OPERATING INSTRUCTIONS

ZIRKOR302 P

Oxygen Analyzer

Standalone Version
with Measuring Gas Pump

SICK
Sensor Intelligence.

1 General

1.1 Purpose of this Document

These operating instructions provide operators with information about:

Operation

Safety instructions

Maintenance

Troubleshooting

Although other documents (e.g. Product Information) may provide additional information, they must not be regarded as a substitute for these operating instructions.

1.2 Operating Personnel

For certain activities (electrical installation, for example), specialist knowledge is required. Such activities must only be carried out by suitably qualified personnel.

Those responsible for personal safety must make sure that:

All work on the device components is carried out by qualified personnel only.

They always have access to the operating instructions supplied with the device as well as the associated order documentation when carrying out work and observe this documentation to avoid hazards and damage.

Faults must be analyzed by qualified personnel. Measures must be taken to prevent consequential damage, personal injury, and damage to the system.

Qualified personnel

These persons must be qualified by virtue of their expertise (training, education, experience) or understanding of the relevant standards, specifications, accident prevention regulations, and properties of the system. It is crucial that these persons be able to identify and avoid potential hazards in good time.

Technical experts are those persons defined in DIN VDE 0105, IEC 364, or directly equivalent standards, such as DIN 0832.

User groups

Two user groups have been defined for handling the LAMBDA TRANSMITTER P oxygen analyzer:

Service technicians and trained customer personnel:
Qualified technicians/engineers who have an in-depth knowledge of the device.

Operators, in-house installation engineers:
Technicians for instrumentation and control technology, electrical engineering and electronics, who have a basic knowledge of the device.

1.3 Other Documents

For accessories and special applications, consult the documentation supplied.

Basic Safety Instructions

These operating instructions contain the most important information regarding the safe operation of the LAMBDA TRANSMITTER P oxygen analyzer. Always read them before starting work. Warnings must be observed at all times.

1.4 Obligations and Liability

Observe notes in these operating instructions

Before you can operate the device safely and properly, you must be familiar with the basic safety precautions and regulations. These operating instructions (in particular the safety precautions) must be observed by everyone who uses the LAMBDA TRANSMITTER P oxygen analyzer and connected components. In addition, the general and local accident prevention rules and regulations must be observed.

Hazards when using the LAMBDA TRANSMITTER P

The LAMBDA TRANSMITTER P oxygen analyzer is constructed in accordance with the current state of the art and recognized safety regulations. Measures must nonetheless be taken to prevent injury to the operator or a third person and to prevent the LAMBDA TRANSMITTER P or other objects from being damaged. The LAMBDA TRANSMITTER P must only be used:

For its intended purpose

When it is in good working order.

Faults that could compromise safety must be rectified immediately.

Warranty and liability

Our "General Terms of Sale and Delivery" always apply. These are available to the operator as soon as a contract has been concluded. Warranty and liability claims for personal injury or material damage shall be excluded if they are attributable to one or more of the following causes:

The LAMBDA TRANSMITTER P oxygen analyzer and connected components have not been used for their intended purpose.

The LAMBDA TRANSMITTER P and connected components have been installed, commissioned, operated, or serviced incorrectly.

The LAMBDA TRANSMITTER P oxygen analyzer and connected components have been operated with safety and protective equipment that is either defective, incorrectly installed, or not in working order.

The information in the operating instructions regarding the operation, maintenance, and installation of the LAMBDA TRANSMITTER P and connected components has not been observed.

Unauthorized alterations to the construction of the LAMBDA TRANSMITTER P and connected components have been made.

Components subject to servicing have not been checked properly.

Repairs have been carried out incorrectly.

Rough handling or the ingress of foreign bodies has resulted in catastrophic damage.

1.5 Safety Symbols

The following designations and symbols for hazards, warnings, and information are used in these operating instructions:

DANGER

Indicates potential danger for personnel, particularly due to electrical equipment.

WARNING

Indicates potential danger for personnel due to incorrect handling of system components.

IMPORTANT!

Indicates a risk of damage to system components and potential functional impairments.

NOTE

Highlights information on the features of the system or system components and provides additional tips.

The operator must observe the legal accident prevention guidelines at all times and take all the appropriate measures to prevent personal injury and material damage.

1.6 Intended Use

The LAMBDA TRANSMITTER P continuous measuring system measures the O_2 concentration in gases in the hyperstoichiometric range.

Prerequisite

All planning, mounting, installation, commissioning, maintenance, and repair work must be carried out by adequately trained personnel only and checked by experts.

Proper usage

You must make sure that:

The system is used in accordance with the technical data and specifications regarding usage, assembly, connection, ambient, and operating conditions (see the order documentation, user information, rating plates, and so on) and the documentation supplied.

Users act in accordance with the local, system-specific conditions and with due consideration paid to operational hazards and specifications.

All of the measures required to maintain the device, for example, transportation and storage, as well as maintenance and inspection requirements, are provided.

Observing the operating instructions

Intended use also includes:

Observing all the information in the operating instructions.

Carrying out all inspection and maintenance work.

1.7 Incorrect Usage

It is forbidden to use the device in any other way than described above. Incorrect usage can be hazardous.

If the measuring system is to be used in any other application in which its proper functioning cannot be ensured, consult the manufacturer beforehand.

1.8 Informal Safety Measures

The LAMBDA TRANSMITTER P oxygen analyzer must only be operated when all the safety equipment is in good working order.

The operator must take all the appropriate measures to prevent personal injury and material damage.

You must make sure that:

- The system is used in accordance with the technical data and specifications regarding usage, ambient, and operating conditions (see the order documentation, user information, rating plates, and so on) and the documentation supplied.
- Users act in accordance with the local, system-specific conditions and with due consideration paid to operational hazards and specifications.
- All of the measures required to maintain the device (e.g. for transportation and storage, as well as maintenance and inspection requirements) are provided.

If the system is used or handled incorrectly, this can pose a risk to health or cause material damage. To prevent damage, observe the safety precautions at all times.

If the LAMBDA TRANSMITTER P is used as a sensor in conjunction with a control system, the operator must ensure that a failure or malfunction cannot lead to operating conditions that cause damage or lead to other hazardous operating conditions.

To prevent malfunctions, which can cause personal injury or damage to the system either directly or indirectly, the operator must ensure that:

- The maintenance personnel can be alerted immediately and at any time.
- The maintenance personnel is qualified to respond to malfunctions on the LAMBDA TRANSMITTER P and associated system malfunctions correctly.
- The defective equipment can be switched off immediately if necessary.
- Switching off equipment does not indirectly cause further malfunctions.

The LAMBDA TRANSMITTER P oxygen analyzer is a high-quality electronic measuring system. It must be handled with care when it is removed from service, transported, and stored.

1.9 Danger from Electrical Power

DANGER

The LAMBDA TRANSMITTER P system components are designed for use in industrial power installations. When working on power connections or on live components, make sure that the power supply is switched off. Before reconnecting the power supply, install any shock protection devices that may have been removed. The relevant safety regulations must be observed at all times.

1.10 Hazardous Areas

The LAMBDA TRANSMITTER P is installed directly in the gas-carrying duct above the counterflange. When the LAMBDA TRANSMITTER P is removed, corrosive and/or hot gases can – depending on the device and, in particular, if the duct is pressurized – escape from the duct. This gas can cause serious injury if appropriate protection measures are not taken.

WARNING

If the duct is pressurized and corrosive gases and/or temperatures in excess of 200°C (390°F) are present in the gas duct, gas can escape from the duct when the LAMBDA TRANSMITTER P is removed. For this reason, you must observe the following:

Switch the system off before you open it. If this is not possible, wear protective clothing and a mask.

Attach warning signs in the vicinity of the mounting location.

Close the opening immediately. Cover flange plates (dummy flanges) are available as accessories.

WARNING

The flange and the tube of the LAMBDA TRANSMITTER P is very hot.

Cooling down before removing or wear protective gloves.

1.11 Removal from Service

IMPORTANT!

The LAMBDA TRANSMITTER P must not be switched off once it has been installed nor when the plant is shut down. Residual gases can cause corrosion and damage system components.

If the device is stored outdoors, it must be protected from the elements. It must always be stored in a dry place and, if possible, in its original packaging.

When decommissioning the device, protect the cable ends and connectors against corrosion. Corroded connectors can cause the device to malfunction.

Whenever possible, transport the device in its original packaging.

1.12 Alterations to the Construction of Devices

No alterations must be made to the construction of or equipment fitted to the LAMBDA TRANSMITTER P oxygen analyzer without the prior approval of the manufacturer.

2 General Description

2.1 Theoretical Fundamentals and Measuring Principle

The O_2 measuring cell essentially comprises a zirconium dioxide solid electrolyte tube, which is sealed at one end. The internal and external surface is coated with layers of precious metal as electrodes. The crystal lattice of the zirconium dioxide solid electrolyte, which is doped with yttrium oxide or other rare earth oxides, contains oxygen vacancies to enable oxygen ion conductivity that increases exponentially with the temperature. The solid-electrolyte cell, which can be heated by means of an internal electric heater, is surrounded by a quartz or ceramic cladding tube. A defined sample gas flow (500 ml/h) passes through the cladding tube by means of a flow-control capillary and an extraction device/measuring gas pump.

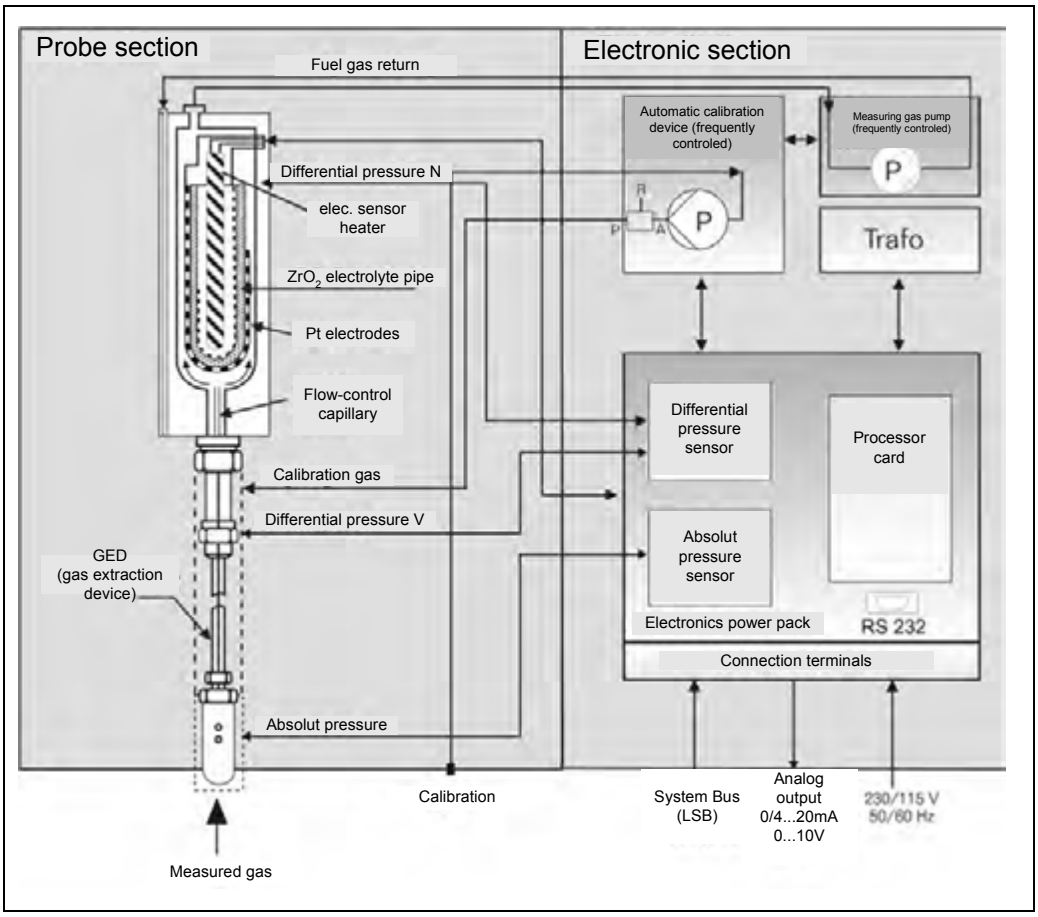


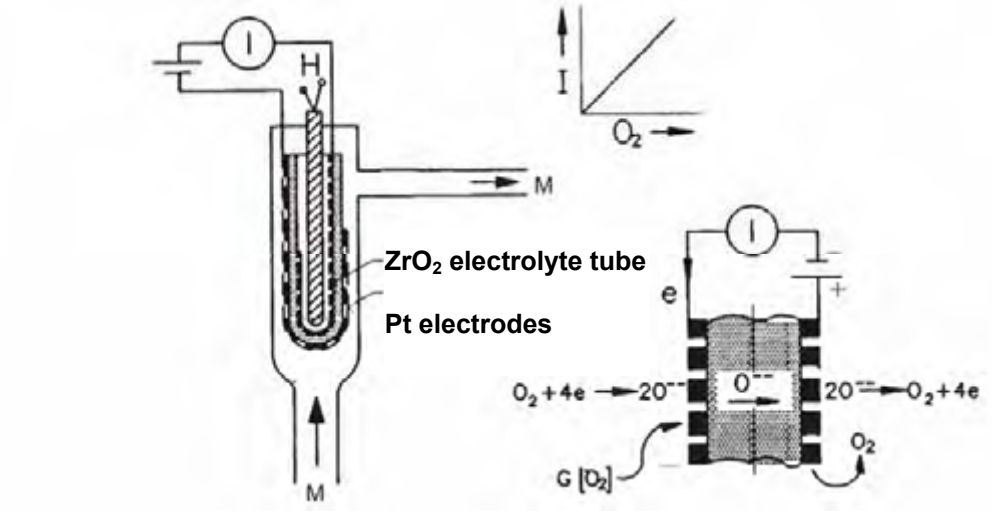
Fig. 2-1:
Measuring principle

Changes in the sample gas flow (e.g. as a result of pressure variations upstream or downstream of the capillary) are recorded by means of a differential pressure measurement and corrected by the microprocessor.

To determine the oxygen concentration in the sample gas, a direct-current voltage of between 0.4 and 1.0 V is applied to the electrodes in the cell (at an operating temperature of > 800°C (1470°F)); the oxygen ions flowing through the solid electrolytes are measured using a milliammeter. All the oxygen in the sample gas ionizes under the influence of the direct-current voltage at the negative outer electrode.

The negative oxygen ion flow is transported to the positive internal electrode and is discharged to form molecular oxygen. A linear correlation exists between the ionic current, which is measured as the probe current signal, and both the oxygen concentration and sample gas quantity that passes through the cell in each time unit.

Calibrating this in line with a gas with a known oxygen concentration (preferably air with 20.96 vol.% O_2) enables the sample gas flow rate to be determined. Variations in the sample gas flow rate are compensated by means of the differential pressure compensation.



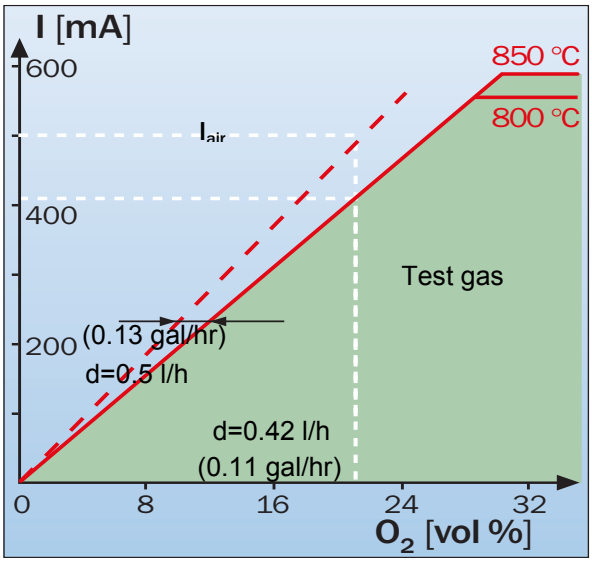


Fig. 2-2:
Structure and function of the oxygen probe

I	Current as function of oxygen	A	Adjustment value ($I_{air} \approx 21$ vol. % O_2)
H	Electric sensor heater	d	Test/sample gas quantity
M	Test gas		

This characteristic shows that it is not necessary to know the proportionality factor or the measuring gas quantity in order to measure the oxygen. It is sufficient to assign the oxygen concentration (O_2 = 21%) to the probe current measured with air I (air) and then draw a straight line to the zero-point (I = 0; (O_2) = 0) through the adjustment point derived in this way. In practice, this means that the probe can be easily aligned and adjusted by assigning ~ 21 Vol. % O_2 to the measured air value (20.96).

If the cell is structured appropriately and a suitable voltage is applied, the linear characteristic of the probe depends solely on the sample gas quantity, which governs the gradient of the straight lines (see diagram).

The temperature of the solid electrolytes and the electrodes is not explicitly incorporated in the probe signal, although it does determine the internal resistance of the probe or its limit current and, in turn, the measurable oxygen concentration range.

The probe temperature doesn't need to be measured or regulated, but it must be ensured that it does not undershoot a defined critical value, which depends on the required measurement range. To measure oxygen concentrations of up to 21 vol. % (atmospheric oxygen) the minimum probe temperature is 800°C (1470°F), for example. The static probe characteristic I = f (O2) in the diagram shows that the measurement accuracy is generally stable, regardless of the probe temperature and oxygen concentration.

Using a current-proportional probe voltage and by compensating pressure and temperature effects on the flow-control capillary, a measurement accuracy of better than ± 0.2 vol.% oxygen in flue gases of all common fuels can be achieved, even when measured values are not compensated. Probe ageing during long-term operation does not affect the measurement accuracy; it merely narrows the measurement range. For adjustment monitoring purposes, however, it should be at least 21 vol.% oxygen.

Probe (measuring cell) aging is compensated by measuring the int. cell resistance and, in turn, adjusting (increasing) the temperature of the measuring cell over a broad range.

Long-term experience of operating the device under difficult conditions (e.g. incineration of industrial waste, waste incineration, bio/sewage gas, etc.) has shown that the measuring principle is extremely resistant to "contamination" provided that the LAMBDA TRANSMITTER P Lambda transmitter is used properly.

Cross-sensitivity with non-combustible gas components (e.g. H2O, N2, CO2, NOX, SO2, etc.) is not an issue. When oxygen is present, combustible gas components are incinerated on the platinum-coated surface of the sensor, which is approx. 800°C (1470°F).

Example: 2CO + O2 = 2CO2
This means that with 1 vol. % CO in the measuring gas, 0.5 vol. % oxygen too little is displayed. For this reason, this measuring principle is not suitable for measuring oxygen in combustible gases.

The amperometric measuring principle of the Lambda transmitter yields an almost linear sensor characteristic. This characteristic passes through zero and its gradient is determined by an adjustment point. When the measurement is taken in ambient air with an oxygen concentration of ψ_{cal} = 20.96 vol. %, this point is normally derived by determining the probe current I_{cal} [mA].

With respect to the measured probe current I, the ideal oxygen concentration (ψ_{O2}) of any measuring gas is governed by the following formula:

$$\psi_{02,ideal} = \psi_{cal} \times I / I_{cal} \quad \text{Gl. (1)}$$

Depending on physical and design aspects, the LAMBDA TRANSMITTER P probe current depends not only on the oxygen content of the measuring gas, but also on the gas temperature (T), the differential pressure (Δp), the absolute pressure upstream of the flow-control capillary, the average molecular weight (M_m), and a function of the mean isentropic exponents ($F(\kappa)$) of the measuring gas in relation to the adjustment conditions (index "cal"):

$$\psi_{O2} = \psi_{02,ideal} \times p_{cal} / p \times (T/Tcal)^{1/2} \times (M_m/M_{m,cal})^{1/2} \times F_{(\kappa)cal} / F_{(\kappa)} \quad \text{Gl. (2)}$$

To compensate these fault effects, the LAMBDA TRANSMITTER P oxygen analyzer features the following measured value corrections:

- Temperature compensation
- Pressure compensation
- Flow rate compensation

See also "Flow Rate Compensation".

2.2 Functional Description

2.2.1 General Functional Description

The LAMBDA TRANSMITTER P is a versatile microprocessor-based O_2 measuring device for taking direct measurements of the O_2 concentration of gases in the hyperstoichiometric range (λ >1). The measuring method is based on the tried-and-tested ZrO_2 current measuring principle. The measured values are output via an analog output with 0/4...20 mA or 0...10 V. The device can be operated via a display/control unit, a PC in conjunction with the remote display software, or via a remote display connected to the LAMBDA TRANSMITTER P via the LSB BUS.

