current + b$$
$$Oxygen = 1.3125\%/mA \times 12,5mA - 5.25\%$$
$$Oxygen = 11.16\%$$

4.2.3   Electrical properties

The analog interfaces are not galvanically isolated and refer to ground.

The idle voltage without connected load is approx. 0.5V below supply voltage. The maximum load resistance which can be connected is 800Ω.
To avoid high power dissipation and heat build-up the load resistance should be chosen as high as possible.

4.3 Narrowband-Sensor emulation

Standard Narrowband-Sensors can display three statuses:

- Rich mixture: There is no oxygen but unburnt fuel contained in the exhaust gas. The voltage at the sensor output is around 0.7 – 1.0 Volt.
- Lean mixture: There is nearly no unburnt fuel but high amounts of oxygen contained in the exhaust gas. The voltage at the sensor output drops below 0.2 Volt.
- Stoichiometric mixture: There is almost no unburnt fuel and no oxygen in the exhaust gas. The main components are neutral gasses like carbon dioxide, nitrogen and water steam. The voltage at the sensor output is at 0.4 – 0.5 Volt.

The Narrowband-Sensor emulation can be useful if an existing Narrowband-Sensor should be replaced by a Wideband-Sensor but the Narrowband signal is still necessary (e.g. original ECU).

The Narrowband-Sensor emulation at the Lambda-Messwandler is therefore adjustable. While a standard Narrowband-Sensor is switching always at λ=1.0 (Gasoline: AFR 14.7) at the Lambda-Messwandler this point can be adjusted between λ=0.85 and λ=1.15.
If a Lambda value is measured below the threshold a voltage of approx. 0.1V is output. Is the value above the threshold the output voltage is approx. 0.9V.
If the value is exact the threshold value the output voltage is approx. 0.45V.

The Narrowband-Sensor emulation is only available at the measurement range λ=0.7…1.3 and AFR=10…20. How to setup the Narrowband-Sensor emulation is described in detail in Chapter 8.5. In all other measurement ranges the output is used as Alarm output. For details see Chapter 5.

Similar to the standard Narrowband-Sensors the output is with approx. 50kΩ inner resistance quite high ohmic.
The output signal is referred to ground potential.

5   Use digital interfaces

With the digital interfaces the Lambda-Messwandler can be controlled. With them the measurement can be started and stopped, error status, threshold values and further diagnostic information can be read.

In general there are two ways to differ between the digital interfaces:

- Interfaces for stand-alone operations. For stand-alone operation the Start input, Error and Alarm output is used.
- Interface for operations with connected computer, processor or controller. For this the serial interface (RS232 voltage levels) are used.

5.1   Start input

The Start input is used to start the measurement.

The Start input is equipped with a pull-down resistor. If no signal is connected to the input it is pulled to ground potential and the measurement is stopped.
If a voltage greater than 4 Volt is applied to the Start input the measurement starts (details see Chapter 7).
The Start input is protected against overvoltage. The measurement can be started by applying a voltage between 4 and 30 Volt.

5.2   Error output

The Error output is used to display any active error. If an error is detected by the Lambda-Messwandler the output is pulled down to ground potential.

As soon as an error is detected a running measurement is stopped immediately. The measurement can be started again after all errors have been removed.
Beside the Error output the red LED mounted on the Lambda-Messwandler is light up.

5.2.1   Voltage without error

The voltage at the Error-output can be chosen by solder jumpers at the back of the Lambda-Messwandler (see Chapter 8):

- Voltage without error = 5V
- Voltage without error = Supply voltage
- Voltage without error = „Open Collector"

The voltage levels at delivery are set to following standards:

- 12 Volt Version: 5V
- 24 Volt Version: Supply voltage (approx. 24V)

5.2.2 Electrical properties

The inner circuit of the Error output is designed like this:
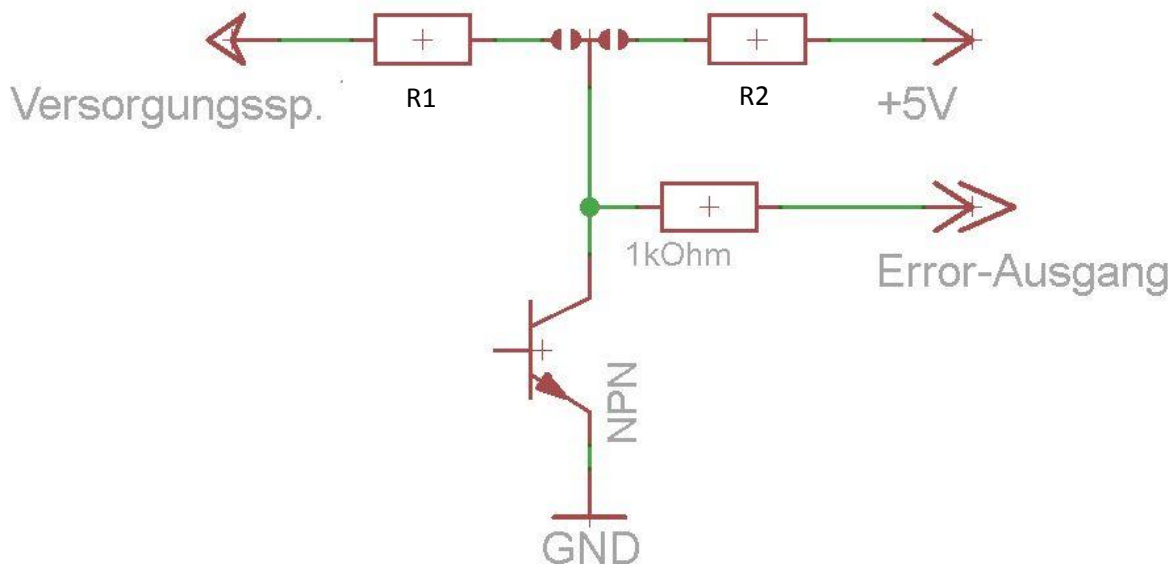
Abb. 8: Electrical properties of Error output

The used NPN transistor is able to handle voltages up to 50 Volt. With an external pull-up resistor there can be a large range covered for the voltage without error.

The resistors R1 and R2 have following values:

	R1	R2
L-MW V4.0	10kΩ	10kΩ
L-MW V4.1	5kΩ	4.7kΩ

Table 9: Resistors R1 and R2 at Error output

5.3 Alarm output

The Alarm output is only available if a measurement range is not set to auf λ=0.7…1.3 or AFR 10...20. In this case the Alarm output is used as Narrowband-Sensor emulation (see Chapter 4.3).

The switching threshold is adjustable (see Chapter 8.6). As soon as the measured Lambda value rises above the threshold a voltage of approx. 5V is output.
Is the measured value below the threshold the output will be pulled to ground potential.

Please note: The Alarm output has an inner resistance of approx. 50kΩ and is therefore high ohmic. Even small loads can lead to a breakdown of the voltage at the output!
To switch higher loads it is recommended to use a Darlington Transistor, FET or TTL gates.
If you have questions how to achieve this, please contact the customer service (Chapter 13).

5.4 RS232 Interface

All functions of the stand-alone mode can also be operated by using the RS232 interface. Additional to these functions further status and diagnostic information are available over this interface. There is also the possibility to adjust the settings in the Lambda-Messwandler over this interface.

Following information is available and can be read out:

- Read out Software and Hardware version of the Lambda-Messwandler
- Operating hours
- Highest and lowest PCB temperature occurred while operation
- Highest temperature of the Lambda sensor while operation
- Currently measured Lambda value
- Content of CJ125 diagnosis register
- Enhanced diagnosis register

Following properties can be changed:

- Used Sensor (Bosch LSU4.2 or LSU4.9)
- Used measurement range
- Measurement frequency
- Turn-On delay
- Output format over RS232 interface (clear text or Excel "csv" format)
- Firmware update

The RS232 interface can be connected directly with a computer with serial interface. Is no serial interface available at the computer but an USB interface, the Lambda-Messwandler can be operated with an according RS232-USB converter.
The RS232 interface has standard RS232 voltage levels and is therefore not compatible to TTL levels.

The RS232 interface can be read out by usual terminal programs.

6 Connect the Lambda-Messwandler with a Computer

The RS232 interface uses two signal lines (RxD and TxD) as well as a connection with ground (GND). Please take care that the ground connection between Messwandler and computer is available. If ground is not connected that leads to errors in data transmission.

The pin assignment can be found in Table 6: Pin Assignment Interface.

6.1 Connecting via USB

Most modern computers don't have a real RS232 serial interface anymore. To use the extended functionality of the Messwandler anyway a RS232-to-USB converter can be used to translate the signals.

Please take care that a high quality device with RS232 voltage levels is used. The serial interface of the Messwandler is not compatible with TTL voltage levels!

6.2 Preparations for data exchange

To establish the connection between Messwandler and computer a physical connection must be made. This is done in most cases by using a 9-pin SUB-D connector.
At the computer side a "Male" connector is used, at Messwandler side a "Female" connector is used.
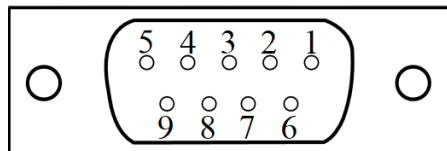
Abb. 9: Pin assignment SUB-D connector (RS232)

Pin L-MW 12 Volt	Pin L-MW 24 Volt	Pin SUB-D connector
Pin 3 (TxD)	Pin 3 (TxD)	Pin 2 (RxD)
Pin 4 (RxD)	Pin 4 (RxD)	Pin 3 (TxD)
Pin 7 (GND)	Pin 8 (GND)	Pin 5 (GND)

Table 10: Pin assignment SUB-D connector (RS232)

6.3   Data exchange

Following setup of RS232 interface parameters is required for data exchange:

- Baud rate 115200 Baud
- 1 Stop bit
- No parity
- No handshake
- 115200 Baud 8N1

The Messwandler sends its information and ends the line with the control character "CR" (carriage return) and "LF" (line feed).
The information sent to the Messwandler are only ended with the control character "CR". The character "LF" is not allowed here.

For sending commands to the Messwandler only single numbers and capital letters can be used.

6.4   Using a terminal program

The Messwandler is not stick to a special terminal program. Any suitable program can be used.
Within this manual the program "HTerm 0.81" is used, this program is runnable without installation.
It is compatible to Windows XP and Windows 7.

The program is available free of charge here: http://www.der-hammer.info/terminal/

Step 1:

Disconnect all connections from Messwandler except the voltage supply and serial interface.
The supply voltage should be within 11 and 15 Volt respectively 22 and 28 Volt.

The red and green LED of the Messwandler should light.

Step 2:

Connect the serial interface with the computer. Note which COM-Port is used for the Messwandler.

Start the terminal program:
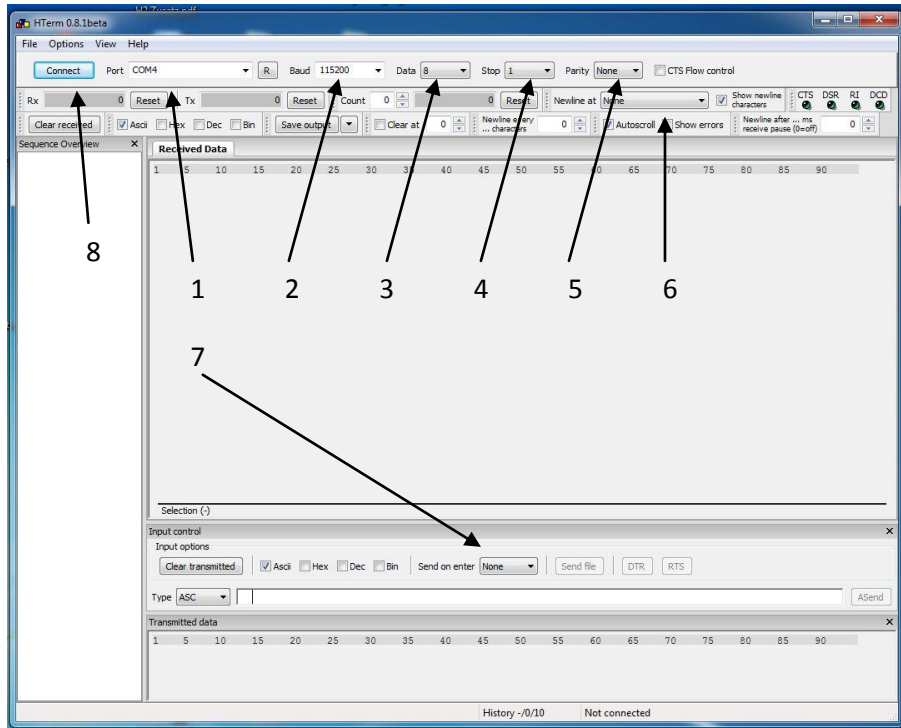
Abb. 10: Basis setup of HTerm