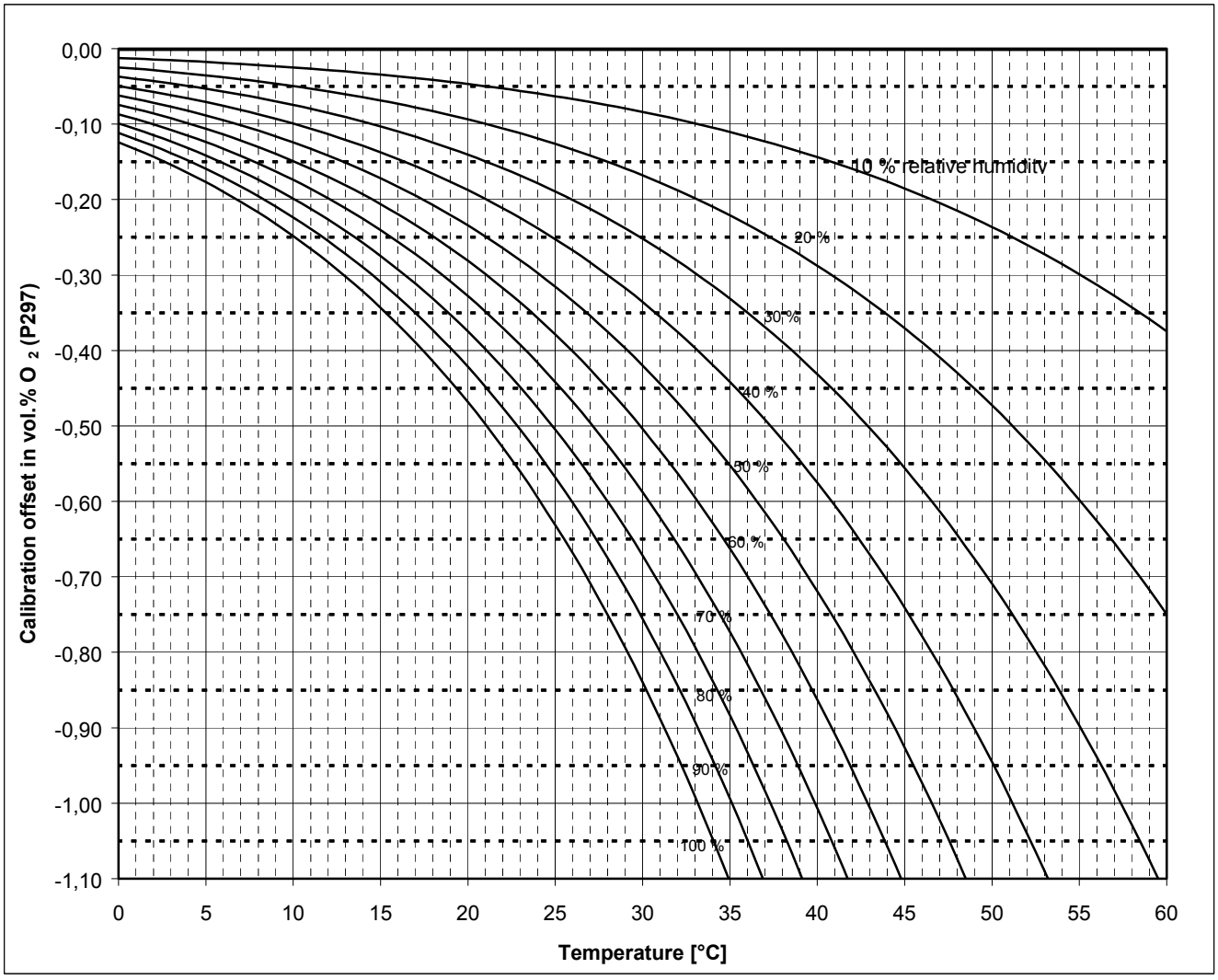
2.2.2 Benefits of the Measuring Principle

- Quasi-linear measurement signal with fixed zero-point
- Adjustment with ambient air (no special measuring gases required)
- High measurement accuracy (better than 0.2 vol.% O_2 in the range 0 ... 25 vol.% O_2)
- Automatic probe monitoring and adjustment with ageing compensation for the ZrO_2 measuring cell
- Sensor element outside of the flue gas system (stack), no ignition source in the flue gas duct (TÜV confirmed)
- No gas preparation required, measurement directly in the humid flue gas
- Test gas temperature of max. 950°C (1750°F) with metal extraction and up to 1,600°C (2900°F) with ceramic gas extraction device
- A small measuring gas quantity (approx. 0.5 l/h) means that the measuring gas temperature does not affect the measurement accuracy. The sensor system itself is located outside the flue gas system.
- Rapid response time of the entire system (T_{90}) < 20 seconds with standard extraction (length: 1000 mm)
- No reference gas required
- Simple operation
- Degree of protection IP 66 for ambient temperatures of –20°C to +55°C (-4…130°F)
- The ZrO_2 sensor, heater, and all gas-carrying components can be replaced by the end customer.
- Wide range of applications
- The measuring gas-side components are identical to those in the previous system.
- Electrical contacting outside the flue gas
- Maintenance free
- Minimum terminal assignments (no compressed air connection required)

2.2.3 Influence of air humidity on the O_2 calibration value

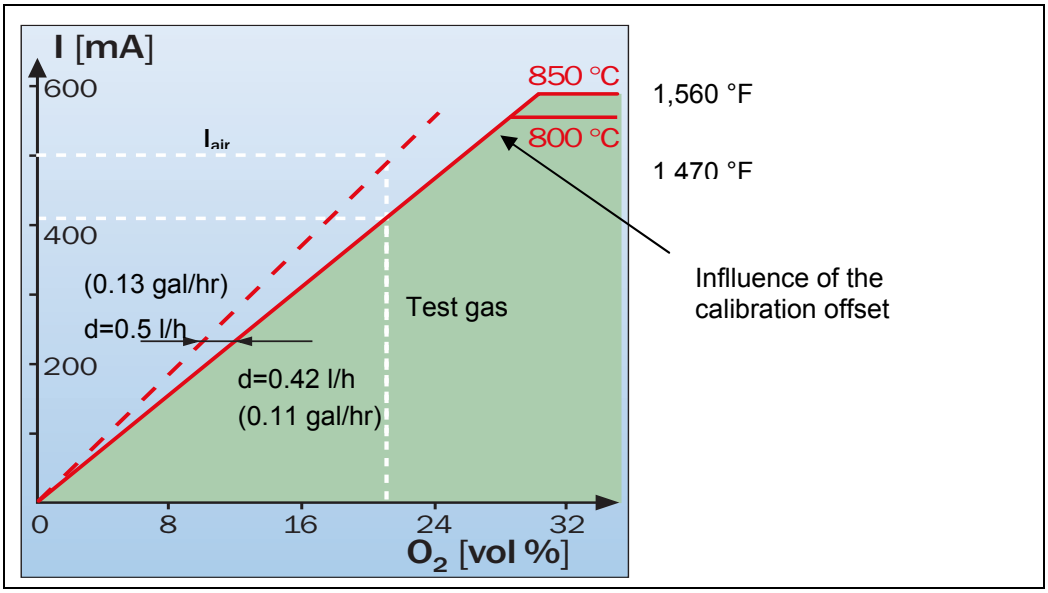
The calibration procedure takes place by ambient air. In order to consider the relative humidity of the air used for the calibration procedure a calibration offset (parameter 297) has to be set. The setting of the calibration offset parameter (P297)at works: –0.3 vol% of O_2.

The influence of the rel. humidity of air in relation to the air temperature is shown in the following diagram.



Influence of air humidity on the O_2 calibration value of 20.96 vol.%

Due to the linear characteristic curve with fixed zero cycle the calibration offset is applied at high O2 values higher than 10%.



Influence of the calibration offset

2.2.4 Flow Rate Compensation

The flow rate through the capillary depends on the average molecular weight/gas constants of the gas to be measured. With "normal" flue gases from oil, gas, and coal firing, the effect on the measurement accuracy is insignificant. The measurement error is within the specified measurement accuracy of ± 0.2 vol. % O_2.

The following diagram shows the fault effect for different fuels. This arises from the correlation between the sample gas flow rate and the average molecular weight/gas constants of the flue gas. The diagram shows the typical ratio of CO_2 to H_2O in the flue gas (calibration with dry air).

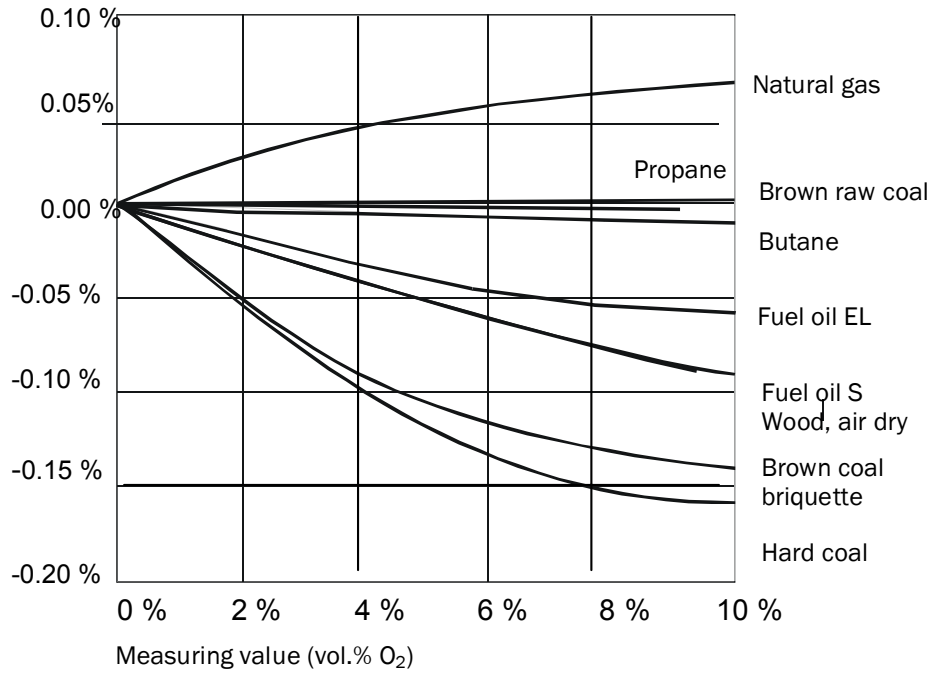


Fig. 2-3:
Fault effect for different fuels

NOTE

Fuel-specific flow rate compensation is deactivated by default. It can be activated via parameter 836.

Fuel-specific flow rate compensation

Fuel-specific compensation is set via parameter group 835 - 899.

Measured value correction

Measured values are corrected via parameters 1280 to 1283. This is recommended in the following cases:

- High level of humidity (H_2O) and low CO_2 content (e.g. downstream of wet scrubber)
- High CO_2 content and low H_2O content

2.2.5 Cold-Start Delay

The LAMBDA TRANSMITTER P oxygen analyzer features an intelligent cold-start delay function, which prevents flue gas from passing through a cold probe. The optimum time for switching on the measuring gas pump is governed by the temperature of the zirconium dioxide measuring cell, which is determined by measuring the internal cell resistance during the warm-up phase.

The cold-start delay is always activated after the power has been switched off. Once the probe temperature is above 260°C, it can be interrupted at any time as follows:

- Via the multi-function key
- Via the remote display software
- Via the display/control unit

During the cold-start delay, the system outputs either a substitute value or the "current measured value".
Factory setting: Non substitute value
Can be setted via parameters 361 and 362.

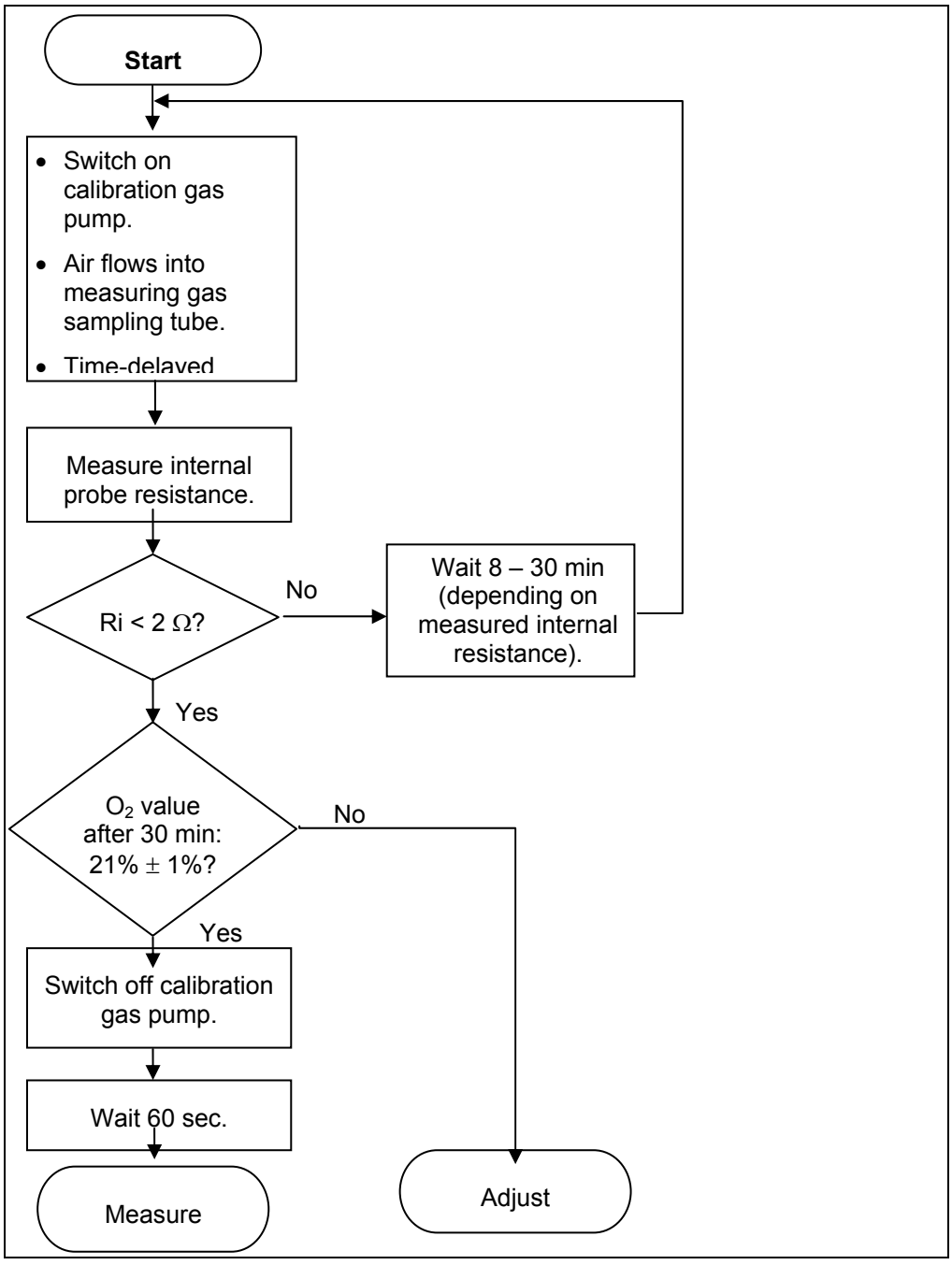


Fig. 2-4: Intelligent cold-start delay

2.2.6 Cold start Ri-table (Parameter 1984..1999)

During the cold start the internal resistance (Ri) is measured, in order to recognize the heating condition of the probe. The determinde values are put in the cold start Ri-table. On the base of these values a diagnostic of the cold start process is possible, otherwise they have no function. With an restart the values are deleted and again filled by the following cold start. Not used values are setted to „0“.

2.2.7 Ri-table (last Ri-value Parameter 1800...1898)

Last measured Ri-value and Ri-table belongs together. The internal resistance and the heating power in the course of probe aging are stored. In the first entry of this history (last measured Ri-value), the internal resistance determined with the last aging compensation is put down in each case as well as the heating power and the time (operation hours). In the remaining parameters entries are put down, as soon as the heating power was changed by the aging compensation.

After exchange of the sensor (Par. 104) this history will be deleted.

2.2.8 Aging compensation

The aging of the sensor is compensated by increasing of the heating power. The internal resistance of the ZrO2-sensor is measured and if necessary an aging compensation (increasing the heating power) is accomplished. This takes place after the 1. calibration after coldstart and then approx. 1x per week (every 10000 minutes). The measured internal resistance of the sensor (Ri) is registered into the table in Par.1805...1898. Thus the aging of the sensor can be supervised.

CAUTION!

After exchange of the sensor the heating power must be reset on the basic value. Set Parameter 104 on „Release“ and acknowledge with „Enter“. If the instruction is implemented, the parameter 104 jumps back to "0".

2.2.9 Calibration history (Parameter 1570...1791)

In the calibration history with each accomplishing automatic calibration a data set is stored. The data records are sorted, the last calibration is always put down in cal. history 1. If by the automatic calibration new data records are added, older data records are overwritten, simply the oldest data records are however not deleted, separate always temporally at closest placing overwritten, so that always a complete overview of the entire is presented. The parameters put down in the respective data record are self-describing. they correspond to the actual values of the parameters 74, 76, 54, 53, 51, 57, 18 and 5 available at the end of the calibration.

By means of Par. 119 the calibration history can be deleted.

2.2.10 Calibration drift history (Parameter 3600...3679)

In this history is stored the change of the O2-value of the last 40 automatic calibrations, together with the time (operation hours), so that e.g. the probe drift with a cyclic calibration every 24 hours for the last 40 days is available.

This history is sorted, the newest entry always stands at the beginning.

Examples for text + parameter in the display:

Calibration Drift History

Operating Hours

Par. 3600: 7430 h

Calibration modified about

Par. 3601: -0,07 %

Operating Hours

Par. 3602: 7454 h

Calibration modified about

Par. 3603: +0,03 %

e.c. up to Par. 3679

Not used values are setted to „0“.

The values can be read aout via the display or via the Remote-Display-Software.

The parameters can also be queried via a Profibus-interface, which is connected to LSB.

The output of the datas via CANopen-protocol is not be possible.

2.3 General View

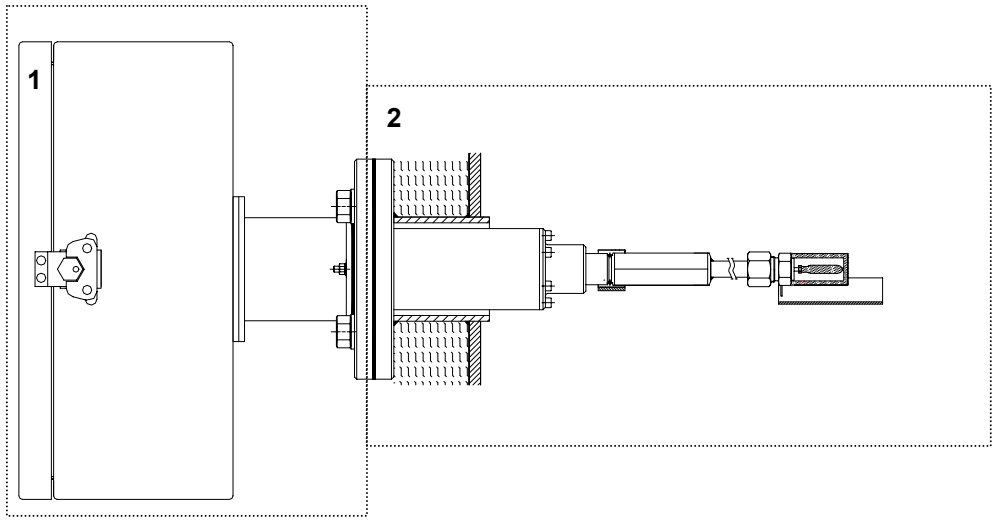


Fig. 2-5:
LAMBDA
TRANSMITTER P

1 Electronics section
2 Probe section

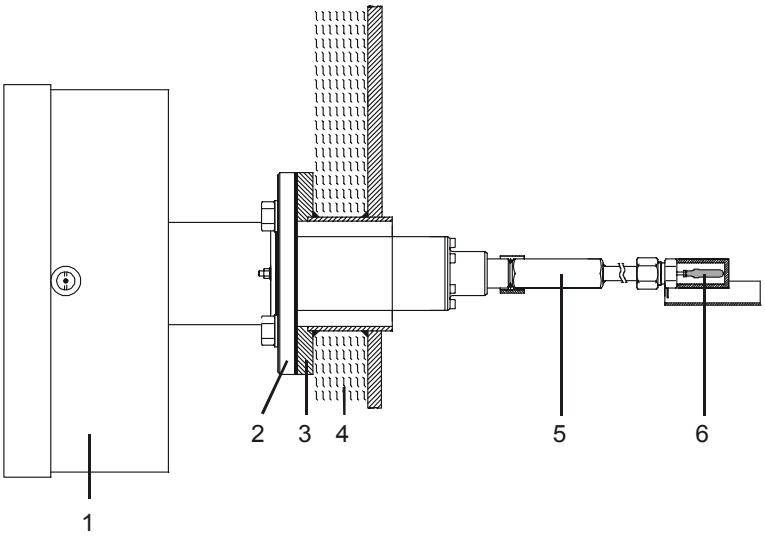


Fig. 2-6:
LAMBDA
TRANSMITTER P installed on the flue gas duct (side view)

1 Electronics section
2 Flange
3 Counterflange
4 Insulation
5 Protective pipe for gas extraction device, with sintered metal pre-heater
6 Gas extraction device (GED)

Display/control unit (optional)

Lock for opening the electronics section

Additional Operating/fault mode display via LED's, multi-function key, maintenance switch

RS422/CAN/LSB communication LEDs

Processor card

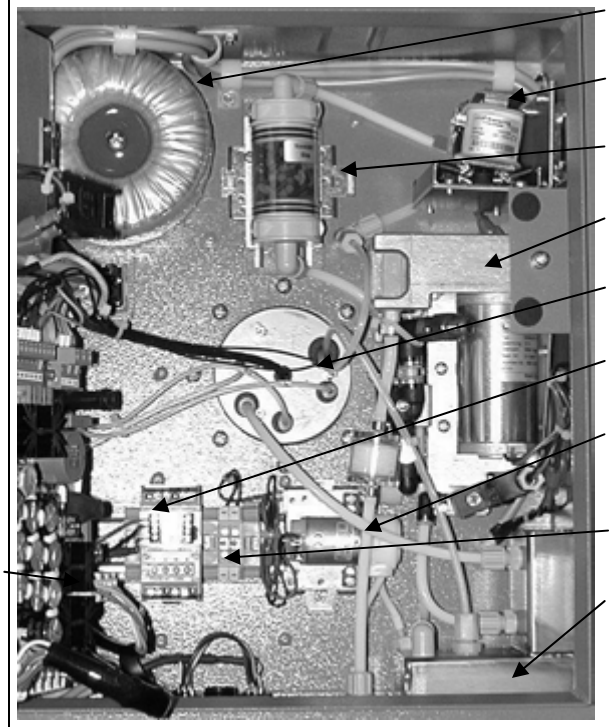
LEDs for fuse monitoring

RS232 PC interface for connecting the remote display software

Fig. 2-7: In sheet-steel housing (front view of electronics section)

DANGER

Before opening the internal door (entry electronic section) disconnect line voltage !!