1. Adjust here the correct COM-Port to which the Messwandler has been connected or which has been assigned by the operating system. To refresh the list of available ports press the "R" button on the right of the dropdown menu.
2. Chose the baud rate of 115200.
3. Chose at Data "8".
4. Chose at Stop "N".
5. Chose at Parity "None".
6. Chose at "Newline at" the option "CR+LF".
7. Chose at "Send on enter" the option "CR".

All other basis setup should already be correct.

Step 3:

Press now the button "Connect" at the upper left side (8).
If the setup is correct and the connection of Messwandler and Computer is OK the received data should be displayed in the field "Received Data". For example:

0;1;127;65407

Disconnect now shortly the supply voltage while the serial connection should remain connected.
After reconnecting the supply voltage, following text (or similar) should be displayed:
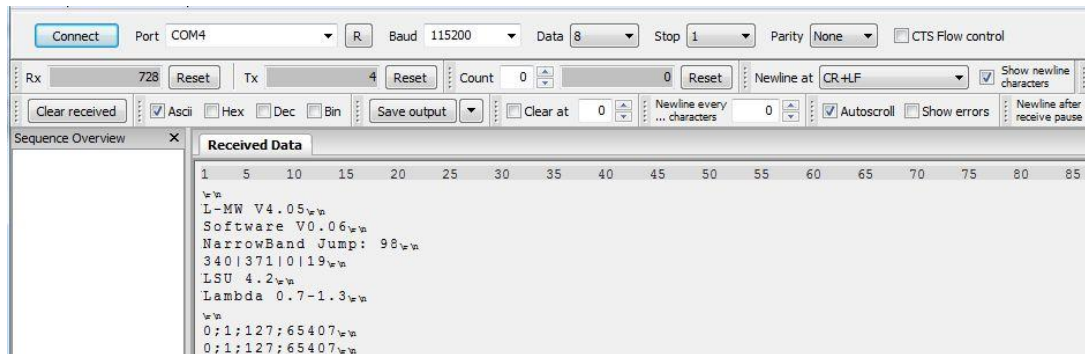
Abb. 11: HTerm display

After connecting the supply voltage to the Messwandler, the Messwandler transmits the saved setup in following order:

Sent text	Description
L-MW V4.051	Hardware version
Software V0.06b	Software version
NarrowBand Jump: 100	Narrowband-Sensor emulation setting
340|371|830|19	Min. temperature	Max. temp.	Max. Sensor temp.	Operating time in minutes
LSU 4.2	Used Lambda sensor type
Lambda 0,7-1,3	Used measurement range

Table 11: Saved properties

After displaying the saved properties on the Messwandler, every 0.5 seconds a new measurement value, the content of diagnosis registers and a checksum are transmitted.

Step 4:

To send a command to the Messwandler, type in the desired number or character in the field "Input control". After pressing enter the command will be send to the Messwandler.
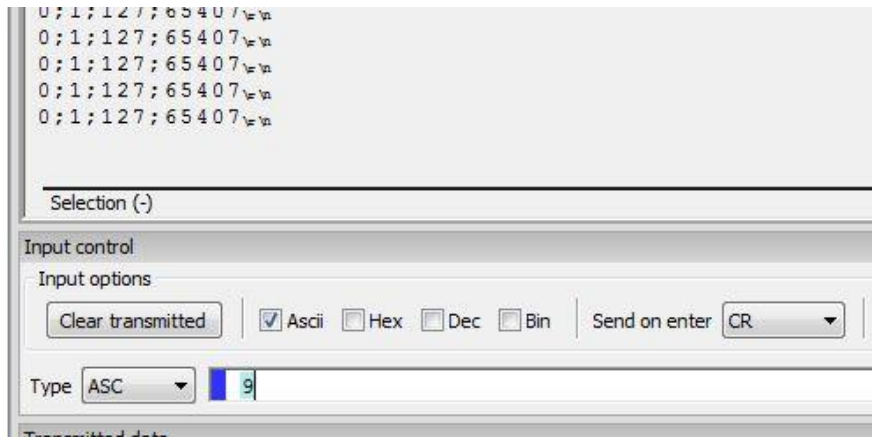
Abb. 12: HTerm send command

7   Measure with the Lambda-Messwandler

The Lambda-Messwandler is designed for long-term operation without additional electronic devices (e.g. Computer). It can easily be integrated into existing systems.
The measurements can be started with the "Start input" or with the serial interface.

To measure the Lambda value with a wideband lambda sensor, the sensor must be heated up first to operating temperature (approx. 785°C).
Since the heating comes along with high power consumption the sensor is only heated up if it is requested.

Please take care that no condensed water can hit the sensor (e.g. due to cooled down exhaust gasses). Condensed water in combination with the hot sensor can cause damages to the inner sensor ceramics.

7.1   Start and stop the measurement with the Start input

The measurement is started as soon as the Start input of the Lambda-Messwandler (see Chapter 3.3) is connected to a voltage above 4 Volt (maximum 30 Volt).
This voltage can be taken in the car from T15 (ignition on switch) or fuel pump relay.
The Start input can also be connected directly to supply voltage. In this case the measurement will start immediately after connecting the supply voltage.

The measurement will be stopped as soon as the voltage at the Start input drops below 2 Volt of if the Start input is connected to Ground.

As soon as an error occurs the sensors heater will be disabled and the measurement will be stopped to avoid damages to the sensor.
As soon as the error is removed and the Start input is still connected to a voltage above 4 Volts, the heater will be reactivated and the measurement is resumed.

7.2   Start and stop the measurement with the serial interface

The measurement can also be started by using the serial interface of the Lambda-Messwandler.

At first the connection to the sensor has to be established, see Chapter 6.

To start the heating process, the command "H" must be sent to the Messwandler. To stop the measurement the command "D" must be sent to the Messwandler.

In case of an error the sensors heater will be disabled. The measurement does not resume automatically and has to be restarted manually.

7.3 Capturing the measuring values by Analog outputs

At the Analog output a voltage in range of 0 to 5 Volt is output. This voltage is linear to the chosen measurement range.
For calculating the Lambda value, AFR value and oxygen content please refer to Chapter 4.

Caused by hardware tolerances the maximum output voltage can fluctuate between 4.8 and 5.2 Volt. These fluctuations are compensated internally so the linearity of the signal is not affected.

For correct measurement readings a good ground connection must be ensured.

7.4 Capturing the measuring values by serial interface

To capture measuring values from Lambda-Messwandler, please note all preparations stated in Chapter 6.

The Messwandler in standard setup is giving out a measuring value all 0.5 seconds over the serial interface.

Sensor is not yet on operating temperature or an error is occoured:

0;1;127;65407

Sensor has reached operating temperature and the measurement is valid:

130;160;255;64990

At the first place comes the measuring value, at second place the content of Messwandler Status register, at third place the content of CJ125 Diagnosis register and at last place the checksum.
The values are all divided by a semicolon (compatible to Excel csv-Format).

7.4.1 Measurement values

The measurement value will be displayed in clear text. Lambda values are displayed multiplied with a factor of 100, AFR and oxygen values will be displayed multiplied with a factor of 10.

A Lambda value of 1.05 is therefore displayed as 105. A oxygen value of 8.9% is displayed as 89.

If the sensor is not heated up completely yet of an error occurred, the measurement value will be displayed as zero.

7.4.2   Messwandler-Status register

The status register informs about the current general operating status of the Messwandler. The register is displayed as a decimal value and has to be decoded into binary format. That can be done for example with the Windows Calculator (shown here).

Open the Windows Calculator and switch at the menu point "View" to "Programmer" view. Now type in the register value as a decimal value and the binary value will be displayed:
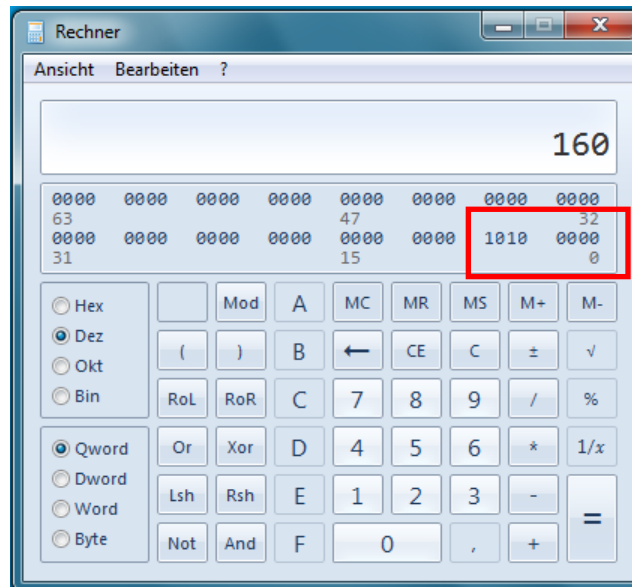
Abb. 13: Conversion decimal - binary

The decimal value "160" will be converted to the binary value "1010 0000". The binary value starts at the left with Bit 7 and ends at the right with Bit 0.

To assign the status register value to a status, following table should be used:

Status register Bit	Description
Bit 7	Heater active
Bit 6	Reserved
Bit 5	Operating temperature is reached
Bit 4	CJ125 communication error
Bit 3	Supply voltage too high
Bit 2	Supply voltage too low
Bit 1	Temperature of Lambda sensor too high
Bit 0	CJ125 error

Table 12: Evaluation of status registers

7.4.3   CJ125 Error register

The CJ125 internal error register can help in case of an error. The exact states are mentioned in the datasheet of the CJ125.

Normally only two values have significant meaning:

CJ Error register	Description
255	No Error
127	No Lambdasensor connected / Heater error

Table 13: Evaluation of CJ125 Error registers

7.4.4   Calculating of the checksum

To be able to react to communication errors, a simple checksum has been implemented. This checksum is sent on fourth place as an unsigned 16 bit integer value. The value range is from 0 to 65535.

The checksum is build up from the negation of the sum of the three former values in the same line:

Checksum = !(Lambda value + Status register + CJ125 Error register)

Example:

Sent Data from Messwandler: 130;160;255;64990

Lambda value: 130
Status register: 160
CJ125 Error register: 255
Checksum: 64990

Sum of the three former values in the same line = 130 + 160 + 255 = 545

Displayed as uint16:   0000 0010 0010 0001

Negation: 1111 1101 1101 1110

Displayed as decimal: 64990

8   Configuring the Lambda-Messwandler

8.1   Configure the measurement range

By default the measurement range λ 0.7 to 1.3 is configured for the 12V Messwandler and Oxygen 0 – 21% for the 24V Messwandler.
There are in total four different measurement ranges available for each Sensor (Bosch LSU4.2 and LSU4.9).

To change the measurement range of the Messwandler, a connection to a computer must be established (see Chapter 6).
The measurement ranges can be identified by numbers:

Range number	Measurement range	Analog Interface	Digital Interface
3 (Standard)	λ 0.7 – 1.3	λ 0.7 = 0.0 Volt λ 1.3 = 5.0 Volt	λ-Wert * 100
4	λ 1.0 – 10.0	λ 1.0 = 0.0 Volt λ 10.0 = 5.0 Volt	λ-Wert * 100
5	AFR 10 - 20	AFR 10 = 0.0 Volt AFR 20 = 5.0 Volt	AFR-Wert * 10
6	O_2-Gehalt 0 - 21%	0% O_2 = 0.0 Volt 21% O_2 = 5.0 Volt	O_2-Gehalt * 10

Table 14: Available measurement ranges

To choose another measurement range the range number must be sent to the Messwandler using the serial interface. The Messwandler is saving the new configuration permanently.
To check if the new configuration has been taken over, with the "information" command "I" this can be checked. The Messwandler will sent then an overview over its configuration.