Probe and electronics transformer

Measuring gas pump

Pump protection filter

Automatic calibration unit

Probe section (side of connention)

LSB module (optional)

Condensate pump

Terminals analog output

Pressure buffer and condensate tank for probe measurements

Condensate tanks for differential and absolute pressure measurements

Fig. 2-8: In sheet-steel housing (internal view of electronics section)

2.4 Probe Section View

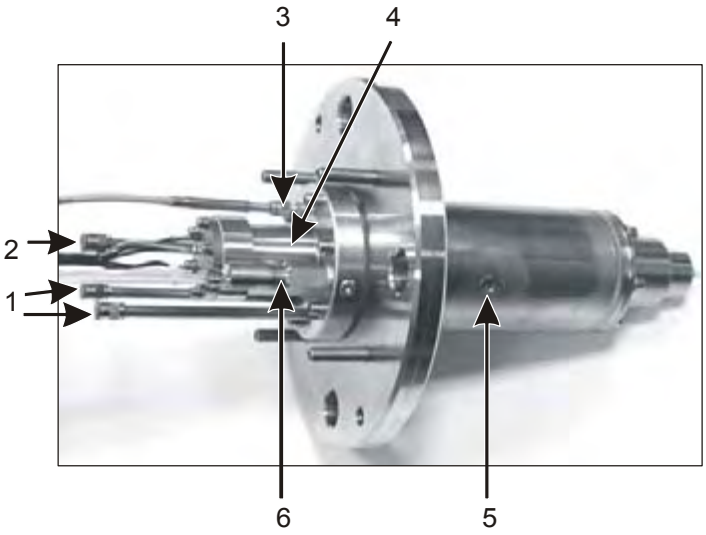


Fig. 2-9: Probe section (side view)

1 Connections for differential pressure sensor
2 Connection for air calibration
3 PT100 temperature measuring element
4 O_2 measuring cell (inside)
5 Measuring gas outlet
6 Exhaust device and flue gas return

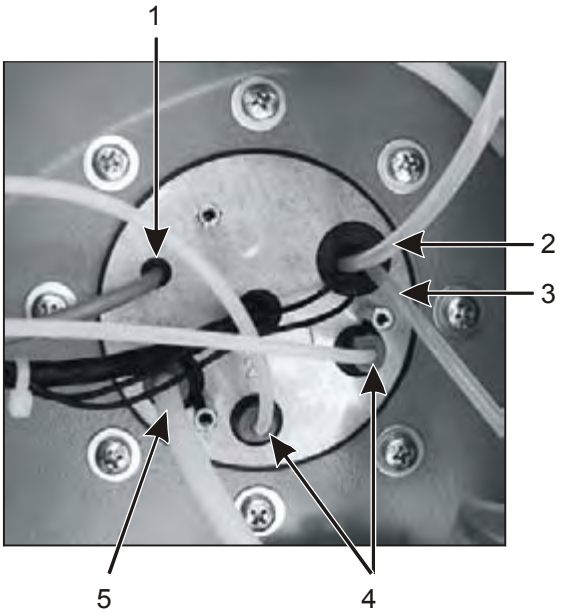
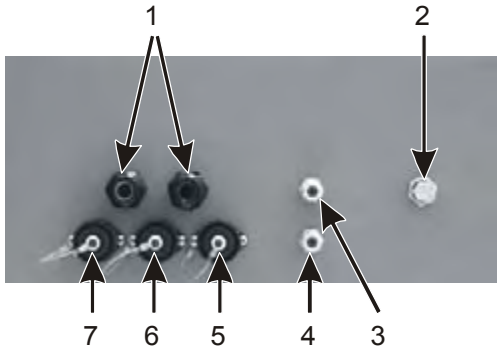


Fig. 2-10: Probe section (connection side)

1 PT100 temperature measuring element
2 Flue gas return (connection for measuring gas pump)
3 Measuring gas sampling (connection for condensate tank)
4 Connections for differential pressure sensor
5 Air/Calibration gas inlet (connection for pressure buffer)

Fig. 2-11:
Connections



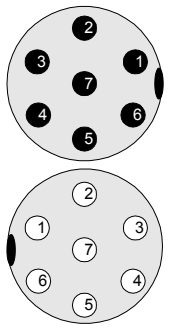
1 Free cable connection (e.g. for analog output, RS232 interface cable, additional modules)
2 Drain plug for condensate tank (see Note)
3 Calibration gas inlet
4 Condensat outlet
5 Connection for LSB BUS
6 Connection for LSB BUS
7 Power terminal

NOTE

The drain plug for the condensate container does not normally need to be opened. The LAMBDA TRANSMITTER P is equipped with an automatic condensate drain with an integrated hose pump.

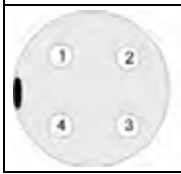
6 7-pin LSB/CAN female connection to gas extraction device and filter heater

7 7-pin LSB/CAN male connection to other devices with a LSB/CAN terminal



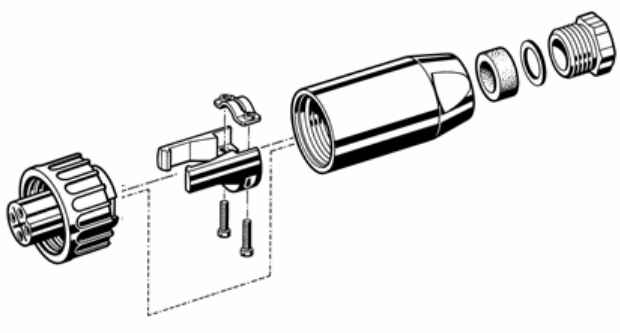
1 - NC
2 - CAN-GND
3 - CAN low
4 - CAN high
5 - GND from EVU
6 - +24V from EVU
7 - PE

8 Power connection



1 - L
2 - N
3 -
4 - PE

Fig. 2-12:
Suitable cable connection



2.5 Gas Extraction Device

2.5.1 View of Gas Extraction Device (GED)

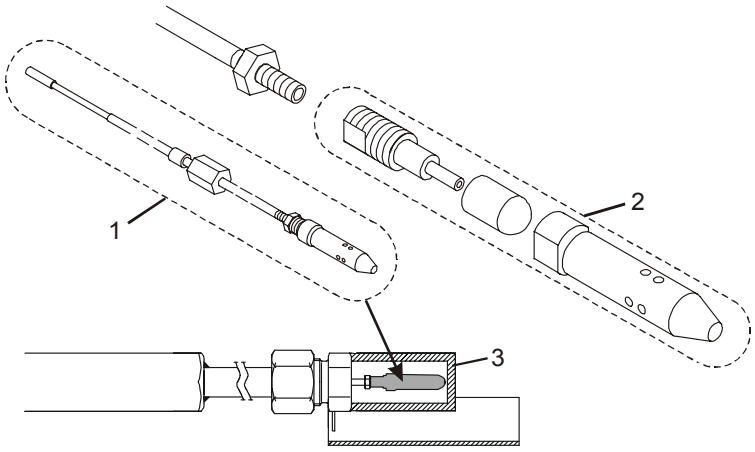


Fig. 2-13:
Detailed view of gas extraction device

1 Gas extraction device (GED)
2 Sampling filter
3 Sintered metal pre-filter

2.5.2 Measure Gas Temperature

Up to 700°C (1300°F)

Test gas temperature up to 700 °C (1300°F) (standard)

Capillary tube:	Material:	2.4851 (Alloy 601)
Extraction attachment:	Material:	1.4762
Sintered metal filter:	Material:	Hastelloy X
Protective pipe:	Material:	1.4571 up to 700 °C
Pre-filter:	Material:	Hastelloy X

Up to 950°C (1750°F)

Test gas temperature up to 950 °C (1750°F) (Inconell)

Capillary tube:	Material:	2.4851 (Alloy 601)
Extraction attachment:	Material:	1.4762
Sintered metal filter:	Material:	Hastelloy X
Protective pipe:	Material:	Inconell 600
Pre-filter:	Material:	Hastelloy X

From 950°C to 1400°C (1750°F to 2550°F)

Test gas temperature from 950 °C to 1400 °C (1750°F to 2550°F)

Ceramic gas extraction device

Capillary tube:	Material Al_2O_3
Protective pipe:	Material Al_2O_3
Pre-filter:	Material Al_2O_3
	Filter mesh 50 µm

Up to 1600°C (2900°F)

Test gas temperature up to 1,600 °C (2900°F) (on request)

Below 180°C (355°F)

Test gas temperature below 180 °C (355°F)

The temperature across the entire length of the gas extraction device (capillary) must be above the dew point (water/acid dew point). This means:

Highly sulfurous fuels (heavy-grade oil, coal):	Above 180 °C (355°F)
Gas:	Above 80 °C (175°F)
Light fuel oil:	Above 120 °C (250°F)

If this cannot be ensured, the gas extraction device and, if necessary, the sintered metal pre-filter must be heated (see "Optional Accessories").

IMPORTANT!

In double-wall stacks, a heater for the gas extraction device is required. With flue gases that are 100% saturated (exhaust vapors), a sintered metal pre-filter must also be used.

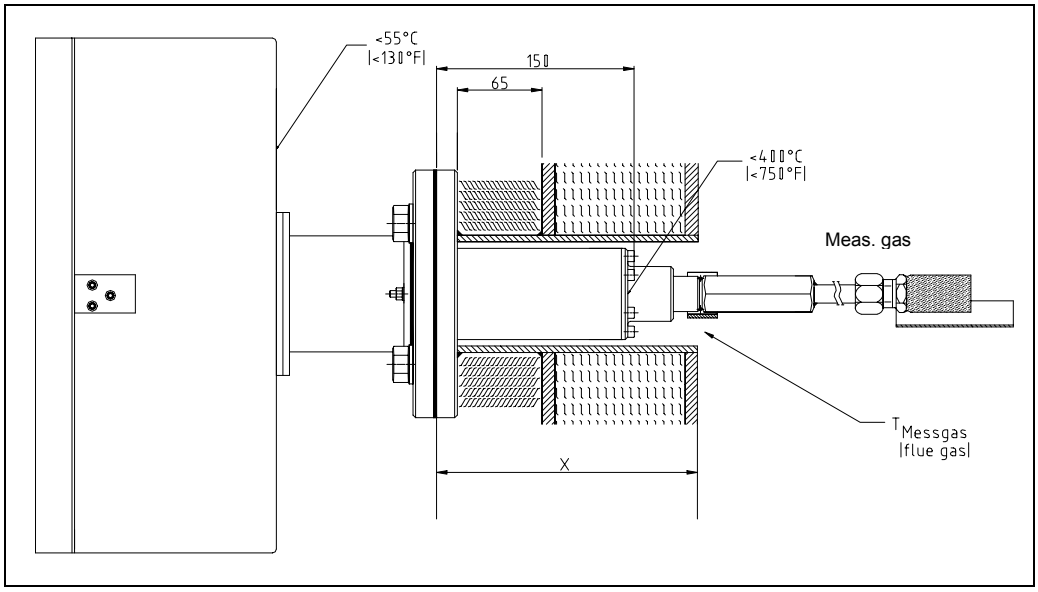


Fig. 2-14:
Installation planning aid, max. temperatures

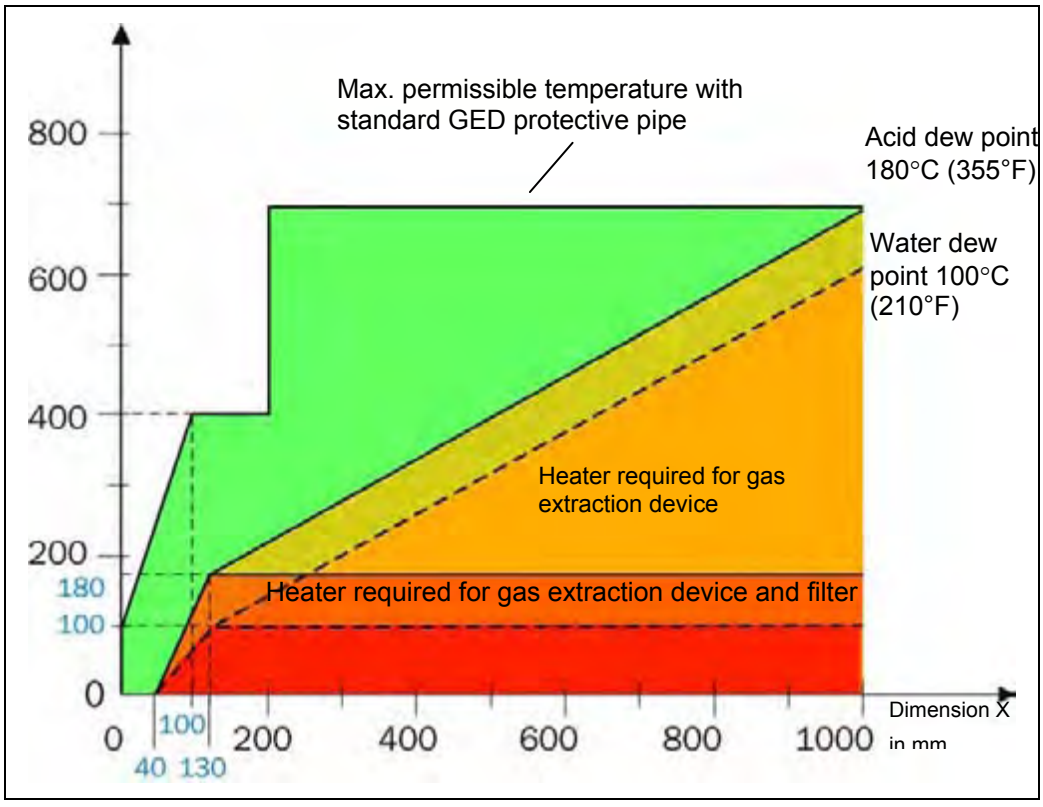


Fig. 2-15:
Using a gas extraction device and filter heater

2.5.3 Length of the Gas Extraction Device

Max. length of the gas extraction device: 3m (9,84 ft)

Recommended length: Only as long as required

IMPORTANT!

With horizontal installation, it is recommended that the protective pipe for the gas extraction device be supported as of the following gas extraction device lengths.

- Standard: > 1000 mm (39,4 in)
- Ceramic protective pipe: > 1000 mm (39,4 in)
- Protective pipe with heater for gas extraction device > 1000 mm (39,4 in)

If the measuring point is subject to vibrations, support should be provided for the protective pipe for the gas extraction device with shorter gas extraction device lengths. See "Optional Accessories".

Useful information

The "core flow measurement", which is often required, is often not necessary. "Strands" are, in practice, very rare. Experience has shown that they occur under the following conditions:

When gases of different temperatures collide (usually re-circulated air and flue gas).

With gas velocities less than 1m/s (separation). If genuine "strands" occur, however, it is extremely difficult to find an extraction location above the insertion depth of the measuring gas sampler that is suitable for all operating conditions. Even the core flow is not immune to genuine strands, which tend to "wander".

2.6 Protective Pipe with Aluminum Core

The protective pipe with an aluminum core (standard ex immersion depth >500mm) distributes the heat of the measuring gas equally across the entire length of the gas extraction device. An electrical heater is not usually needed.

Protective pipe with aluminum core without heater: Type 6 57 R 3441…R 3444.

IMPORTANT!

With horizontal installation, it is recommended that the protective pipe for the gas extraction device be supported with lengths of > 1000 mm (3.9 in). The protective pipe support is supplied for the appropriate insertion depth.

If the measuring point is subject to vibrations, support should be provided for the protective pipe with shorter gas extraction device lengths.

Protective pipe support type 657R3520

2.7 Conformity

The LAMBDA TRANSMITTER P oxygen analyzer:

Complies with the currently applicable VDE (Verein Deutscher Elektroingenieure) regulations.

Fulfills the requirements of the Federal German Pollution Control Act (13th and 17th Implementing Ordinances) and the German Clean Air Act (TA Luft). TÜV-Type proofed (Proof No. 936 / 21203535 / A)

Complies with the "minimum requirements for emissions-related measuring devices" of the federal environment office in accordance with the guidelines for the performance testing, installation, calibration, and maintenance of systems for continuous emissions measurements.

3 Installation

3.1 Prerequisites

Before installation, the following points must be taken into account:

Measuring location

The measuring location must be easily accessible. The weight of the LAMBDA TRANSMITTER P is about 30kg.

Test gas temperature

No condensate must be allowed to form in the gas extraction device. The temperature along the entire length of the gas extraction device must, therefore, be above the dew point.

Guide values for temperature:

Light hydrocarbons (e.g. natural gas, propane, butane, hydrogen, etc.)	>80°C (175°F)
Light fuel oil	>120°C (250°F)
Fuels (e.g. fuel oil S, coal, pyrolysis gases, etc.) in which high levels of SO_2, HCL, or corrosive substances are likely to form.	>180°C (355°F)

IMPORTANT!

If the temperature anywhere on the gas extraction device is below the dew point, a heater is required for the gas extraction device.

In double-wall stacks, a heater for the gas extraction device is required. With flue gases that are 100% saturated (exhaust vapors), a sintered metal pre-filter must also be used.

NOTE

Corrosion on the gas extraction device indicates that the temperature is below the dew point. If the gas extraction device is blocked, this is a sure sign that the temperature has fallen below the dew point.

The desired heater temperature should never be set higher than required. The greater the heat output, the shorter the service life of the heater.

Gas extraction device version

Usage limits for the gas extraction device material:

Standard stainless steel (material 1.4571):	Up to 700°C (1300°F)
Inconell:	Up to 950°C (1750°F)
Ceramic:	Up to 1400°C (2550°F)

Versions up to 1,600°C (2900°F) on request

Dust content

When a high dust content or abrasive flue gas constituents are present, a protective pipe for high-dust applications must be used for the gas extraction device (see "Optional Accessories").

Length of dust extraction device

The length of the gas extraction device should always be kept to a minimum. The probe should be attached as close as possible to the measuring point (duct).

3.2 Installing the Counterflange

1. Plan the mounting position.
   It can be mounted in any position between the –20° of the vertical axis to the horizontal axis.
   Connection side below.

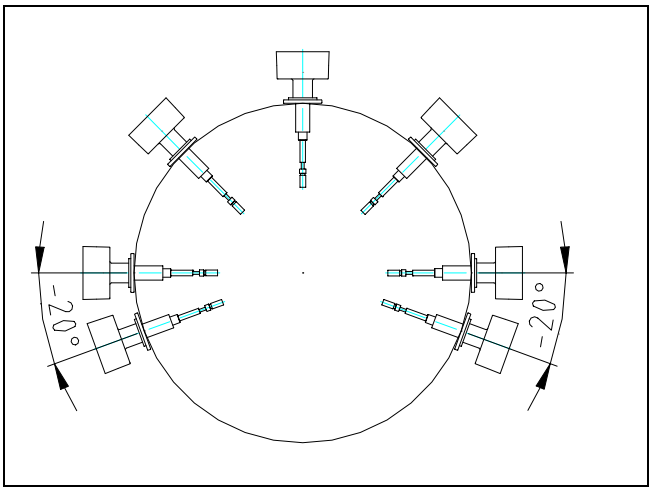


Fig. 3-1:
Mounting position

2. Flame-cut a hole with a diameter of 125mm (4,9 inch) in the flue gas duct.

WARNING

When you create the apertures, parts that fall into the duct may cause damage. For this reason, a wire must be used to secure parts that are to be cut away.

Appropriate measures must be taken to protect against hot, explosive, or poisonous flue gases that may escape.

3. Align the counterflange (see diagram) and weld it securely to the measuring point. The two threaded holes (M8) must face up/down.

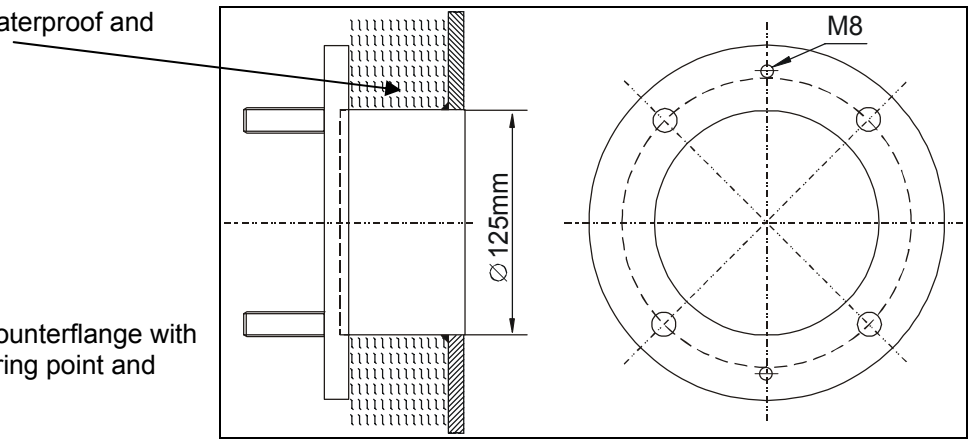


Fig. 3-2:
Align the counterflange with the measuring point and weld on.

4. Seal the aperture with a dummy flange.

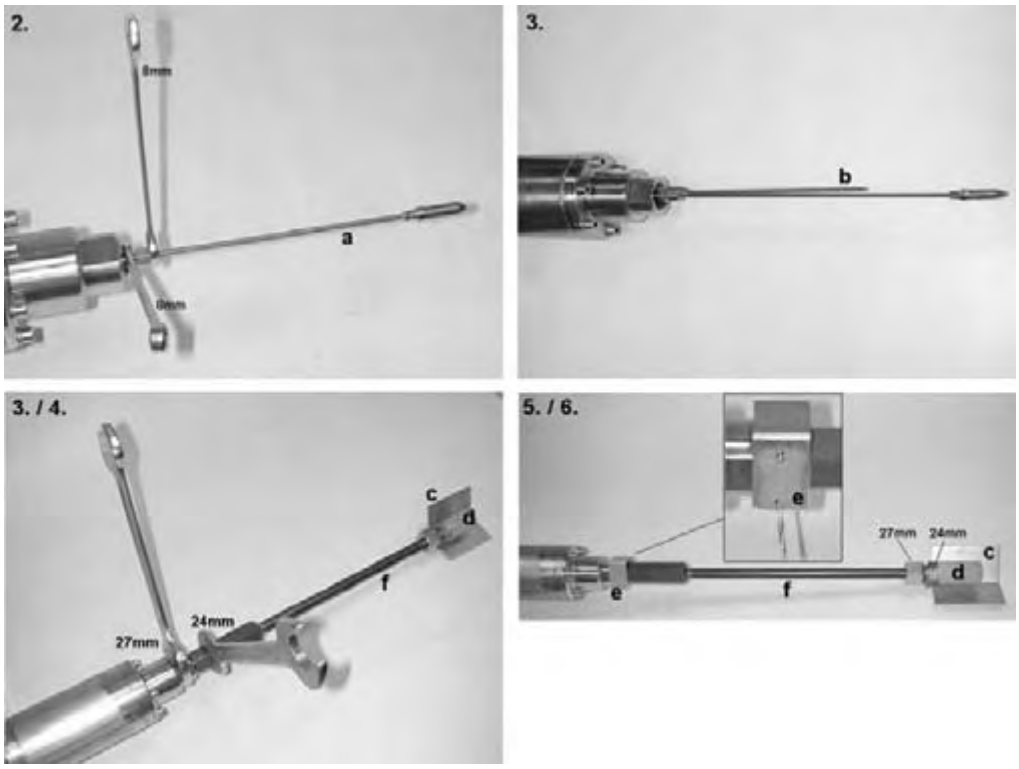
5.→ The neck must be isolated waterproof and thermic.

CAUTION!

If the neck is not be isolated, maybe you will be get dep point falling. This can falsify the measured value.

3.3 Installing the Gas Extraction Device (GED) and Protective Pipe

Installation steps of the gas extraction device and the gas extraction device.