8.2   Configure the update frequency

The Lambda-Messwandler V4.x sends a new dataset of measurement values by default every 500ms over the serial interface.
At the analog interface the measurement value will be updated every 20ms. The frequency of the analog interface cannot be changed.

For data recording purposes the update frequency of the serial interface can be increased to 100ms. The higher frequency is configured by sending the "Fast" command "F" (see Chapter 6). To switch back to the slower frequency, the "Slow" command "S" can be sent.

Command for update frequency	Update frequency
F	Fast update (100ms)
S	Slow update (Standard, 500ms)

Table 15: Configuration of the update frequency

Note: The Messwandler does not save this configuration permanently. After reset (disconnect power supply), the standard slow frequency will be used.

8.3   Configure the turn-on delay

By default the Lambda sensor will be heated up with low heating power in the first 15 seconds after a measurement start command has been received. This is done to avoid damages to the sensor by cold, condensed water in the exhaust pipe.

Following configurations for the turn-on delay are available:

Command for turn-on delay	Turn-on delay time
U	Off (0 seconds)
V	15 seconds (Standard)
W	30 seconds
X	60 seconds

Table 16: Configuration of turn-on delay

The command for the turn-on delay can only be sent over the serial interface (see Chapter 6).
The configuration will be saved permanently and will be used even after a reset (disconnect of power supply).

8.4   Configuration of the output format

The Lambda-Messwandler outputs its information over the serial interface in a CSV format by default Comma-separated values):

0;0;255;65152

To give a better readability this can be switched to clear text format:

Lambda: 105
Error: 160
CJError: 255

Command for output format	Output format
T	Clear text format
E	CSV format (Standard)

Table 17: Configuration of the output format

Note: The Messwandler does not save this configuration permanently. After reset (disconnect power supply), the standard CSV format will be used.

8.5   Adjust the Narrowband-Sensor emulation

The jumping point of the Narrowband-Sensor emulation can be changed with the potentiometer mounted on top of the Lambda-Messwandler (position see Chapter 1.3).
The standard setting is random due to manufacturing tolerances!

The setting of the potentiometer is only read after power cycling the Lambda-Messwandler (disconnect power supply and connect again). If the potentiometer is turned while operating the Messwandler, this has no effect on the Narrowband-Sensor emulation output.

The current setting of the jumping point of the Narrowband-Sensor emulation will be given out over serial interface after power cycling the Messwandler (see Chapter 6).

At the output a voltage will be adjusted varying from 0.1 Volt ($λ$ > Threshold), 0.45 Volt ($λ$ = Threshold) or 0.9 Volt ($λ$ < Threshold). The voltage refers to ground.

Caution: The Narrowband-Sensor emulation is only available in measurement ranges $λ$ 0.7 – 1.3 and AFR 10 – 20.
If the measurement ranges $λ$ 1.0 – 10.0 or O_2 content 0 – 21% is used, the output will be set up as an Alarm output (see Chapter 8.6).

8.6   Configure the Alarm output

This function is similar to the Narrowband-Sensor emulation but uses TTL voltage levels (0/5V).

The Alarm output is only available in the measurement ranges $λ$ 1.0 – 10.0 and oxygen content 0 – 21%.

8.7   Configure the Error output

The Error output can be configured for the 12V and the 24V variant of the Lambda-Messwandler:

- TTL (High-Level = 5V)
- Supply voltage (High-Level = Supply voltage)
- Open-Collector

The standard configuration for the 12 Volt Messwandler is "TTL". The standard configuration for the 24 Volt Messwandler is "supply voltage".

Note: To change the configuration of the Error output one solder jumper on the bottom side of the Messwandler has to be changed.
The in Chapter 9.1 (General hints and requirements) mentioned requirements must be fulfilled. The How-To for changing the solder jumpers can be found in Chapter 9.2 (Changing of solder jumpers).

8.7.1   Messwandler 12 Volt

Bottom view of 12 Volt Lambda-Messwandler solder jumpers for Error output (setting "TTL"):
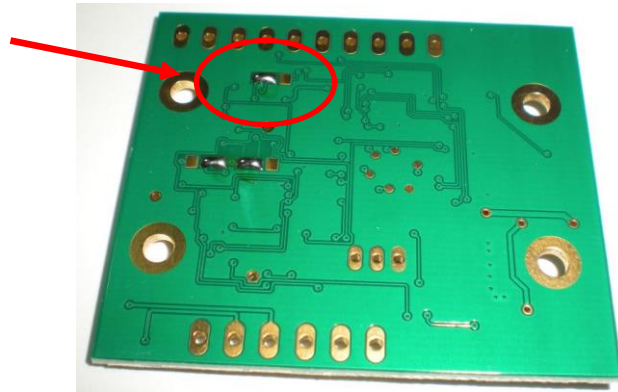
The default setting is "TTL". The solder jumper is set to the left and middle pads. To change the setting to "supply voltage" the jumper has to be moved to the right and middle pads.
To change the Error output to "open-collector" the solder jumper has to be removed completely.

The exact procedure for changing the solder jumpers can be found in Chapter 9.1 and Chapter 9.2.

8.7.2   Messwandler 24 Volt

Bottom view of 12 Volt Lambda-Messwandler solder jumpers for Error output (setting "TTL"):

The default setting is "supply voltage". The solder jumper is set to the left and middle pads. To change the setting to "TTL" the jumper has to be moved to the right and middle pads.
To change the Error output to "open-collector" the solder jumper has to be removed completely.

The exact procedure for changing the solder jumpers can be found in Chapter 9.1 and Chapter 9.2.

9   Changing from Lambda sensor LSU4.2 to LSU4.9

9.1   General hints and requirements

The Lambda-Messwandler type L-MW V4.x supports Lambda sensors from type LSU 4.2 and LSU 4.9. If no other remark is given at the packaging the sensor type LSU 4.2 is adjusted by standard.