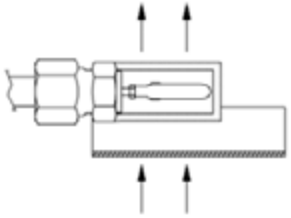
a	Gas extraction device .	**a**	Gas extraction device .
b	Absolute pressure capillary	**b**	Absolute pressure capillary
c	Baffle plate	**c**	Baffle plate

Fig. 3-3:
Installing the gas extraction device and protective pipe for the gas extraction device (work steps specified)

IMPORTANT!

All glands and threads must be treated with anti-seize paste (type 650 R 1090).

1. Remove the protective cap from the measuring gas inlet.
2. Mount the gas extraction device **(a)** and carefully secure (max. 6 Nm.).
3. Screw in the absolute pressure capillary **(b)** by hand.
4. Install the protective pipe **(f)** with the sintered metal filter **(d)** on the probe installation fitting.
5. Align the baffle plate **(c)** in such a way that it protects the filter **(d)** against contamination. The filter should be located in the "wake region".



Direction of measuring gas flow

Tighten the nut on the pre-filter.

IMPORTANT!

The sintered metal filter is very fragile. Once installed, Calibration cannot be carried out without the filter.

6. Attach the aperture securing mechanism **(e)** for the protective pipe **(f)** for the GED.

3.4 Installing the LAMBDA TRANSMITTER P Oxygen Analyzer

CAUTION!

Observe the line voltage !!!

Factory default is AC230V.

For changing over to AC115V see chapter 12.4.1

IMPORTANT!

The LAMBDA TRANSMITTER P oxygen analyzer must only be operated when the ambient temperature is between -20 °C and +55 °C (4…130°F).

1. Install the gas extraction device and protective pipe for the gas extraction device if this has not already been done
   (see "Installing the Gas Extraction Device and Protective Pipe for the Gas Extraction Device on the LAMBDA TRANSMITTER P ").
2. Remove the dummy cover (if installed) from the counterflange.
3. Place the seal (type 657 R 3540) between the threaded rods of the counterflange.
4. Install the LAMBDA TRANSMITTER P.
5. Connect the LAMBDA TRANSMITTER P:

- Power supply
- LSB BUS (if required)
- LSB modules (if required)
- Analog output (if required)
- RS232 interface for connecting a PC with remote display software (if required)

NOTE

If the device is installed in a location that is difficult to access, it is recommended that the probe section be installed separately from the electronics section (see "Removing the Probe Body").

NOTE

We recommended the use of a second seal (type 657 R 3542) for heat isolation if a LAMBDA TRANSMITTER P is fitted to the counterflange with temperatures > 200° C (390°F).

3.5 System Settings in Accordance with System Composition (Reduced to Case Studies)

System Composition						System Settings in the Transmitter				on power supply unit for GED heater
Case	MEV heater	Filter heater	RS422-GM31 connection	EVU 31	LSB module(s)	Optional 2nd RS422 (10.12)	Par 121	Par 3895	Par 402	DIP switch SW1 (4.6.5)
1	0	0	0	0	0	no	no heater	LSB	default	ON
2	0	0	0	0	1	no	no heater	LSB	default	ON
3	0	0	0	1	0	no	no heater	CAN	default	OFF
4	0	0	1	0	0	no	no heater	LSB	default	ON
5	1	0	0	0	0	no	MEV heater	LSB	default	ON
6	1	0	0	0	1	no	MEV heater	LSB	default	ON
7	1	0	0	1	0	no	MEV heater	CAN	default	OFF
8	1	0	1	0	0	yes	MEV heater	LSB	default	ON
9	1	1	0	0	0	no	MEV/filter heater	LSB	default	ON
10	1	1	0	0	1	no	MEV/filter heater	LSB	default	ON
11	1	1	0	1	0	no	MEV/filter heater	CAN	default	OFF
12	1	1	1	0	0	yes	MEV/filter heater	LSB	default	ON

- The variants with ONLY a filter heater have been omitted (inapplicable).
- RS422 on board: can be switched between RS422 and CAN/LSB (using the jumper setting, see section 12.5.1). Used with the GED/filter heater ('LSB') OR for LSB modules ('LSB') OR for the RS422 GM31 connection ('RS422').
- Second optional RS232 interface: if the RS422 GM31 connection is used and the first RS422 interface is assigned to the gas extraction device/filter heater ('LSB') OR LSB modules ('LSB').
- Evaluation unit and the RS422 GM31 connection are mutually exclusive.
- Evaluation unit requires the CAN bus.
- LSB modules require the LSB bus.
- Evaluation unit and LSB modules are mutually exclusive.
- Parameter 121: no heater/GED heater/gas extraction device/filter heater
- Parameter 3895: when operated with Evaluation unit on CAN/when operated WITHOUT Evaluation unit on LSB
- Parameter 402: default temperature for gas extraction device heater: can remain at default setting (250 °C/482 °F)
- Parameter 058: "Measured temperature value from gas extraction device heater": measured value only. Not variable.

3.6 Installing the Gas Extraction Device and Pre-Filter Heater (Optional)

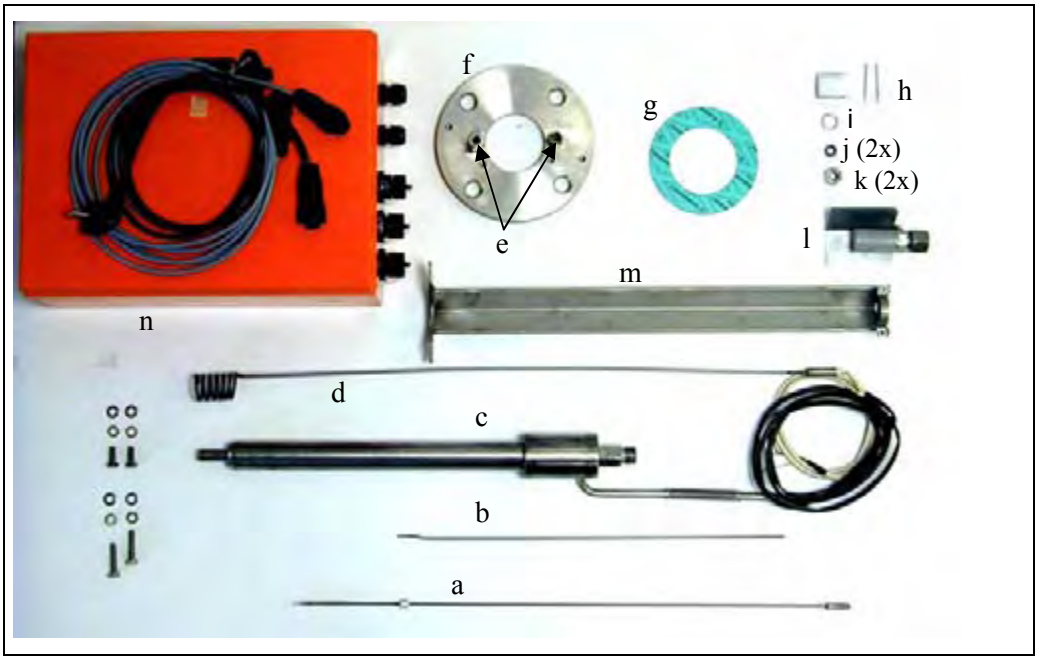


Fig. 3-4:
Components of the gas extraction device and pre-filter heater

a GED with sampling filter

b Absolute pressure capillary

c Protective pipe with heater for GED

d Heater for filter attachment

e Threaded connector ends through which the connection cables are fed

f Connection flange for gas extraction device heater (incl. 2 M8 x 35 securing bolts)

g DN80PN6 flange seal
Type 657R3542

h Safety device for protective pipe incl. 2 splints

i Copper seal for protective pipe

j Cutting ring (2x)

k Scew caps (2x)

l baffle plate with the filter attachment

m Strut of the protective pipe

n Cable box for gas extraction device and pre-filter heater (power pack), incl. feeder and 5m (16,4 ft) LSB/CAN-line for connection to LT-P

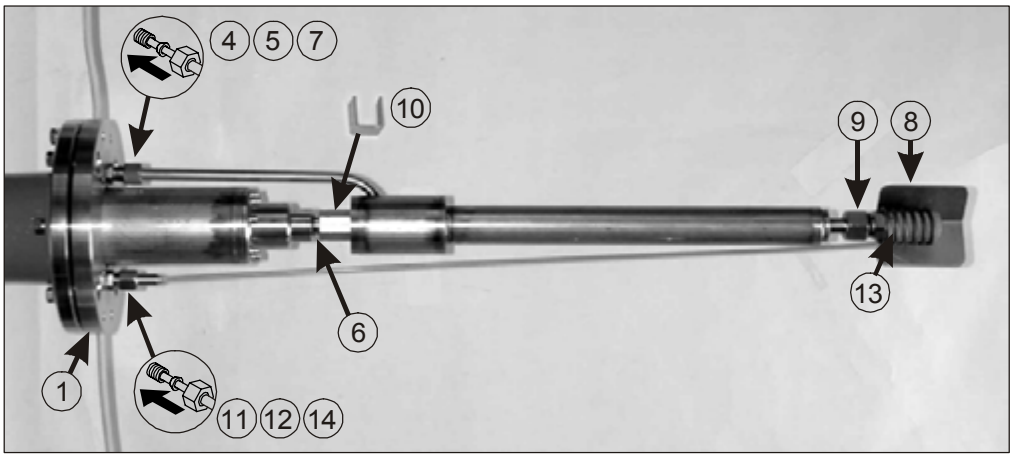


Fig. 3-5:
Installing the gas extraction device and pre-filter heater

IMPORTANT!

All glands and threads must be treated with anti-seize paste (type 650 R 1090).

1. Attach the connection flange (f) to the Lambda Transmitter P.
   Use the M8x35 screws provided.
   Use flange seal DN80 (type 657 R 3540) without holes (not flange seal (g)).
2. Mount the gas extraction device (a) on the probe and secure (max. 6 Nm.).
3. Attach the absolute pressure capillary.
4. Push the screw caps (k) and the cutting ring (j) over the connection cable for the heater for the gas extraction device.
5. Route the connection cables with the screw cap and cutting ring through the threaded connector end (c) on the flange.
6. Insert the CU seal (i) in the probe. Mount the protective pipe with the heater (c) for the gas extraction device on the probe and secure.
7. Tighten the screw cap (k) on the connection flange (f).
8. Align the baffle plate with the filter attachment (l) in such a way that it protects the filter against the flow in the duct.
9. Tighten the nut on the baffle plate.

IMPORTANT!

The sintered metal filter is very fragile. Once installed, adjustment cannot be carried out without the filter.

10. Install the safety device for the protective pipe (h) and secure using the two splints provided.
11. Push the screw caps (k) and the cutting ring (j) over the connection cable for the pre-filter heater (d).
12. Route the connection cable for the pre-filter heater (d) through the second threaded connector end (c) on the connection flange (f).
13. Place the pre-filter heater (d) on the filter attachment (l).
14. Tighten the second screw cap (k) on the connection flange (f).
15. By immersions depths >1000mm the strut of the protection type (m) must be installed.
16. Install the LAMBDA TRANSMITTER P on the counterflange using the flange seal (g).
    See "Installing the LAMBDA TRANSMITTER P ".
17. Establish the electrical connections for the gas extraction device and pre-filter heater on the power pack (type 657 R 3160).
18. Connect the power pack and the LAMBDA TRANSMITTER P via the LSB BUS. When the LAMBDA TRANSMITTER P and the power pack are switched on, the gas extraction device and pre-filter heater are recognized automatically. The heat output is set to 50%.

IMPORTANT!

The heater must be in contact with the filter to ensure good heat transmission.

3.6.1 Power pack of the gas extraction device and pre-filter heater

CAUTION!

Observe the line voltage !!!

Factory default is AC230V.

For changing over to AC115V see chapter 3.6.4

A separate power pack is required to electrically heat the gas extraction device and the sintered metal pre-filter.
Note: this is supplied in the "gas extraction kit with heater for gas extraction device" and "gas extraction kit with gas extraction device and filter heater".

Design :Wall mounting case IP 65

Features :configurable heating power via LAMBDA TRANSMITTER P

Interface :LSB-BUS or CANopen for connection to LAMBDA TRANSMITTER P

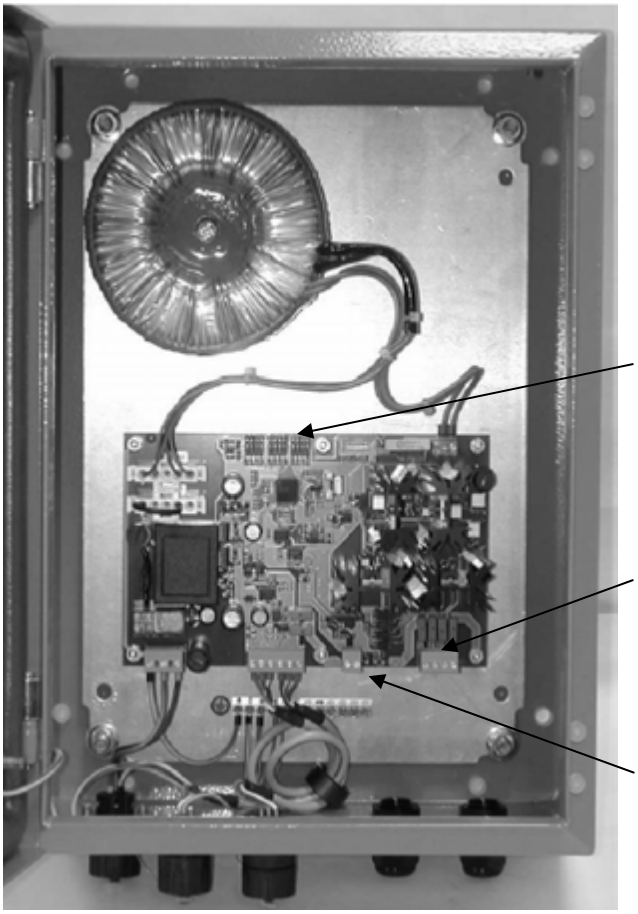
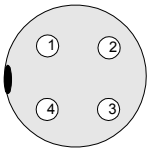


Fig. 3-6:
Power pack of the gas extraction device and pre-filter heater

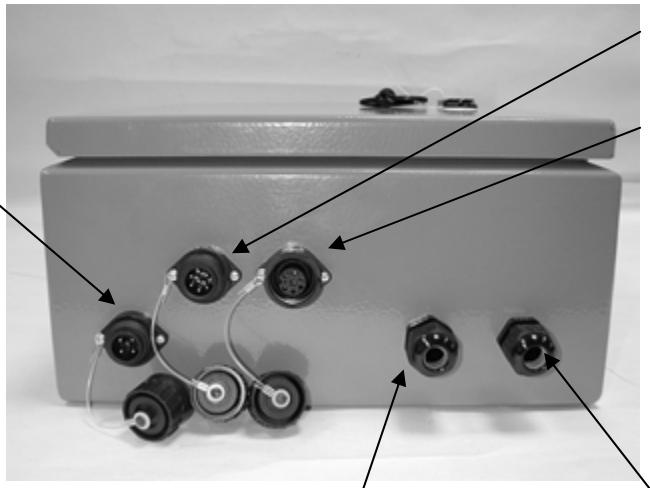
3.6.2 Connectors of the power pack

Power connection 4-pins:
AC230V/50...60Hz, or
AC115V/50...60Hz
(Changing trafo plug to X2
Exchanging F1, see 4.6.3)

- Power consumption: only GED max. 400VA, GED and pre filter max. 500VA



1 - L
2 - N
3 -
4 - PE



7-pin LSB/CAN connection to LAMBDA TRANSMITTER P

7-pin LSB/CAN connection to other devices with a LSB/CAN terminal

Cable gland M20 for pre filter heater.

Cable gland M20 for GED heater with PT100.

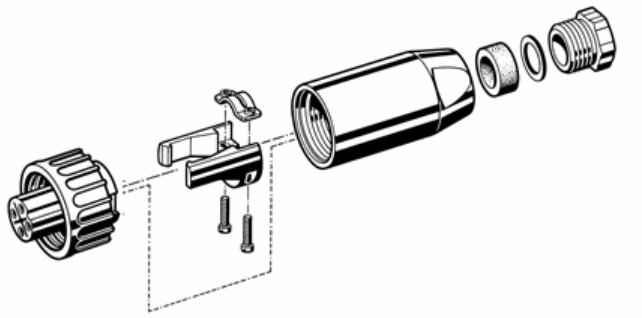
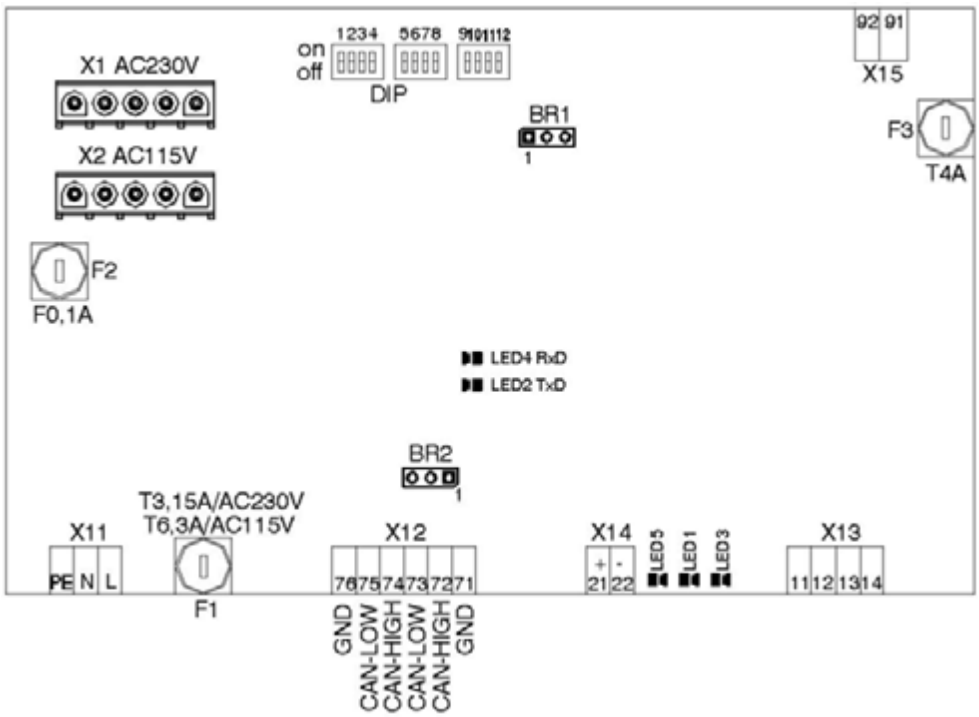


Fig. 3-7:
Suitable cable connection

3.6.3 Electronics Board of the Power Pack



F1 → Main fuse line voltage

F2 → Fuse print trafo

F3 → Fuse heating

X1 → Trafo connector primary winding, if line voltage = AC230V

X2 → Bypass connector, if line voltage = AC230V
or
Trafo connector primary winding, if line voltage = AC115V

X11 → Electrically connection for line voltage

X12 → Electrically connection for line voltage SYSTEM BUS

X13 → 11/12 Electrically connection GED-heating

X13 → 13/14 Electrically connection prefilter-heating

X14 → Electrically connection PT100 measuring element for the GED-heating

X15 → Trafo connector secondary winding AC42V

DIP → Micro switches SW1...SW12

BR1 → Position 1-2 → Normaly operation mode
Position 2-3 → Mode for software update

BR2 → Position 1-2 → 120R termination resistor SYSTEM BUS disable
Position 2-3 → 120R termination resistor SYSTEM BUS enable

3.6.4 Switching over the line voltage from AC230V to AC115V (if required)

1.) Changing main fuse F1
New value 6,3A slow-blow

2.) Remove bypass connector X2

3.) Switch over trafo connector from X1 to X2

3.6.5 Function of the LEDs on the Power Pack Board:

Interface LEDs 2 and 4

green = receive, yellow = send.

When operating normally, the gas extraction device heater sends a short data packet every two seconds, (i.e. the yellow LED flashes briefly every two seconds); the green LED flickers irregularly as it shows all bus activity.

Three green LEDs are located between the PT100 terminal and the heater terminals. From left to right:

LED 5 (green, on the left): shows operating voltage, permanently lit.

LED 1 (green, center): shows whether the gas extraction device heater is switched on or off.

LED 3 (green, on the right): shows whether the filter heater is switched on or off.

If a defect is detected on one or both heaters (normally a defective heater or fuse), the corresponding LED flashes very rapidly (approx. every 0.2 sec instead of every second). A current of approx. 0.6 A must be flowing through the filter heater and 1.3 A through the gas extraction device heater to trigger monitoring.

3.6.6 Assignment of DIP-switches on the board of the power pack

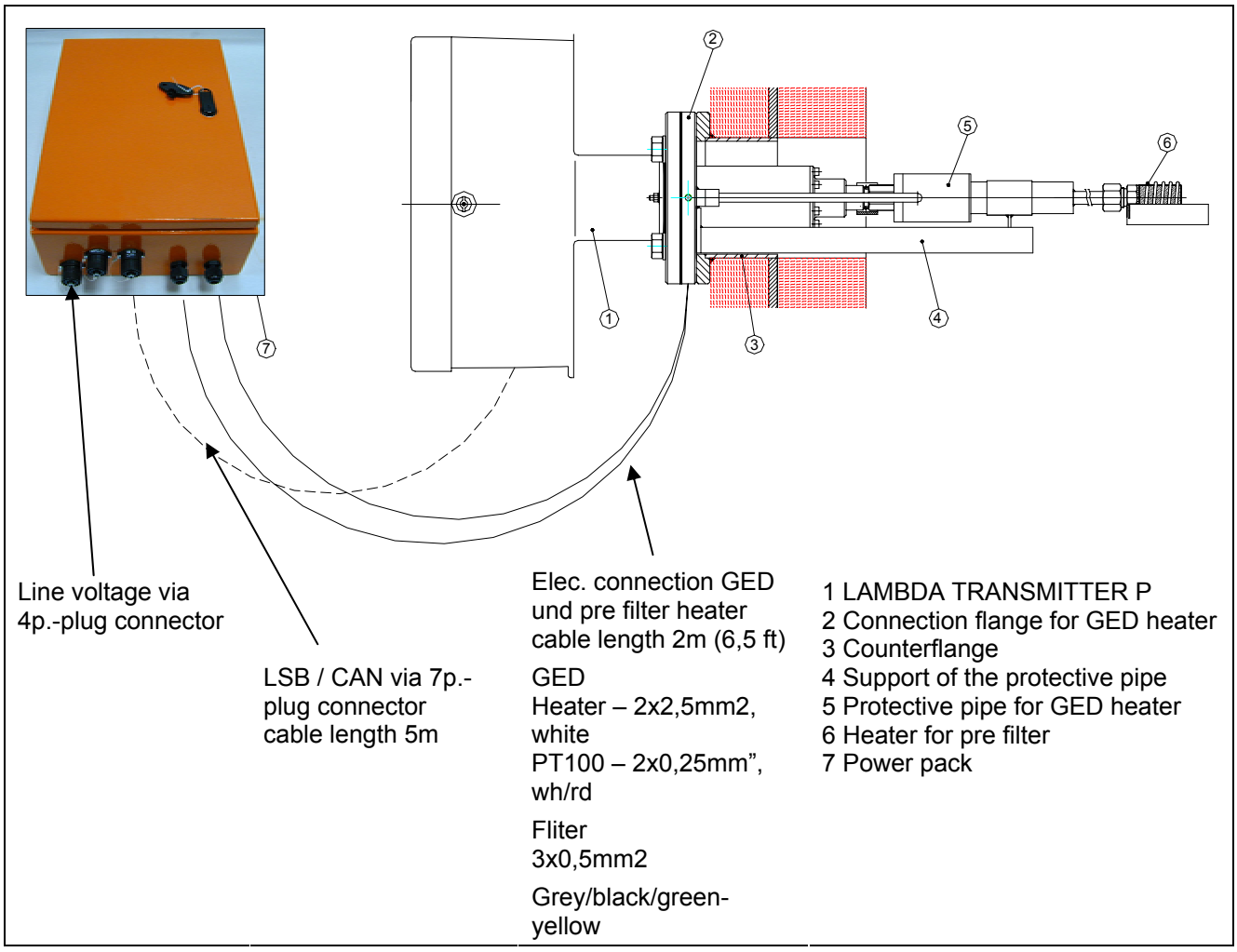
SW 1 OFF	CAN
SW 1 ON	LSB (software version 4V24a or more recent)

SW2 (only relevant for standalone versions)	
SW 2 OFF	Gas extraction device + filter heater
SW 2 ON	Gas extraction device heater only

SW9 to SW12 determine the default required temperature of the GED-heater, if communication is not taking place (standalone). Otherwise, the temperature set in P402, is used for controlling.

SW9	SW10	SW11	SW12	Required temperature
0	0	0	0	200 °C (392 °F)
0	0	0	1	100 °C (212 °F)
0	0	1	0	120 °C (248 °F)
0	0	1	1	140 °C (284 °F)
0	1	0	0	160 °C (320 °F)
0	1	0	1	180 °C (356 °F)
0	1	1	0	190 °C (374 °F)
0	1	1	1	200 °C (392 °F)
1	0	0	0	210 °C (410 °F)
1	0	0	1	220 °C (428 °F)
1	0	1	0	230 °C (446 °F)
1	0	1	1	240 °C (464 °F)
1	1	0	0	260 °C (500 °F)
1	1	0	1	280 °C (536 °F)
1	1	1	0	300 °C (572 °F)
1	1	1	1	OFF

3.6.7 Electrical connection at LAMBDA TRANSMITTER P



3.6.8 Setting of the LAMBDA TRANSMITTER P and the power pack (see also chapter 4.5)

Check the DIP-switch 1 on power supply unit for MEV-/Filter-heater **and** the parameter setting in LAMBDA TRANSMITTER P.

Set DIP-switch 1 on electronic board of the power pack for MEV-/Filter-heater:

- for operation without EvU: "ON" (LSB operation)
- for operation together with EvU: "OFF" (CAN operation)

Set parameters (service level) in LAMBDA TRANSMITTER P:

- Parameter 121: "MEV-heater" or "MEV- and pre-filter heater
- Parameter 402: "MEV-Temperature setpoint = 250°C (482°F)"
- Parameter 3895 for operation without EvU: "LSB"
- Parameter 3895 for operation together with EvU: "CANopen"

Read Parameters:

- Parameter 058: MEV-Temperature “xx°C”

NOTE

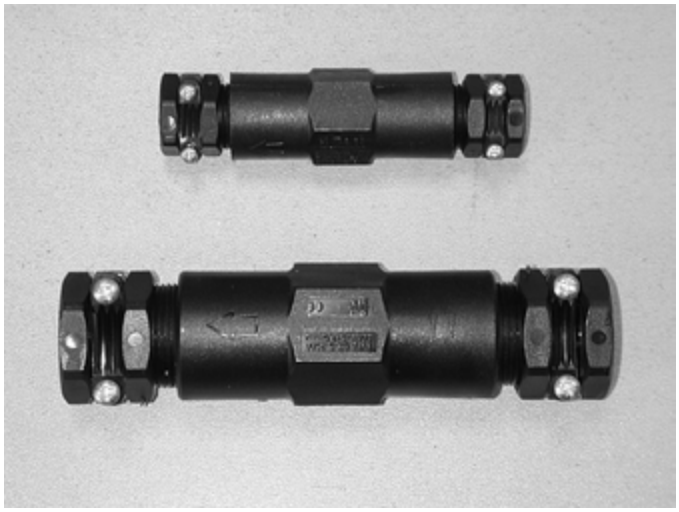
If the control via CANopen or LSB should fail, it will be regulated to the temperature attitude of the DIP switches SW9...SW12 (see chapter 4.6.5).

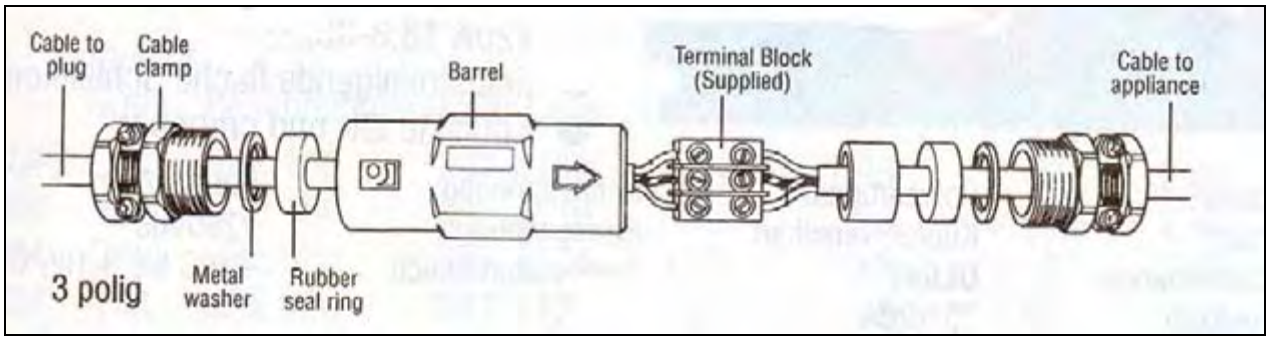
3.6.9 Cable connector for extension the GED and pre filter heater

2-pole (for pre filter heater):
Lenght 100mm (3,9 in)
External diameter 24mm (0,9 in)
Conductor 2,5 sqmm
Diameter cond. min 5mm, max 12,5mm,
Item no. 657R3167

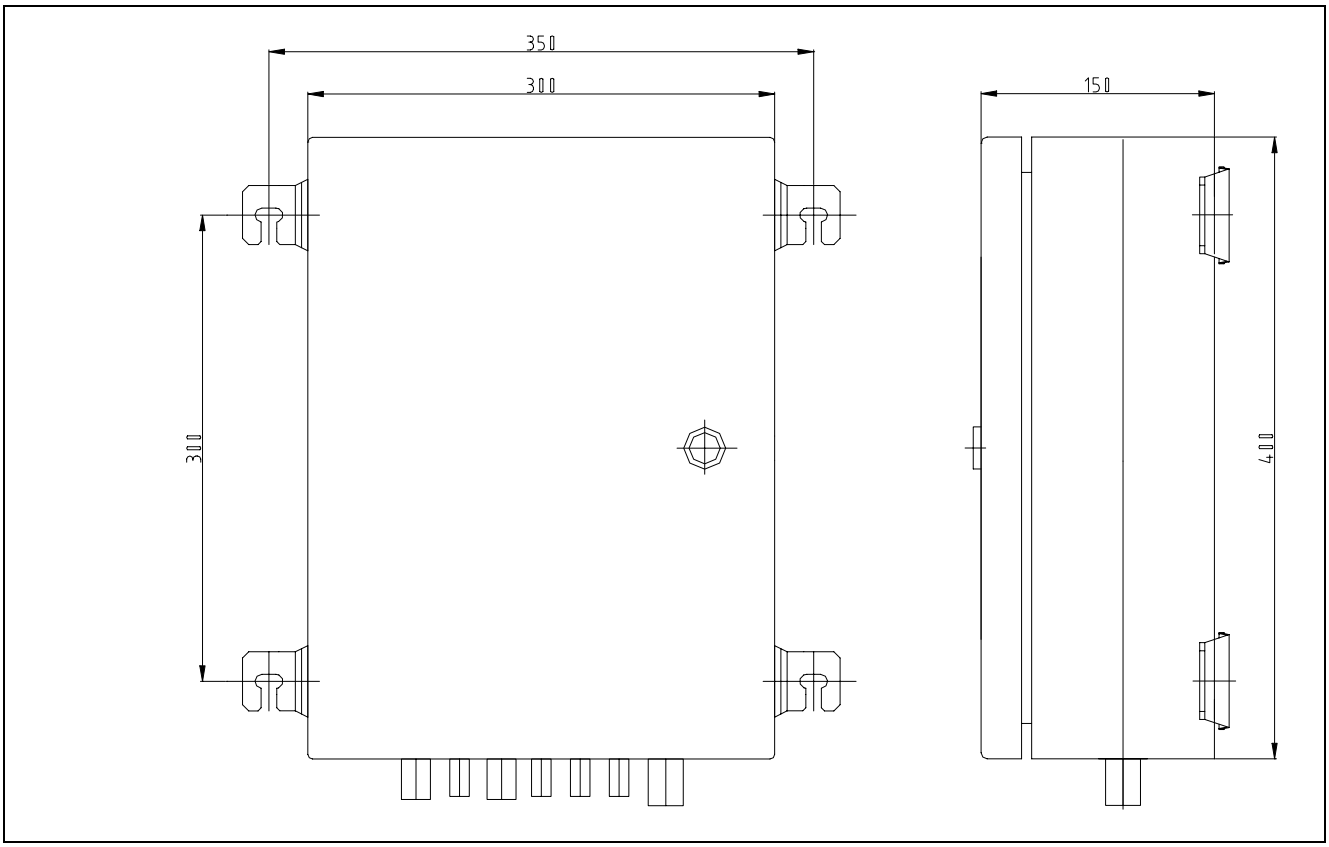
5-pole (for GED heater with Pt100):
Lenght 150mm (5,9 in)
External diameter 35mm (1,4 in)
Conductor 2,5 sqmm
Diameter cond. min 10mm, max 19mm,
Item no. 657R3168

Type of protection IP67
Range of temperature -20°C...+66°C
(-4…+150°F)





3.6.10 Dimensions of the powerpack



3.7 Installing the High-Dust Protective Pipe

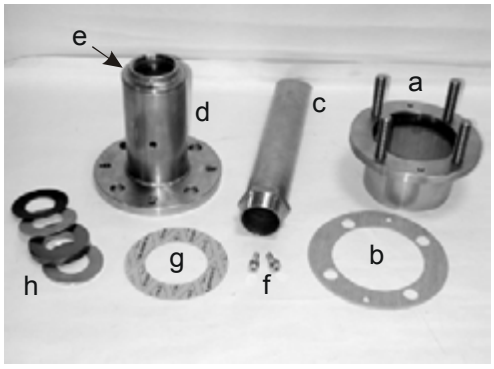


Fig. 3-8:
Components of the high-dust protective pipe

a Counterflange
b Flange seal for counterflange
c Protective pipe for high-dust applications
d Adapter flange for protective pipe for gas extraction device
e Grub screw
f M8x25 hexagon-socket screws with spring washer for securing the adapter flange to the counterflange
g Standard flange seal for the adapter flange
h Seal set

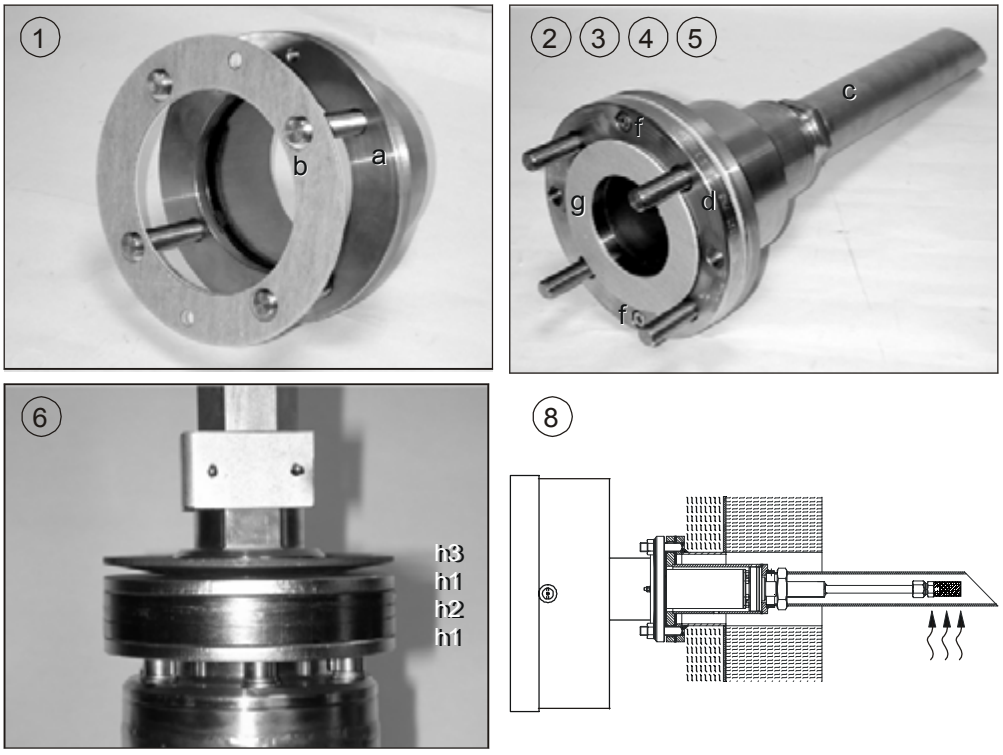


Fig. 3-9:
Installing the gas extraction device for high-dust applications

IMPORTANT!

All glands and threads must be treated with anti-seize paste (type 650 R 1090).

1. Push the flange seal (b) over the threaded rods of the counterflange.
   The counterflange must already be welded onto the flue gas duct.
2. Screw the protective pipe for high-dust applications (c) into the adapter flange (d).
3. Align the protective pipe for high-dust applications (c) with the flow direction of the flue gas and secure it using the grub screw (e).
4. Push the adapter flange (d) with the protective pipe for high-dust applications (c) over the threaded rods of the counterflange and secure it using the two M8 x 25 hexagon-socket screws with the spring washer (f).
5. Place the standard seal (g) between the threaded rods of the counterflange (a).
6. Attach the seal set (h) to the probe unit on the LAMBDA TRANSMITTER P.
   Make sure that you do this in the correct order:

- h1: Pressure disk
- h2: Graphite seal for high-dust applications
- h1: Pressure disk
- h3: Disk spring

7. Remove the baffle plate from the protective pipe for the gas extraction device.
8. Install the gas extraction device and the protective pipe for the gas extraction device.
   See "Installing the Gas Extraction Device and Protective Pipe for the Gas Extraction Device on the LAMBDA TRANSMITTER P ".
9. Install the LAMBDA TRANSMITTER P on the adapter flange
   See "Installing the LAMBDA TRANSMITTER P ".

NOTE:

In the case of use of the high dust protective pipe, no strut of the protective pipe can be installed.

4 Operation and Display Controls

4.1 Multi-Function Key

All the basic functions can be executed by means of the multi-function key and maintenance switch.

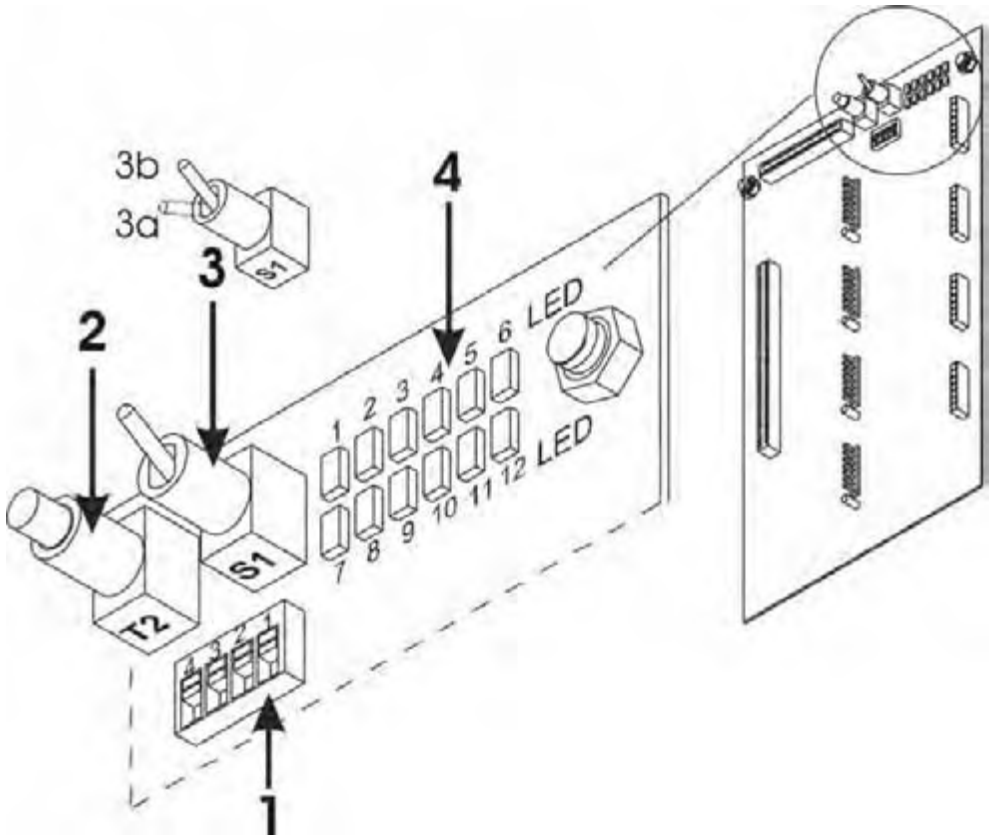


Fig. 4-1:
Operation and display unit on the processor board

1 DIP switch

2 Multi-function key **T2**

3 Maintenance switch **S1**
3a = "ON" position, 3b = "OFF" position

4 LED row: LED 1 to 12

Function:	Key **T2** operation:
Toggle the displayed warning/fault	Briefly
Reset the displayed warning/fault	3 sec*
Quick start of measuring gas pump; interruption of cold start	3 sec/6 sec**
* Some warnings/faults cannot be reset if the fault is still present or the routine is still running. ** If more than one warning/fault is present, the key must be pressed for 6 seconds.	
The mode „Maintenance“ can be activated via , maintenance switch **S1**, the display or via the Remote-Display-Software. The mode „Maintenance“ will also be enabled, if a higher release level via a password is activated (can be set in Par.974, default = “factory“).	

4.2 LED-Display

Legend: LED Off Flashes Lights up

LED 1 Maintenance

- Normal operation
- Maintenance mode active

LED 2 —

LED 3 —

LED 4 Heater monitoring

- **Heater control active**
- Heater with fixed voltage

LED 5 Operation mode display

- Calibration
- Measurement

LED 6 Operation display

- **Operation**

LED 12 Alarm/fault display

- No alarm/fault
- **At least 1 fault is present**
- At least 1 alarm is present

Function:	Key operation:
Toggle the displayed alarm/fault	Briefly
Reset the displayed alarm/fault	3 sec*
Quick start of measuring gas pump; interruption of cold start	3 sec/6 sec**
* Some alarms/faults cannot be reset if the fault is still present or the routine is still running. ** If more than one alarm/fault is present, the key must be pressed for 6 seconds.	
The mode „Maintenance“ can be activated via , maintenance switch, the display or via the Remote-Display-Software. The mode „Maintenance“ will also be enabled, if a higher release level via a password is activated (can be set in Par.974, default = “factory“).	

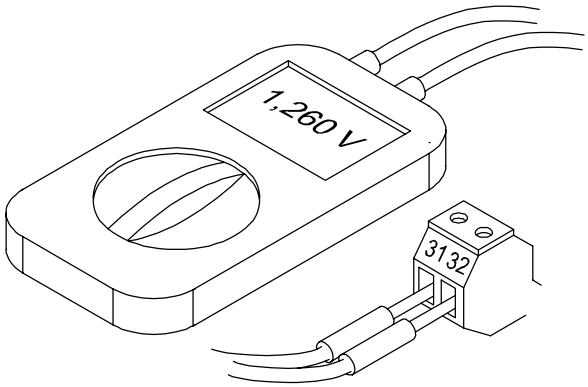
4.3 Monitor Output / DIP Switch on Processor card

The following measured values can be queried via terminals 31 and 32:

Measured O_2 value

Probe voltage

Probe current

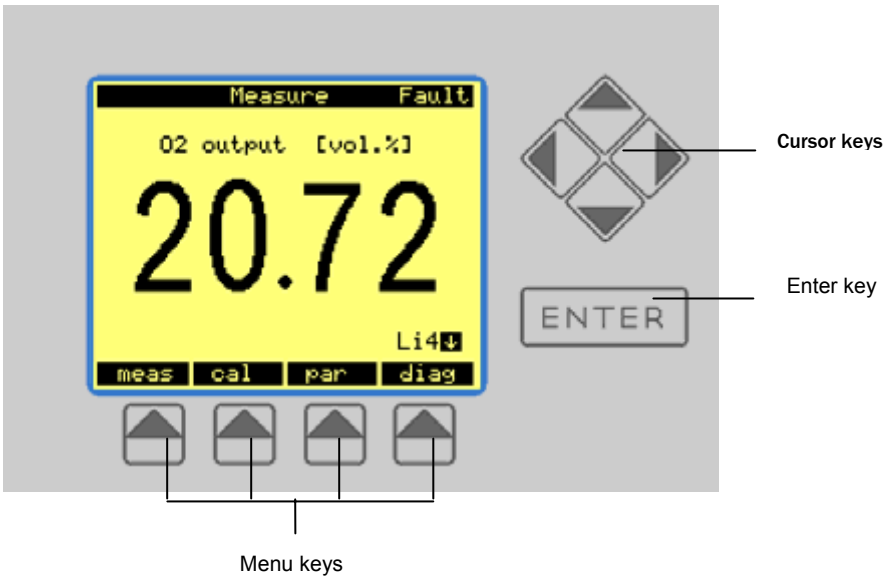


Measurement	Conversion	DIP switch	SW1	SW2
Measured O_2 value	0...2.5 V -> 0...25% O_2		off	off
Probe voltage	0...1.4 V -> 0...1400 mV		on	off
Probe current	0...1 V ->0...1000 mA		off	on

4.4 Remote Display Software

- For operation of the LAMBDA TRANSMITTER P via RS232 interface
- To backup and restore the data set
- Instructions are provided in the software.