To change from the sensor type LSU4.2 to LSU4.9 or vice versa, two soldering jumpers on the backside has to be changed.
To perform this change basic soldering knowledge is required. Additionally following tools are needed:

- Electronics soldering iron with fine soldering tip adjusted to max. 350 – 380°C
- Fine electronics desoldering braid
- Electronics solder with a diameter of 0.5 – 1.0mm
- Fireproof underground
- Maybe fine needle nose pliers
- Multimeter

After successful changing of the solder jumper the software also has to be adjusted to the new sensor type. If this process is not done wrong measurement values are transmitted and in worst case the sensor can be destroyed.

Following tools and knowledge is needed to change the software adjustment:

- Basic computer knowledge
- Connection between L-MW V4.x and the computer via serial port or USB port by using a RS232-USB converter (see Chapter 6)

If the works are done improper the Lambda-Messwandler can be damaged or destroyed. All warranty claims will be void in this case!
If you are not sure if you can do these works properly please contact the customer support (Chapter 13).

9.2   Changing of solder jumpers

In total two soldering jumpers has to be changed. Please note that the 12 Volt and 24 Volt Messwandler differ!

Step 1:
Prepare all tools an o clean and fireproof underground. Bring the soldering iron to operating temperature.
Remove all cables and connection from the Lambda-Messwandler and place it with the bottom side up on the same underground.

Step 2:
Remove the soldering jumpers by using soldering iron and desoldering braid.
Make sure that there is no electrical connection between the pads any more. Make sure the

soldering iron is not in contact with the board for more than 3 seconds. If the heat is too high, the pads can come off the board, which can lead to irreparable damage.
Be careful not to apply excessive force to the circuit board.

Step 3:
To restore the soldering jumpers, place the tip of the soldering iron between the two pads to be connected and add solder.
Once the bridge is formed, gently remove the soldering iron from the circuit board.
If the bridge is removed with this action, re-solder the bridge by using more solder.

Check that the electrical connection has been established.
Check if there are no short circuits to neighboring pads.

Ensure that the soldering iron is not in contact with the board for more than 3 seconds at all steps. If the heat is too high, the pads can come off the board, which can lead to irreparable damage.
Be careful not to apply excessive force to the circuit board.

9.2.1   Messwandler 12 Volt

View of the 12 Volt Lambda-Messwandler from below (setting LSU4.2):
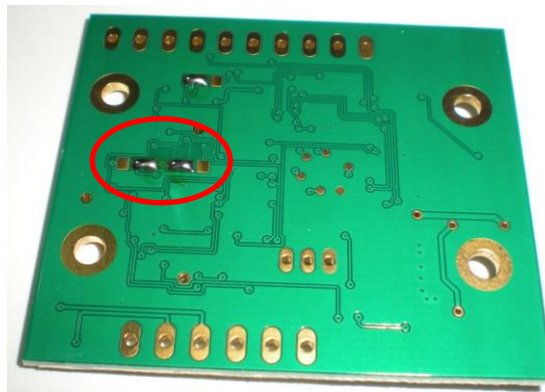
If the soldering jumper faces each other, the Lambda sensor of type Bosch LSU4.2 is selected:

If the soldering jumpers are facing away from each other, the Lambda sensor of type Bosch LSU4.9 is selected:
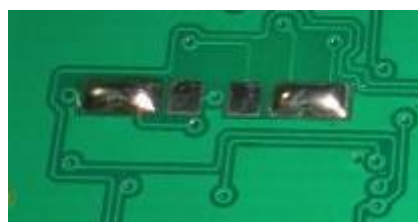
9.2.2 Messwandler 24 Volt

View of the 24 Volt Lambda-Messwandler from below (setting LSU4.2):
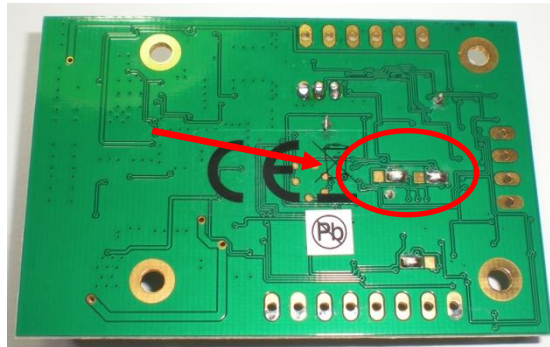
If the soldering jumper is facing the 4-pin connector, the Lambda sensor of type Bosch LSU4.2 is selected:
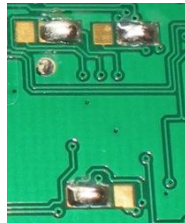
If the soldering jumper is facing the CE mark, the Lambda sensor of type Bosch LSU4.9 is selected:

9.3   Changing of Messwandler settings

To complete the conversion, the Lambda-Messwandler settings must be changed via the digital interface. For this purpose, you need a connection to the converter, see Chapter 6.

If the connection is established, the command corresponding to the Lambda sensor must be sent to the transducer:

Command	Lambda sensor
2	Type LSU4.2
9	Type LSU4.9

Table 18: Setting of Lambda sensor type

After the command has been transferred, the current settings should be checked by sending the "I" command.
After a reset (switching off the supply voltage), the configuration for the new probe type is completed.

10 Troubleshooting

Description of Error	Possible Solution
The red LED at the Messwandler is blinking steadily:	- Is the power supply voltage within allowed range (see Chapter 3.1)? -Is the Lambda sensor correctly connected (see Chapter 3.2)? -Which errors are given out over the serial interface (see Chapter 7.4)?
The Messwandler heats the Lambda sensor but is aborting after ~15 seconds and starts again:	-Is the power supply voltage within allowed range (see Chapter 3.1)? -Is the power supply able to deliver the peak current without voltage breaks down (see Chapter 3.1)? -Are the used cable cross sections high enough (see Chapter 2.2)?
The Messwandler aborts the measurement in irregular intervals:	-Is the power supply voltage within allowed range (see Chapter 3.1)? -Is the cable length between Messwandler and Lambda sensor too long (see Chapter 3.2)? -Are all mounting hints taken into account for mounting the Lambda sensor? -Is the Lambda sensor maybe defect or is above the guaranteed lifetime?
The connection over the digital interface can't be established:	-Are all SUB-D connectors correctly setup and is the ground connection between PC and Messwandler available (see Chapter 6.2)? -Are all settings in the Terminal program correctly set (see Chapter 6.4)? -Is a connection with another PC possible? -If a USB to RS232 converter is used, is it possible to establish the connection with another converter?