4.5 Display/Control Unit



Brightness and contrast

Contrast + : + Contrast - : +

Brightness + : + Brightness - : +

Limit values

Li 4↑ The limit value is overshot

Li 4↓ The limit value is below

NOTE

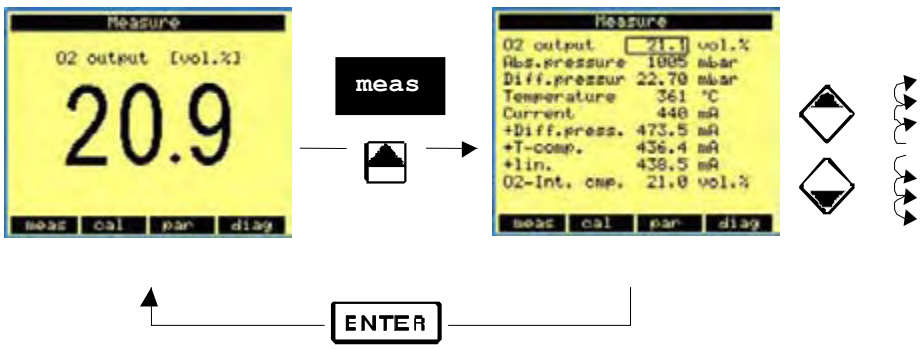
The limit values (Li 1 to Li 4) are only displayed if the limit value monitoring function has been activated.

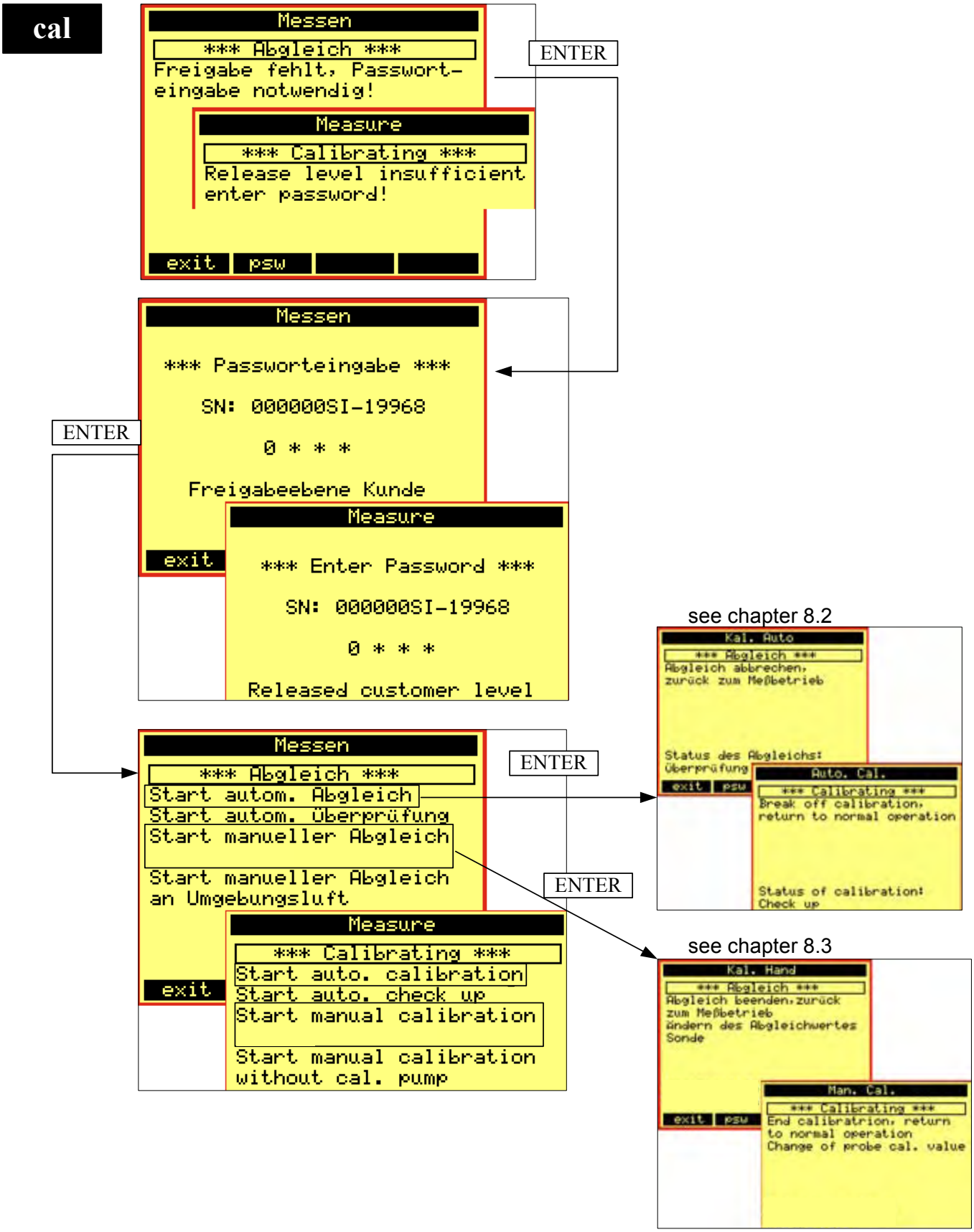
Menu keys

meas:	Measurement
cal :	Calibration
par:	Parameter setup
diag:	Diagnostic

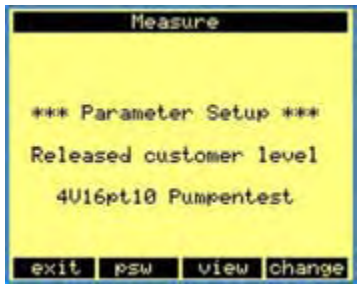
4.5.1 Functions of the menus

meas



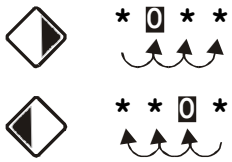

cal
Messen
*** Abgleich ***
Freigabe fehlt, Passwort-
eingabe notwendig!
exit
psw
Measure
*** Calibrating ***
Release level insufficient
enter password!
ENTER
Messen
*** Passworteingabe ***
SN: 000000SI-19968
0 * * *
Freigabeebene Kunde
exit
Measure
*** Enter Password ***
SN: 000000SI-19968
0 * * *
Released customer level
ENTER
Messen
*** Abgleich ***
Start autom. Abgleich
Start autom. Überprüfung
Start manueller Abgleich
Start manueller Abgleich
an Umgebungsluft
exit
Measure
*** Calibrating ***
Start auto. calibration
Start auto. check up
Start manual calibration
Start manual calibration
without cal. pump
ENTER
ENTER
see chapter 8.2
Kal. Auto
*** Abgleich ***
Abgleich abbrechen,
zurück zum Meßbetrieb
Status des Abgleichs:
Überprüfung
exit
psw
Auto. Cal.
*** Calibrating ***
Break off calibration,
return to normal operation
Status of calibration:
Check up
see chapter 8.3
Kal. Hand
*** Abgleich ***
Abgleich beenden,zurück
zum Meßbetrieb
ändern des Abgleichwertes
Sonde
exit
psw
Man. Cal.
*** Calibrating ***
End calibration, return
to normal operation
Change of probe cal. value

par



exit — Return to previous menu

psw — Password entry



exit — Return to previous menu

clear — Reset to “”Released customer level”

---- — 0 0→1→2→...9→A→B→...

++++ — 0 0→Z→Y→...A→9→8→...

ENTER — Confirm password

par

view

Display all parameters. These are divided into groups

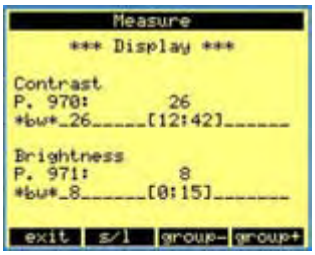
These groups contain other parameters

exit

Return to previous menu

s/l

Change the scope of information



*kw*_30_____[12 ; 42]_____

Value range for Change of parameter

Default value (base value in EPROM)

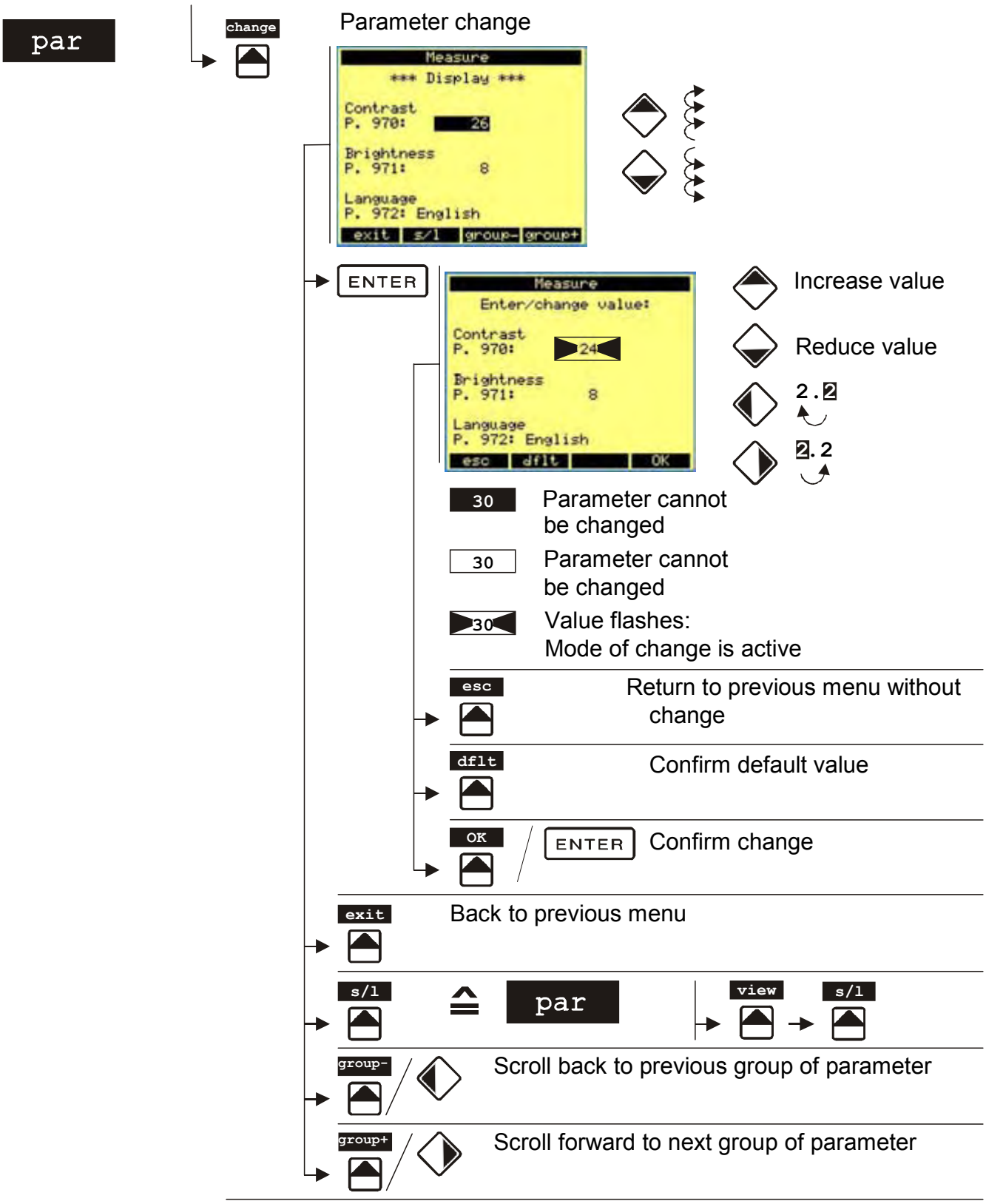
ÒRÓ released customer levelÓ and parameter type:
b = operation, k = customer, s = service,
f = production ,w = write , r = read

group-

Scroll back to previous group of parameter

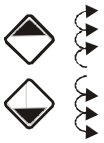
group+

Scroll forward to next group of parameter


par
change
Parameter change
Measure
*** Display ***
Contrast
P. 970: 26
Brightness
P. 971: 8
Language
P. 972: English
exit
s/l
group-
group+
ENTER
Measure
Enter/change value:
Contrast
P. 970: 24
Brightness
P. 971: 8
Language
P. 972: English
esc
dflt
OK
Increase value
Reduce value
2.2
2.2
30
Parameter cannot be changed
30
Parameter cannot be changed
30
Value flashes:
Mode of change is active
esc
Return to previous menu without change
dflt
Confirm default value
OK
ENTER
Confirm change
exit
Back to previous menu
s/l
par
view
s/l
group-
Scroll back to previous group of parameter
group+
Scroll forward to next group of parameter

diag

Warnings and faults



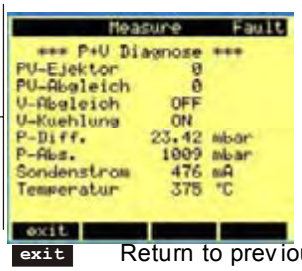
ENTER — Confirmation of error

Note: Not all alarms/faults can be confirmed.

Carry out troubleshooting

---

diag1 + P + V



exit — Return to previous menu

---

exit — Back to previous menu

---

maint — Switch on /off maintenance mode

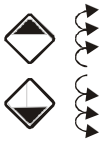
Maintenance switch S1 must be set on ÒoffÓ

---

remote — Establish connection with other LT devices via LSB

---

hist — Display of fault/alarm history



exit — Back to previous menu

<<<< — Switch to entries made recently

>>>> — Switch to older entries

Via „Trigger“ in par.118 the fault history can be reseted.

4.6 Parameter Groups

Groups	Parameters
Test data	1 - 17
Operating data	40 - 61
Counters and times	70 - 76
Commands	100 - 118
Hardware options	120 - 125
Probe glide voltage	130 - 142
Probe heating	150 - 160
Ejector heating	165 - 166
Regular cold start	200 - 208
Internal cold start	220 - 233
Zero/Span values	240 - 242
Probe check up	250 - 253
Probe Calibration	270 - 297
Ageing compensation	300 - 318
Pump heating	350 - 351
Cabinet cooling	354 - 358
O_2 test data configuration	360 - 362
Monitor output	380 - 383
Differential pressure adjustment	386 - 396
Heater for gas extraction device	400 - 409
Differential pressure sensor	410 - 416
Pressure compensation	420 - 439
Pressure measurement	440 - 442
Temperature compensation	450 - 470
Differential pressure compensation	473 - 477
Modbus RS232	480 - 483
Condensate pump	490 - 492
Automatic drift compensation	500 - 504
Analog output 1…4	530 - 569
Analog input 1…4	570 - 609
Test data configuration	700 - 823
Fuel configuration	835 - 899
Limits	910 - 917
Limit configuration	930 - 967
Display	970 - 972
Software version	985 - 990
Digital outputs relais 1…7	1030 - 1099
Solenoid valves	1100 - 1145
Pump diagnostics	1153 - 1155
Flue gas controller	1160 - 1168
Digital inputs 1…8	1170 - 1245
Service times	1260 - 1261

Groups	Parameters
PID controller	1350 - 1357
Configuration of PID controller	1361 - 1372
State of PID controller	1380 - 1391
Constant values	1450
Password / serial number	1472 - 1488
Parameter CRC16	1490 - 1493
Calibration history 1…16	1580 - 1791
Table RI	1800 - 1898
Table of cold start RI	1984 - 1999
Curve 1	2000 - 2039
Curve 2	2050 - 2089
Curve 3	2100 - 2115
Curve 4	2150 - 2165
Curve 5	2200 - 2215
Curve 6	2250 - 2265
Curve 7	2300 - 2315
Curve 8	2350 - 2365
Curve 9	2400 - 2415
Curve 10	2450 - 2465
Curve 11	2500 - 2515
Curve 12	2550 - 2565
Calibration drift history	3600 - 3679
Temperature statistics	3750 - 3770
LSB bus	3800 - 3895
Parameter statistics	4900 - 4904
Parameter fault	4910 - 4974
Parameter commands	4980 - 4987

5 Operation

5.1 Activating Measurement Mode

CAUTION!

Observe the line voltage !!!

Factory default is AC230V.

For changing over to AC115V see chapter 11.4.1

Switch on the LAMBDA TRANSMITTER E

NOTE

If the factory setting is not changed, the measurement is checked automatically every 24 hours and, if necessary, readjusted (cyclic calibration). Manual intervention is not normally necessary.

The time for starting the cyclic calibration can be set in par.061.

If the cold start is interrupted, the calibration must be triggered manually and should be repeated after 2 hours of operation.

Each calibration will be listed in a history (par. 1570…1791). The history can be deleted via par.119. See also chapter 3.1.10.

Typical values during initial commissioning after calibration with compressed air (20.96 vol. % O_2):

- Probe current (uncompensated): 500 ± 50 mA
- Differential pressure via the capillary: 20 - 30 mbar (0.3 – 0.43 psi)
- Temperature of capillary: 300 - 500 °C (572 – 932 °F)
- Pressure increase during Calibration (read via parameter 50): 1 - 5 mbar (0.015 – 0.07 psi)
- Heat output of measuring cell (read via parameter 54): 75 Watt
- Internal resistance (R_i) of ZrO_2 measuring cell (read via parameter 53): < 1Ω

For warranty reasons, the enclosed Probe Record Card (chapter 12.6) must be maintained during commissioning and kept with the LAMBDA TRANSMITTER E .

IMPORTANT!

The cold start cannot be interrupted until the temperature on the capillary is > 260 °C (500 °F).

5.1.1 Output of the „Zero/Span“ values

The output of the “Zero/Span” values can be activated via parameter 240 “ON/OFF”

Output via:

- Analoge output 1, terminals 42 / 43.
- Digital output 4 at the LSB-Module (optionally)

Function

The output of the „Zero/Span“ values, effects after ending of each complete calibration. It doesn’t make any difference if the calibration is released manually, via digital input or via the internal timer.

First will be issued the Zero value for 15 sec., afterwards the Span value.

Additional to the output of the „Zero/Span“ values, closes the contact of output 4 at the optionally LSB digital output module.

Additionally, the values can be issueded before calibration. For this purpose P241 must be set to “ON”.

NOTE

If calibration is released via the internal timer, it makes first a check-up. If the actual O2 value on air is inside the range of 21% O2 +/-0,2% (P 250), it will be carried out no calibration, by reason of reduction of the routine. Also will be issuded no Zero/Span values.

If the Zero/Span values will be required via a digital input, will be always be carried out the value of the last complete calibration.

Will be set P 250 (Check-up tolerance) to „0“, will be always carried out a complete calibration.

Parameter

- P 240: „Zero/Span output after calibration“
  „ON“ (default OFF)
  Output of the „Zero/Span“ values
- P 241: „Additional output check value to Zero/Span output"
  „ON“ (default OFF)
  Additional output of the „Zero/Span“ values before calibration
- P 242: 1...60sec. (default 15 sec. for each value)
  Output timer of the Zero- and Span values
- P 1052:
  Must be set to „not measure“.
- P 1061: „Zero/Span“
  Relay output 4 activated,
  for signal „Zero/Span output“ via LSB modul (optionally)
- P 1201: „Zero/Span output“
  Recall of the „Zero/Span“ values via digital input 4
  from the LSB input module (optionally).

5.2 Operating and Status Messages

5.2.1 List of operating statuses:

Operating notes	State notes	Description
Cold start		Once the device has been switched on, it remains in the "cold start" status until the probe is operational.
Mesure		The device is in "measure" mode and supplies a valid measured O_2 value (provided that no fault is present).
Calibration auto		The normal automatic adjustment is accomplished
	Check up	Air or measuring gas is fed to the probe and the measured value is output as standard. In this mode, an EPA check can be carried out externally, for example. Note that the measured value is only valid if no fault is present.
	1. calibration	The standard automatic adjustment or the first calibration before aging compensation is carried out.
	aging-compensation.	The internal resistance of the ZrO_2 measuring cell is measured and, if necessary, ageing compensation is carried out. (every 10000 min., the measured Ri is registered into the table in par.1805...1898).
	2. calibration	An optional second automatic calibration is carried out after aging compensation.
	Wait for measure	Whenever the device is switched to or from measurement mode, the device remains in the "wait for measurement" status for a short period (a few minutes) to ensure that the measuring cell is filled with the gas to be measured once measurement mode has been activated.
Manual calibration		The device is in "manual calibration " mode. Air is fed to the probe and the calibration value can be changed manually via the remote control unit.
Maintenance		In addition to the above-mentioned operating statuses, the device is in "maintenance" mode. Maintenance mode can be activated via the maintenance switch, the display, or via the remote display software. Maintenance mode is also automatically activated when a higher release level is activated by means of a password. (can be set in par.974, default=“factory“).
Warning		One or more warnings lines up
Fault		One or more faults lines up

5.3 Practical Notes

5.3.1 Smoothing for 'Jumping' Display Values

The display can be smoothed if values 'jump'. Smoothing is specified by: parameter 360 for measured O_2 value ("operational" release level).

NOTE

- A high degree of smoothing causes the measurement signal to slow down.
- Condensate in the gas extraction device can cause measured values to fluctuate.

Water droplets form at the capillary tube. If a water droplet enters the probe, it evaporates. When this occurs, the display falls towards 0 vol. % O_2. When conditions are stable (measuring gas temperature), this occurs at almost regular intervals.

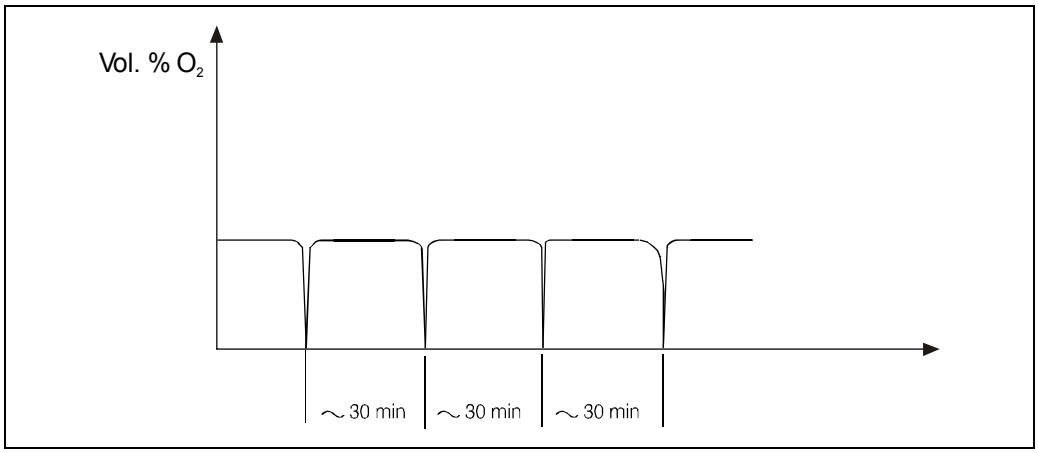


Fig. 5-1:
'Jumping' display values

5.3.2 Measurement in Flue Gases with a High Water Content (Downstream of Wet Scrubber)

Flow rate compensation is recommended in highly unbalanced flue gases with a high moisture and low CO_2 content (see "General Description: Flow Rate Compensation"). Parameter group 1280 to 1283 – "customer" or "service" release level.

5.3.3 Measurement in Humid and Highly Contaminated Flue Gas

- The gas extraction tube (capillary tube) must be kept above the water/acid dew point along its entire length. Min. temperature: 180°C (355°F).

NOTE

If the measuring gas temperature is lower, the gas extraction device must be heated..

5.3.4 Wet/Dry Measurement, Deviations, Conversion Table

NOTE

The LAMBDA TRANSMITTER P measures directly in the humid flue gas (Wet measurement). With extractive devices flue gas is taken and prepared. Here it usually concerns a "dry measurement“, since one extracted from the flue gas the humidity. The O_2-measured values differ therefore. See figure 6.2.

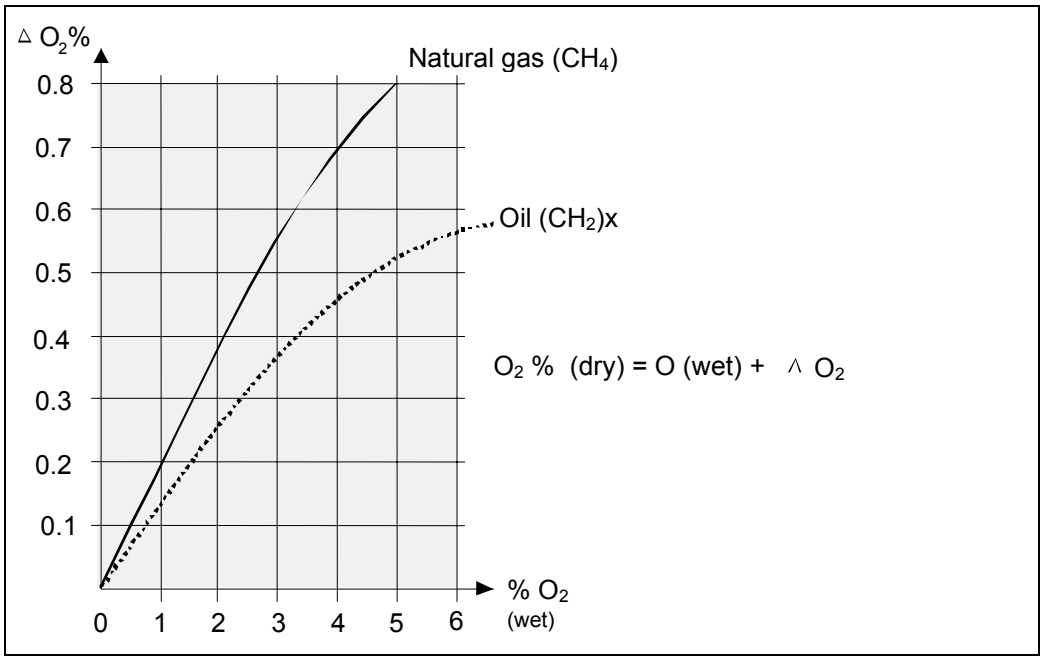


Fig. 5-2:
Theoretical max. deviations of the O_2 concentration in wet and dry measurement. Fuel: natural gas or oil

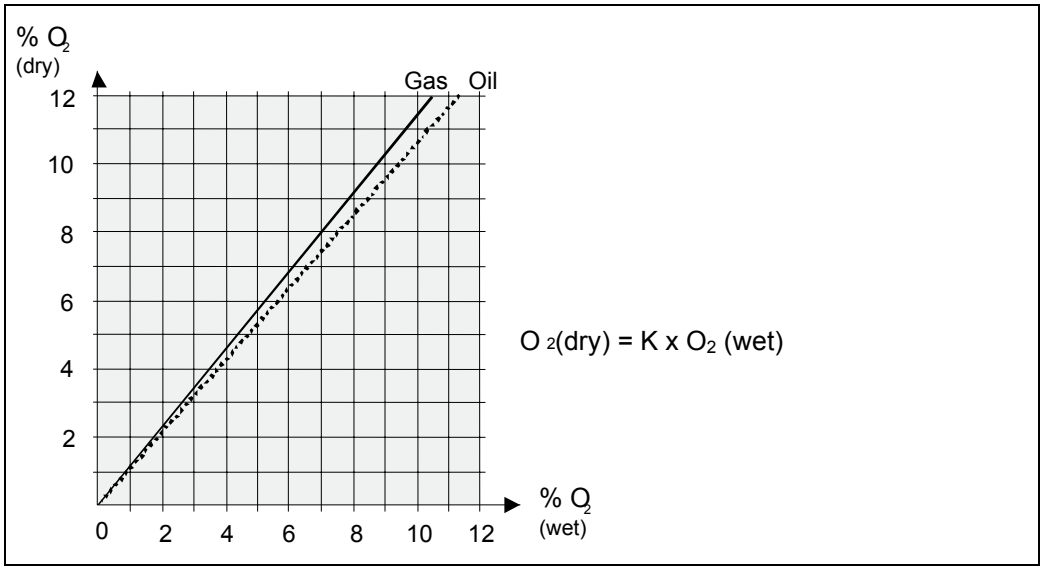


Fig. 5-3:
Calibration plot for the concentration values of O_2 (dry) and O_2 (wet)

Conversion table for concentration values of O_2 (dry) and O_2 (wet)

O_2 concentration range	Constant C gas/Ch_4	Constant C oil/$(CH_2)_x$
0 – 6 % O_2	1.18	1.115
6 – 12 % O_2	1.12	1.08
0 – 12 % O_2	1.15	1.10

5.4 Removal from Service

5.4.1 Brief Service Interruption

If the system is out of service for a short period, you are advised to allow measurement to continue.

5.4.2 Long Service Interruption

If the system is out of service for longer than 10 weeks or if measurement is deactivated, you are advised to remove the Lambda transmitter before or immediately after you have switched off the power supply. This prevents the flow-control capillary from corroding and becoming blocked.

NOTE

Once removed, the LAMBDA TRANSMITTER P can be stored for an unlimited period. The zirconium dioxide measuring element is only subject to wear during operation (when it is at the operating temperature).

6 Alarms and Faults

6.1 Fault history

Only visibly via Display/Control Unit or remote display software.
See chapter 7.3

6.2 Display via Processor Board

6.2.1 Calling Up and Resetting Faults and Alarms

- Display the next fault/alarm: Press multi-function key T1 once.
- Reset a fault: Press multi-function key T1 for 3 sec./ fault.

6.2.2 LED Code Faults

Legend: LED ⊗ Off ⊛ Flashes ⊗ Lights up

7 8 9 10 11 12	**Faults**
⊗ ⊗ ⊗ ⊗ ⊗ ⊗	No fault
⊛ ⊗ ⊗ ⊗ ⊗ ⊛	Cell damaged
⊗ ⊛ ⊗ ⊗ ⊗ ⊛	Flow throughput too low, probe current < 200 mA (1)
⊛ ⊛ ⊗ ⊗ ⊗ ⊛	Difference pressure too low
⊗ ⊗ ⊛ ⊗ ⊗ ⊛	Defective probe heater
⊛ ⊗ ⊛ ⊗ ⊗ ⊛	Probe broken wire
⊗ ⊛ ⊛ ⊗ ⊗ ⊛	Wrong current input of solenoid valves
⊛ ⊛ ⊛ ⊗ ⊗ ⊛	Flue gas pump
⊗ ⊗ ⊗ ⊛ ⊗ ⊛	I-Probe too high (throughput)
⊛ ⊗ ⊗ ⊛ ⊗ ⊛	Dynamic is missing
⊗ ⊛ ⊗ ⊛ ⊗ ⊛	Dirty pre-filter
⊛ ⊛ ⊗ ⊛ ⊗ ⊛	Error analog output
⊗ ⊗ ⊛ ⊛ ⊗ ⊛	Error parameters
⊛ ⊗ ⊛ ⊛ ⊗ ⊛	Delta-p cal. Too low
⊛ ⊛ ⊛ ⊛ ⊗ ⊛	Calibrationpump
⊗ ⊗ ⊗ ⊗ ⊛ ⊛	Capillary blocked

(1) Parameter 51: probe current of last calibration

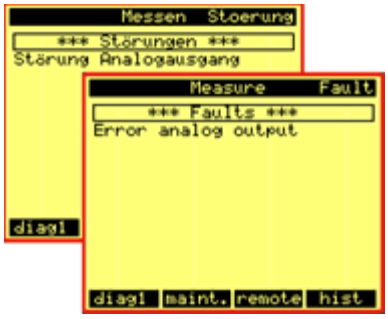
6.2.3 LED Code Warnings

7 8 9 10 11 12	Legend: LED Off Flashes Lights up
	No warning present
	Defective heating control
	Dirty pre-filter
	Flow throughput too low, probe current < 260 mA Parameter 51: probe current of last calibration
	O_2 cell aged- replace
	Delta-p low
	Defective MEV (GED)-heating
	Defective pre-filter heating
	Delta-p by calibration too low
	P (abs) to high / too low
	Probe tempeture to high / too low
	Addon-heating defect
	Capillary nearly blocked
	Defective MEV (GED)-heater temperature-measuring
	Not used
	Probe current limitation
	Lin voltage to high / too low
	Calibration air flow to low
	No constant probe current while calibration
	Not used
	Not used
	Not used
	Not used
	Not used
	Not used
	Not used
	Dynamic is missing
	Dynamic test activated
	Probe exchanged? If yes, activate P.104
	Housing temperature too high
	Cal. Not possible, delta-p too low
	Offset differential pressure sensor too high

6.3 Display via Display/Control Unit

One or more faults are present

Press “diag” 1x



In the diag-menu all faults and warnings are listed

Press “hist” 1x

The fault history is present

Press “exit” 3x for changing to the main menu

Via „Trigger“ in par.118 the fault history can be reseted.

6.4 Causes of Faults

Cell damaged	• Measuring cell severely aged	• Replace measuring cell	• 8.8
Flow throughput too low, probe current < 200 mA	• GED dirty • Exhaust device blocked • Capillary blocked	• Clean / replace • Clean / replace • Clean / replace	• 8.5 • 8.9 • 8.5.1
Difference pressure too low	• Flue gas pump defective • Leakages in the hose/hose connectors • Adjusting screw at capillary loosen • Differential pressure sensor out of the socket or defective • Capillary (GED) flow to large	• Check / replace • Check / replace • Check / replace • Check / replace	 • 8.5.1 • 8.12 • 8.5
Defective probe heater	• Fuse F16, F17 defective • Heater defective	• Check/replace • Check/replace	• 12.4 • 8.7 / 8.8
Probe broken wire	• Fuse F208 defective • CO peak > 10,000 ppm • Supply cable breakage • Measuring cell defective • Base electronics defective	• Check/replace • • Check connection cable • Replace measuring cell • Replace base electronics	• 12.4 • 12.4 • 12.4 • 8.8 • 8.14
Wrong current input of solenoid valves	• Solenoid coil defective • Fuse F11 defective	• Check Ri approx.35 ohm / replace • Check/replace	 • 12.4
Flue gas pump	• Flue gas pump defective	• Check/replace	
I-Probe too high (throughput)	• Gas extraction device not secure • Measuring chamber broken • ZrO_2 measuring cell broken • Adjusting screw at capillary lose • Capillary (GED) flow to large • Short-circuit between pin 94 and 97 on probe plug • Differential pressure sensor out of the socket or defective	• Secure gas extraction device • Replace measuring chamber • Replace measuring cell • Check and, if necessary, secure grub screw • Check / replace • Check plug assignment • Check / replace	• 8.5 • 8.11 • 8.8 • 8.5.1 • 8.5 • 12.4 • 8.12
Dirty pre-filter	• Deposits on filter	• Clean/replace filter	• 8.5.3
Error analog output	• Analog output module defective • Unassigned outputs are activated.	• Replace • Parameters 540, 550, and 560 must be switched off	• 12.5.2 • 5.5.3
Error parameters	• The stored parameters are incorrect The device may be using default settings	• Consult manufacturer	
Delta-p cal. too low	• Calibration unit (pump or sol.valve) defective, blocked • No pre-filter (broken off) • Differential pressure sensor out of the socket or defective	• Check/replace • Check/replace • Check/replace	• 3.2 • 8.5.3 • 8.12
Calibrationpump	• Pump defective	• Check/replace	• 3.2
Capillary blocked	• Capillary / GED blocked • Elec. Control defective	• Clean/replace • Replace base electronics	• 8.5 • 8.14

6.5 Causes of Warnings

Defective heating control	• Fuse F16 • Wiring • Base electronic defective	• Check/replace • Check X16 • Check/replace	• 12.4 • 12.4 • 8.14
Dirty pre-filter	• Deposits on filter	• Clean/replace filter	• 8.5.3
Flow throughput too low, probe current < 260 mA	• Extraction attachment contaminated • Extraction device blocked • Capillary blocked	• Clean/replace • Clean/replace • Clean/replace	• 8.5.2 • 8.9 • 8.5.1
O_2 cell aged- replace	• O_2 measuring cell worn out	• Replace measuring cell	• 8.8
Defective MEV (GED)-heating	• Heater incorrectly connected • Heater burnt out or short-circuit	• Check electrical connections and fuse • Measure internal heater resistance, replace	• 4.6
Defective pre-filter heating	• Heater incorrectly connected • Heater burnt out or short-circuit	• Check electrical connections and fuse • Measure internal heater resistance, replace	• 4.6
Delta-p by calibration too low	• Calibration unit defective • No pre-filter (broken off)	• Check/replace • Check/replace	• 3.3 • 8.5.3
P (abs) to high / too low	• Absolut pressure sensor out of the socket or defective • Incorrect setting (factory setting: max. permissible pressure: 1100 mbar min. permissible pressure: 700 mbar)	• Check/replace • Correct setting Consult manufacturer	• 8.12 • 3.3
Probe tempeture to high / too low	• Temperature exceeds limit value of 550 °C • PT100 defective • PT100 wire breakage • Electronics defective	• Probe must be moved back to prevent damage • Check and, if necessary, replace PT100 • Check connections (plug), cable • Replace base electronics	• • 8.10.1 • 12.4 • 8.14
Addon-heating defect	• Fuse F10 • Cable incorrectly connected • Heater burnt out	• Check/replace • Check • Check	• 12.4 8.8
Capillary nearly blocked	• Capillary / GED nealy blocked	• Clean/replace capillary/GED	• 8.5.1
Defective MEV (GED)-heater temperature-measuring	• PT100 defective • Broken wire • Power pack electronic def.	• Check and, if necessary, replace PT100 • Check • replace	• 4.5

Probe current limitation	• The flow rate through the capillary may be too high • Measuring chamber broken • Base electronics defective • Differential pressure sensor out of the socket or defective	• Check • Check/replace • Check/replace • Check/replace	• 8.5.1 • 8.11 • 8.14 • 8.12
Lin voltage to high / too low	• Incorrect power supply • Electrical connection incorrect • Mains plugs on motherboard not secure	• Check the power supply • Check electrical connection • Ensure that mains plugs are secure	12.4 12.4
Calibration air flow to low	• Supply hose may be blocked • Calibration unit defective • No pre-filter (broken off)	• Check/clean • Check/replace • Check/replace	• 3.3 • 3.2 • 8.5.3
No constant probe current while calibration	• High pressure fluctuations at measuring point • Sintered metal pre-filter broken off • Leak in gas supply • Measuring chamber broken	• Check pressure increase and increase smoothing (par.360) • Replace sintered metal pre-filter • Check seals, glands • Check/replace	• 5.5.5 • 8.5.3 • 8.5.10
Probe exchanged? If yes, activate P.104	• Has the measuring cell been replaced?	• If so, activate parameter 104.	• 5.5.3
Housing temperature too high	• The internal temperature is greater than 75 °C.	• Check housing fans. • Check switching temperature par.354 (default=40°C) • If the temperature of electronic is not in range (par.055), calibration via par.3769	• 3.2
Cal. Not possible, delta-p too low	• in the case of abort of the calibration by small increase of pressure • 5x unsuccessful → fault Delta-p cal. too low		
Offset differential pressure sensor too high	• Differential pressure sensor out of the socket or defective	• Check/replace	• 8.12

6.6 Internal Electronics Fault

Legend: LED ⊗ Off ⊗ Flashes ⊗ Lights up

12 11 10 9 8 7 ⊗ ⊗ ⊗ ⊗ ⊗ ⊗	Electronics fault (rapid flashing)

If an internal fault occurs, you must consult the manufacturer. For the address of the manufacturer, see "General Notes".

7 Service and Maintenance

The LAMBDA TRANSMITTER P is virtually maintenance free. Required maintenance work is displayed via the display/control unit:

- Clean the flow-control capillary / replace the entire gas extraction device.
- Clean the extraction attachment at the tip of the gas extraction device / replace the filter.
- Clean/replace the filter attachment if the alarm "pre-filter contaminated" is displayed or in accordance with empirical values.

WARNING

The flange and the tube of the LAMBDA TRANSMITTER E is very hot.

Cooling down before removing or wear protective gloves.

7.1 Recommendations for practical application

7.1.1 Operations in maintenance interval of 3 monthss (compendium from TÜV inspection report)

The operations in maintenance interval is limited to the visual check of the measuring device. Due to the automatic functional test and readjusting in an interval of 24 hours or more briefly, can be done in principle without a regular task of test gas. The examination and the calibration, if necessary, take place with ambient air. See also chapter 8.2. In individual cases the correctness of the calibration can be examined by the task of test gases on zero and reference point. Due to the measurement principle becomes the examination of the zero point no nitrogen, but a test gas with <2 Vol.-% O_2. In all other respects the instructions of the manufacturer are to be considered.

7.1.2 Functional test and calibration (abridgement from TÜV inspection report)

For the execution of the functional test and/or before the calibration after guideline DIN EN 14181 the following procedure is suggested:

- Visual check of the complete measuring device
- Control of the tightness by task of zero and test gas for the calibration inlet of the probe.
- Examine the linearity with zero and test gas
- Examine the zero point and reference point drift in the maintenance interval (Control of the long-run drift after a basic calibration)
- Determine the dead and response time
- Examine the data flow (analog, status signals) to the evaluation system.

Further details to the functional test and calibration are in the guideline DIN EN 14181 (September 2004), and/or VDI 3950 to take sheet 1 (July 1994).

7.1.3 Air fan for cooling the cabinet

The air fan switches ON itself by housing temperature inside >40°C (p354). All 20000 operation hours the air fan should be exchanged. Operation hour announcement of the housing cooling (air fan) see par.358!

7.2 Checking and Calibration the Probe

NOTE

The calibration procedure takes place by using ambient air. In order to consider the relative humidity of the air used for the calibration procedure a calibration offset (parameter 297) has to be set. The setting of the calibration offset parameter (P297)at works: –0.3 vol% of O_2.

That means:
It is calibrated not on 21% O2, but on 20,7% O2.

With extreme site conditions (the tropics, desert, etc.) the calibration offset is to be adjusted. See chapter 3.2.3.

The probe is checked and/or calibrated automatically in 1 to 10,000 hour cycles. Parameter 270 ("customer" release level). Factory setting is 24 hours.
Parameter 61: Reverse counter for cyclic calibration in minutes, can be set manually, in order to set the time for start of the cyclic calibration.

Manual adjustment can be activated as follows:

- Display/control unit (optional)
- Via the PC in conjunction with the remote display software (optional)
- Via the remote control unit (optional)

NOTE

The calibration is protected with a password. Which release level is to be used , can be set in par.260:

OFF → No password is necessary

CUSTOMER → Customer's password is necessary (factory setting)

SERVICE → Service password is necessary

MAINTENANCE → Maintenance mode is necessary

CUSTOMER + MAINTENANCE → Customer's pw + Maintenance mode is necessary

SERVICE + MAINTENANCE → Service password + Maintenance mode is necessary

A counter can be activated to ensure that calibration is only carried out on every 12th calibration command (parameter 272). This is recommended if other measuring devices that require more frequent calibration are operated via the control unit.

During calibration, the following output values can be selected (parameters 282 and 283):

- Current measured value
- Substitute value
- Last measured value

NOTE

A check routine is carried out before cyclic and automatic adjustment. If the actual O_2 value deviates only slightly from the expected setpoint, no adjustment is carried out. The tolerance can be set via parameter 250 ("customer" release level). The factory setting is +/- 0.3 vol. % O_2.

If adjustment is triggered manually, it is always carried out.

When the check begins, the displayed measured values are not plausible.

Once adjustment has been triggered, air is blown through the protective pipe to the sampling point. The gas quantity is set automatically via the calibration pump in such a way that the pre-filter is pressurized at between 2...5 mbar. This prevents flue gases from reaching the sampling point in the protective pipe, thereby ensuring that only adjustment gas is present at the measuring gas sampling point.

The pressure in the filter is measured by means of an absolute pressure sensor and the measured value is compensated within defined limits (± 50 mbar). If the filter becomes contaminated, the gas flow is reduced via the proportional valve. If the flow rate is too low while the pressure is increasing quickly, the alarm "sintered metal pre-filter is contaminated" is output.

Due to its size, the filter is relatively resistant to contamination. If only a small part of the surface remains clean, this is sufficient for the measuring gas quantity of approx. 0.5 l/h required for the measurement.

Each calibration is registered into calibration history (Par.1570... 1791). The calibration history can be reseted via par.119.