Table 19: Typical errors

11 Errata

11.1 12-Volt Variant

11.1.1 Fixation of the Lambda-Messwandler

Occurrences:
All 12-Volt Messwandler delivered before December 2015.

Defect characteristics:
If the upper left hole in the shielding plate is used for fixation of the Lambda-Messwandler and too high tightening torque is used, functional distortions can occur.

Remedial measure:
Don't use this fixation hole but use the other three.

11.2 24-Volt Variant

11.2.1 Analog Interface 0-5V and 4-20mA

Occurrences:
All 24-Volt Messwandler delivered before October 2013.

Defect characteristics:
Voltages at the 0 – 5V interface of below 0.55V cannot be displayed. Currents at the 4 – 20mA interface of below 5.7mA cannot be displayed.

Remedial measure:
For 0 – 5V Interface: No Remedial measure can be provided. Please contact customer support (Chapter 13).

For 4 – 20mA Interface: Connect the 0 – 5V output Pin 7 with ground Pin 8. The 0 – 5V output can't be used anymore but 4 – 20mA output is working within specifications.

12 Technical Data

12.1 Connections and Interfaces

Voltage supply:

	Pin 12 Volt Variant	Pin 24 Volt Variant
Positive line (+)	1	1
Negative line (-, Ground)	2	2

Table 20: Voltage supply

Connection of Lambda sensor type LSU4.2:

Pin-Description (Color, Pin)	Pin 12 Volt Variant	Pin 24 Volt Variant
VM (yellow, Connector-Pin 5)	11	13
UN (black, Connector -Pin 1)	12	14
RT ((green), Connector -Pin 2)	13	15
IP (red, Connector -Pin 6)	14	16
H- (grey, Connector -Pin 3)	15	17
H+ (white, Connector -Pin 4)	16	18

Table 21: Connection LSU4.2

Connection of Lambda sensor type LSU4.9:

Pin-Description (Color, Pin)	Pin 12 Volt Variant	Pin 24 Volt Variant
VM (yellow, Connector -Pin 2)	11	13
UN (black, Connector -Pin 6)	12	14
RT ((green), Connector -Pin 5)	13	15
IP (red, Connector -Pin 1)	14	16
H- (grey, Connector -Pin 3)	15	17
H+ (white, Connector -Pin 4)	16	18

Table 22: Connection LSU4.9

Connecting digital and analog interface:

	Pin 12 Volt Variant	Pin 24 Volt Variant
Analog: 0 – 5 V	8	7
Analog: Narrowband-Emulation	9	12
Analog: 0 – 10 V	-	11
Analog: 4 – 20 mA	-	10 (+), 9 (-)
Analog: Ground	10	9
Digital: RS232 (RXD)	4	4
Digital: RS232 (TXD)	3	3
Digital: Start-Input	5	5
Digital: Error-Output	6	6
Digital: Ground	7	8

Table 23: Digital and analog Interface

12.2 Physical characteristics

Requirements to power supply:

	12 Volt Variant	24 Volt Variant
Voltage range	11 – 16 Volt DC	22 – 28 Volt DC
Peak current	3 A	2 A
Average current consumption	0.8A	0.6A

Table 24: Requirements to power supply

The Lambda-Messwandler should be operated at ambient temperatures below 60°C and above -20°C. Avoid direct sunlight and mounting positions near to hot surfaces (e.g. engines or exhaust pipes).
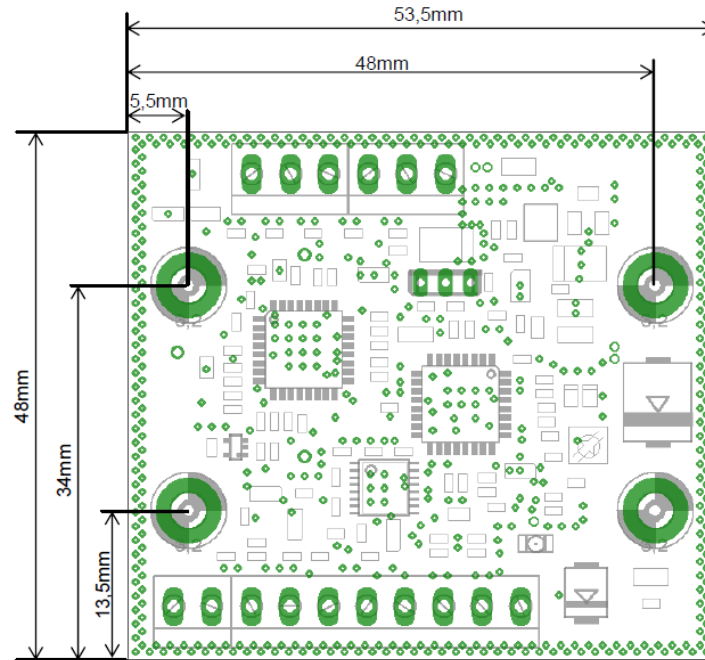
Take care that no water condenses on the Lambda-Messwandler surfaces. The Messwandler must not have contact to any liquids!

The mounting of the Lambda-Messwandler can be done in any position.
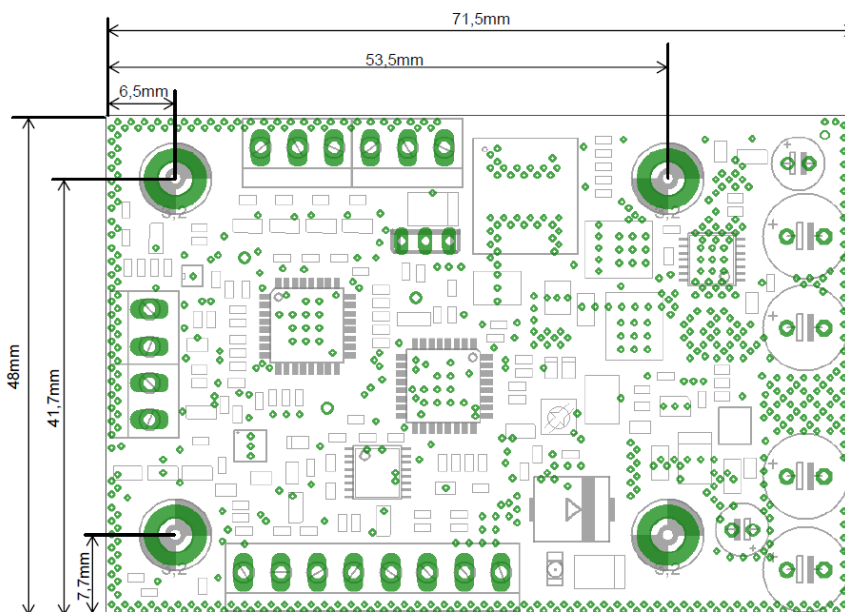
12.3 Mechanical characteristics

12.3.1 Lambda-Messwandler V4.1 – 12 Volt

Valid for Lambda-Messwandler build after December 2015 (Charge 6 and higher):

12.3.2 Lambda-Messwandler V4.x – 24 Volt

Valid for all Lambda-Messwandler 24 Volt:

12.4 Cables

The cross section of the used cable should always as high as possible:

- For basis variant with soldering pad: Max. cross section 1,2mm² (AWG 18)
- For basis screw clamp: Max. cross section 1,5mm² (AWG 18)
- For pluggable screw clamp: Max. cross section 1,5mm² (AWG 18)

The maximum cable length between Lambda-Messwandler and Lambda sensor must not exceed 3 meters (10ft).

If the system is used nearby strong electromagnetic interferences the usage of shielded cables is recommended.

13 Customer service

You can reach the customer service via the following contacts:

E-mail: info@breitband-lambda.de

Mobile: +49 (0) 162 517 68 48

Post: Sebastian Knödler
               Rosenstraße 25
               71549 Auenwald
               Deutschland

13.1 Information on the Internet

Further information regarding the product and technical information can be found on the Internet at the following address: www.breitband-lambda.de

13.2 Support

Before contacting the supports please read this manual and follow all points regarding initial operation.

Should you have problems anyway or if any questions leaves open, please contact the support.
You can find the contact data in Chapter 13.

13.3 Vendor warranty

For the Lambda-Messwandler in Version V4.x the legal guarantee of Germany is given.

The warranty period starts from the date of purchase of the "first-end user" and ends after two years.
Please keep the purchase invoice carefully, so that you can prove the purchase date without doubt.

Please notice that only shortcomings caused by product or production faults can be fixed on warranty.
Defects caused by erroneous first startup, improper installations and handling, nonobservance of this manual, normal wearing or operation environment (hardware and software as well as devices from third party manufacturers) will not be covered by this warranty.

Further we guarantee that the software conforms to general specifications but not necessarily to your personal requirements.
Should you have whishes regarding devices software, please contact the customer support.

13.4 Spareparts

If you need spare parts, please contact customer support.

14 Legal Notice

14.1 CE Declaration of conformity

The manufacturer

> Sebastian Knödler
> Rosenstraße 25
> 71549 Auenwald
> Deutschland

herewith declares that the products

> Lambda-Messwandler V4.0 – 12 Volt
> Lambda-Messwandler V4.0 – 24 Volt
> Lambda-Messwandler V4.1 – 24 Volt

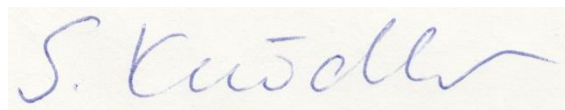comply with legal requirements and guidelines.

The following generic standards were used for the assessment:

- EN-61000-6-1
- EN-61000-6-2
- EN-61000-6-3
- EN-61000-6-4

The conformity of the product with the above standards and regulations is confirmed by the CE symbol:

$$C\!E$$

Auenwald, 11th November 2012
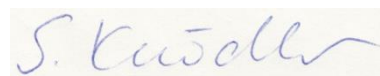
> Sebastian Knödler

14.2 EU Declaration of conformity

EU- Declaration of conformity

1.	Document-Nr./Month.Year:	0001 / 07.2013

2.	This declaration is given for:	
	Manufacturer	Sebastian Knödler Technologie
	Address:	Sebastian Knödler Technologie Rosenstraße 25 D-71549 Auenwald

3.	The sole responsibility for issuing the declaration of conformity with regard to the fulfillment of the essential requirements and the preparation of the technical documentation is:	
	Manufacturer:	Sebastian Knödler Technologie
	Address:	Sebastian Knödler Technologie Rosenstraße 25 71549 Auenwald

4.	The subject of this declaration are the following devices:	
	Type, Modelnr.	Lambda-Messwandler V4.0 L-MW V4.0 12V L-MW V4.0 24V L-MW V4.1 24V

5.	For the mentioned devices is hereby declared that it is meeting the **basic requirements** which are laid down in the following harmonization specifications:
	DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast) – **RoHS**

6.	Declaration of the relevant **harmonized standards** which are used or declaration of the specifications for which the conformity is declared.			
	Norm	Issue date	Title	Harmonized standard for
	EN 50581	2012-09	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances	RoHS
	EN 61000-6-1	2007-10	Immunity standard for residential, commercial and light-industrial environments	Electromagnetic compatibility (EMC)
	EN 61000-6-2	2006-03	Immunity standard for industrial environments	Electromagnetic compatibility (EMC)
	EN 61000-6-3	2011-09	Emission standard for residential, commercial and light-industrial environments	Electromagnetic compatibility (EMC)
	EN 61000-6-4	2011-09	Emission standard for industrial environments	Electromagnetic compatibility (EMC)

7.	Additional specifications:
	This declaration applies to all specimens produced according to the corresponding production drawings, which are part of the technical documentation. Further information on compliance with the above standards is given in the enclosed accompanying documentation accompanying the conformity statement.

Signature from:		Sebastian Knödler
Surname, First Name:	Knödler, Sebastian	
Function:	CEO	

Auenwald, 15.07.2013
_____
Location / Date   Legally valid signature

This declaration confirms compliance with the said harmonization rules, but does not include any assurance of characteristics.