7.3 Check with Test Gas

A check can be triggered as follows:

- Display/control unit (optional)
- Via the PC in conjunction with the remote display software (optional)

NOTE

The calibration is protected with a password. Which release level is to be used , can be set in par.260:

OFF → No password is necessary

CUSTOMER → Customer's password is necessary (factory setting)

SERVICE → Service password is necessary

MAINTENANCE → Maintenance mode is necessary

CUSTOMER + MAINTENANCE → Customer's pw + Maintenance mode is necessary

SERVICE + MAINTENANCE → Service password + Maintenance mode is necessary

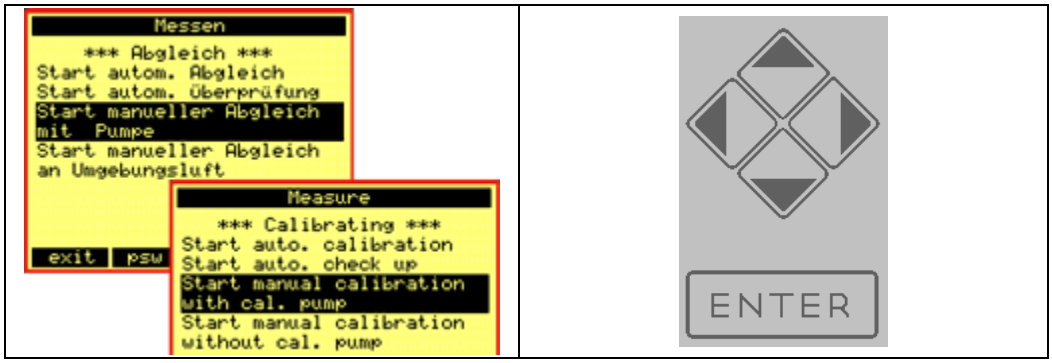
NOTE

The measuring gases used must not contain any combustible gas constituents (e.g. carbon monoxide (CO)). Combustible gas constituents are oxidized (incinerated) on the platinum electrode of the zirconium dioxide measuring cell, which is approx. 800 °C, and reduce the oxygen to be measured.

NOTE

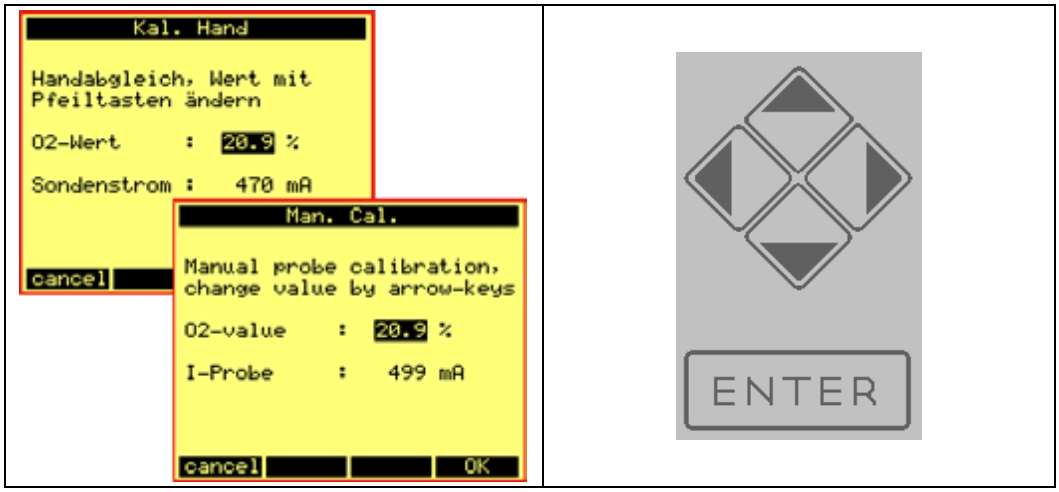
The manual calibration is limited according to factory setting on 15 min. At expiration of this time the equipment shifts back automatically into the measuring mode.

1. Open the menu with the key „cal“, enter password, select with cursor key the menu item „Start manual calibration with cal. pump“ → ENTER.



2. Now left down in the display the text appears in the display „Manual operation, Please wait“, during this time no hose may be attached to the calibration gas inlet, since the pump adjusts the necessary positive pressure. As soon as the text " Manual operation, open test gas" appears, the test gas with a pre pressure by 1 bar can be attached at the calibration gas inlet. → ENTER

3. Manal calibration → „Change value by arrow-keys“.

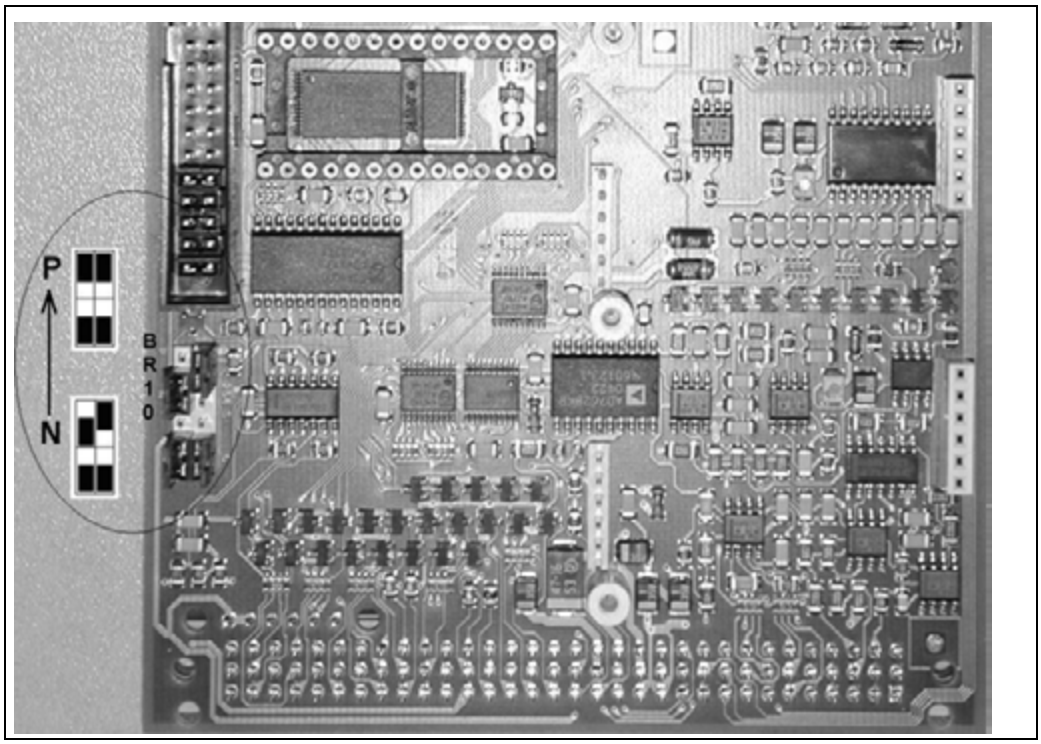


4. End of calibration → Press „OK“ → „End of calibration, back to measure“ → ENTER

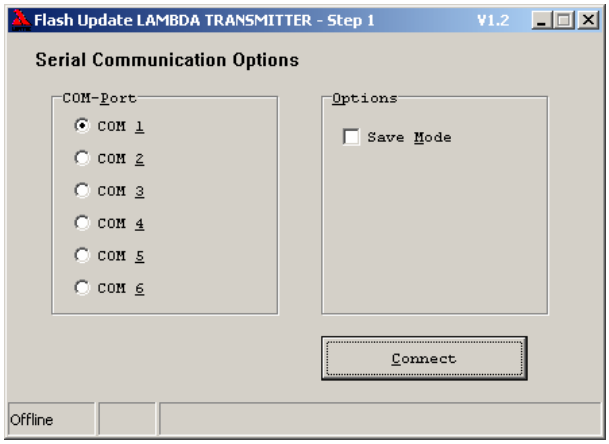
After end of calibration the hose must be removed from the calibration gas inlet.

7.4 Software Update to 5V006 with Flash-Update-Software V1.2

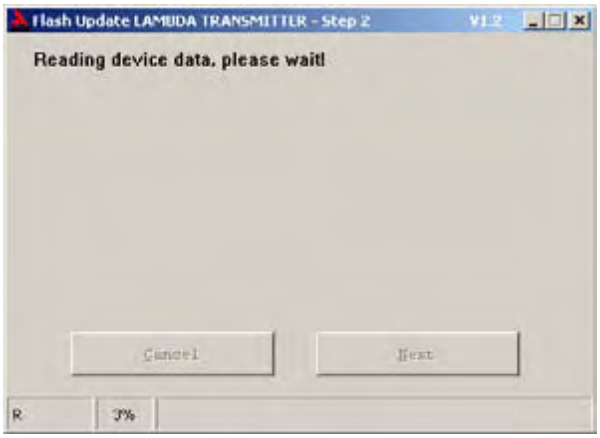
- Switch OFF LAMBDA TRANSMITTER P.
- Set plug-in jumper BR10 in LAMBDA TRANSMITTER P on processor board into position „P“ (enables programming mode).
- Connect PC at RS232-interface from LAMBDA TRANSMITTER P.



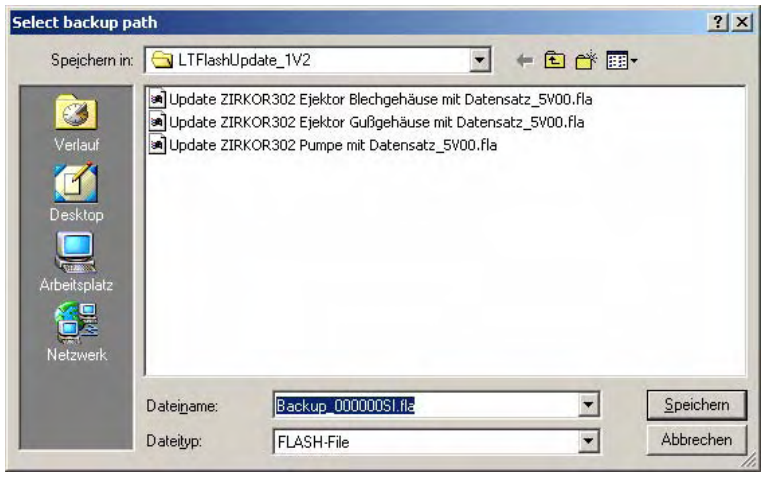
- Switch ON LAMBDA TRANSMITTER P (no display).
- Start LT Flash-Update-Software (LTFlashUpdate V1.2.exe).
- Select COM-Port and „CONNECT“ to LAMBDA TRANSMITTER P.



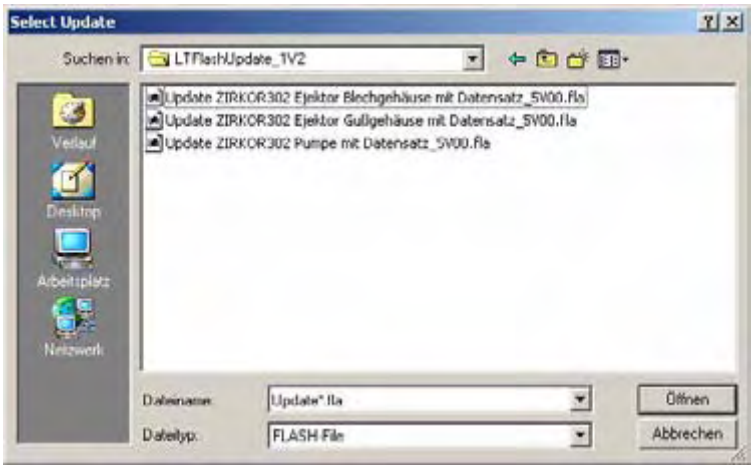
- Datas are reading out and a backup file will be created.



- Continue with „NEXT“.
- Select directory for bachup file and save it.



- Continue with „NEXT“.
- Select dirctory with update file and open it. The file for update must be named so that it begins with "update”.



- Update will be transmit in LAMBDA TRANSMITTER P.
- After succesfully programming end with „END“.

- Switch OFF LAMBDA TRANSMITTER P.
- Reset plug-in jumper BR10 in LAMBDA TRANSMITTER P on processor board into position „N“.
- Switch ON LAMBDA TRANSMITTER P.
- Check the software version via „PAR“-key on the display (5V006)
- The software update is now at the end.

In these version 1.2 of the Flash-Update-Software the following parameters are taken over from the old device:

P.48 PW probe heating

P.51 Value of calibration

P.57 Flow rate

P.70 bis 81 All counters and times

P.121 MEV / pre filter heating ON/OFF

P.358 Cabinet cooling power on time

P.386 Nomial value of differential pressure

P.392 bis 395 Limits for differential pressure

P.400 bis 409 Setting of MEV heating

P.411 Offset differential pressure sensor

P.970 up to 973 Setting display, language and contrast

P.1480 up to 1483 Serial number

P.1500 up to 1564 Measuring place name, probe number, etc

P.1570 up to 1799 History of calibration

P.1800 up to 1899 History of Ri

P.3600 up to 3679 History of dirft

P.3750 up to 3769 Temperature statistics

P.3800 up to 3899 Setting LSB

P.30030 up to 30064 Internal parameters of time

7.5 Removing the Gas Extraction Device and Checking Penetrability

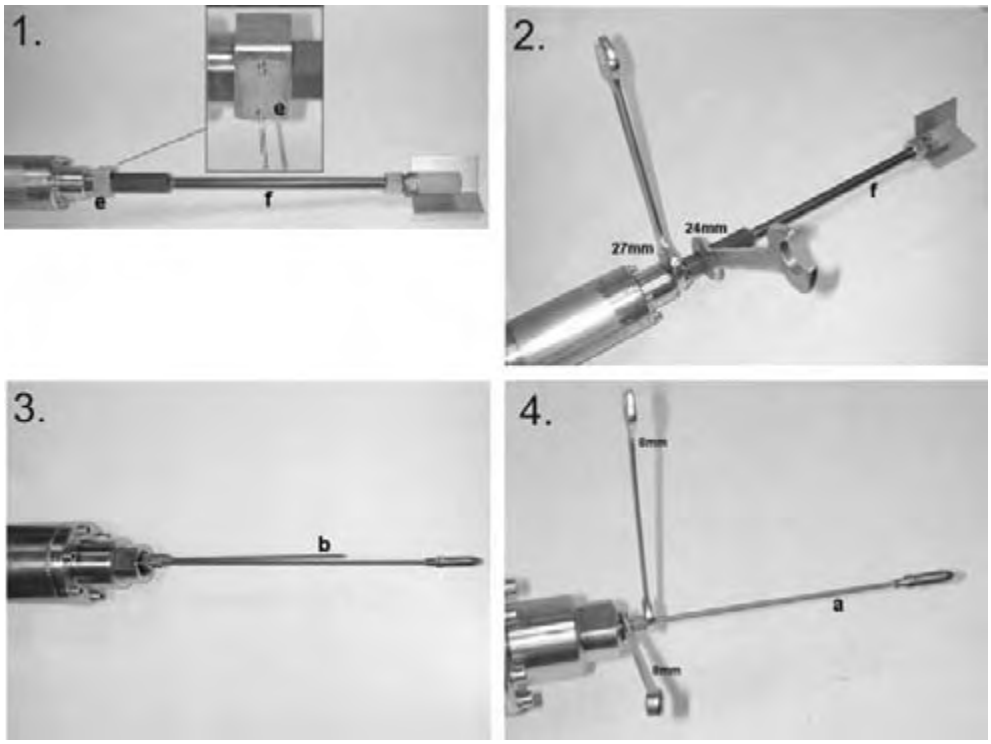


Fig. 7-1:
Removing the gas extraction device (work steps specified)

e	Securing mechanism for protective pipe	**e**	Securing mechanism for protective pipe
f	Protective pipe for gas extraction device, with sintered metal pre-filter	**f**	Protective pipe for gas extraction device, with sintered metal pre-filter

1. Remove the locking element **(e)** for the protective pipe **(f)** by removing the lower safety splint.

2. Unscrew the protective pipe **(f)** and carefully push forwards to remove.

3. Unscrew in the absolute pressure capillary **(b)** by hand.

4. Unscrew the gas extraction device **(a)** and carefully push forwards to remove.

IMPORTANT!

The tip of the gas extraction device, which projects into the probe, is very hot!

5. Check the penetrability of the gas extraction device.
   Place one side into a tumbler and blow compressed air through it.
   If the gas extraction device is blocked, it must be replaced. The capillary can also be unblocked by heating it to a very high temperature and by using a wire (see below). If this does not succeed, the GED must be exchanged.

6. To install, carry out the above steps in reverse order.

7.5.1 Unblocking the capillary by heating to a very high temperature:

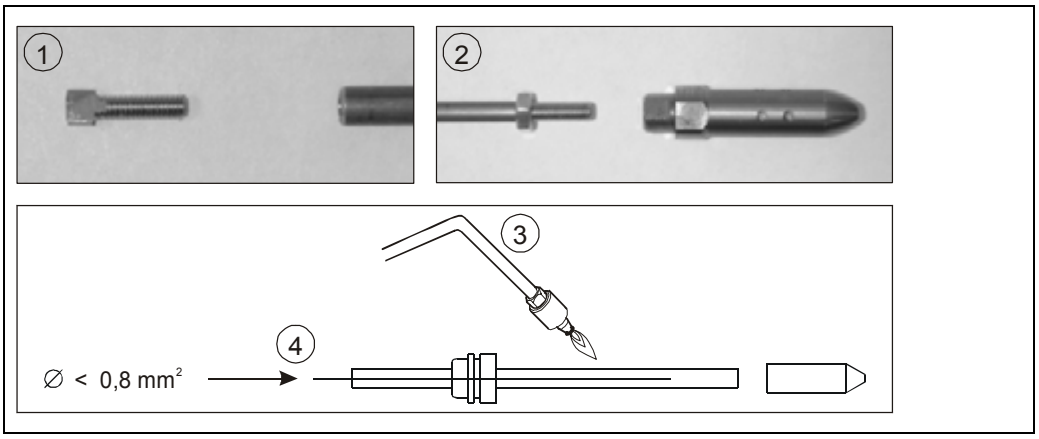


Fig. 7-2:
Unblocking the capillary by heating to a very high temperature

1. Remove the grub screw at the end of the capillary (probe side).
2. Unscrew the extraction attachment (measuring gas side).
3. Heat the capillary tube using a welding torch.
4. Thread the wire through the capillary tube.
5. Install the gas extraction device.
6. Check the flow rate.
   If the flow rate is too high, the entire gas extraction device must be replaced.

7.5.2 Cleaning the Extraction Attachment with Sintered Metal Filter

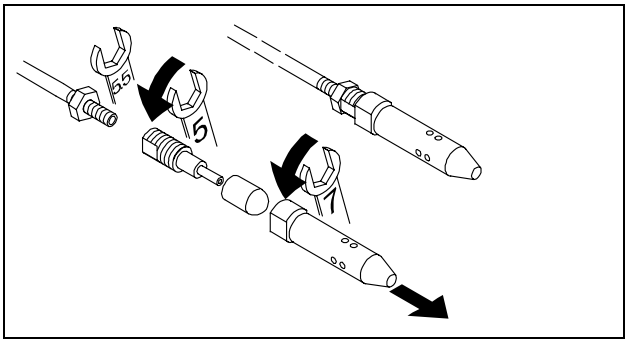


Fig. 7-3:
Removing the extraction attachment

1. Remove the extraction attachment.
   If the sintered metal filter cannot be removed, it must be drilled out and replaced. Replacement filters are available in packs of 10 (order no. type 6 55 R 2803).
2. Clean the extraction attachment and sintered metal filter.
3. Install the extraction attachment.

7.5.3 "Sintered Metal Pre-Filter Contaminated"

To prevent errors occurring due to overpressure during adjustment, the penetrability of the pre-filter is monitored by checking the pressure increase during adjustment. As soon as the pressure in the filter increases by more than the threshold value (parameter 276), an alarm is output. When the alarm "sintered metal pre-filter contaminated" is present, the probe must be removed and the pre-filter cleaned or replaced.

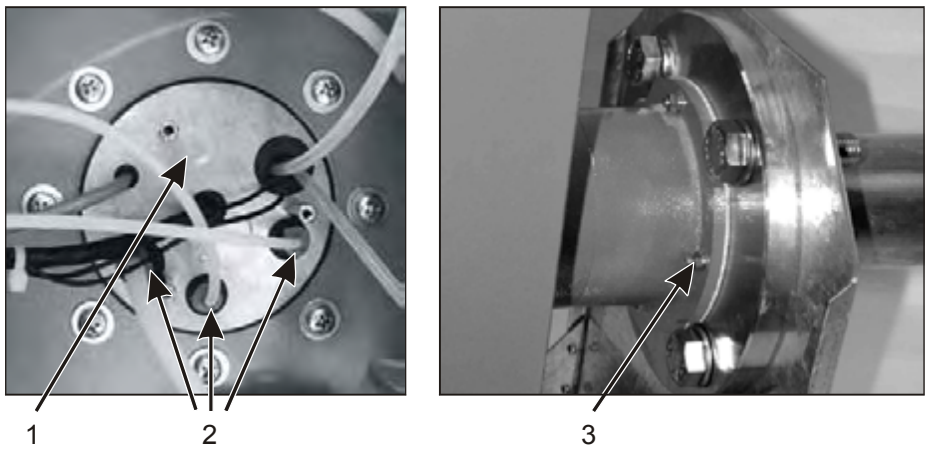
NOTE

The differential pressure before and during adjustment is displayed. The pressure increase during the last adjustment can be read via parameter 50.

7.6 Removing the Probe Body

To remove the probe body, the following tools are required:

- 0.5 x 3.5 screwdriver
- Size 13 combination wrench
- Combination pliers



1 Thermal cover plate
2 Blue connectors
3 4 x M8, width across flats 13

Fig. 7-4:
Connection side of probe section, connection for LAMBDA TRANSMITTER P and probe body

1. Unplug the mains plug and leave the LAMBDA TRANSMITTER P to cool down for 30 mins.

2. Open the housing and the mounting plate with the display/control unit.

3. Remove connectors X15 and X16 from the motherboard.

4. Remove the wires from the connector.

5. Remove all 3 hoses from the probe body. To do so, press down the blue connectors.

6. Remove the thermal cover plate by pulling the pins. Combination pliers can be used here.

7. Separate the LAMBDA TRANSMITTER P from the probe body at the neck of the housing and carefully remove. To do so, remove the 4 nuts (M8 / width across flats 13).
The probe body has now been separated. The measuring cell and temperature sensor can be replaced (see the following section).

8. To install, carry out the above steps in reverse order.

9. Reset the heater control to the base value.
To do so, set parameter 104 to "Trigger" and acknowledge with "Enter". Once the command has been executed, parameter 104 returns to "0".

NOTE

When the probe body is being installed, the flat gasket on the housing must be replaced. Seals are provided with the replacement sets.

7.7 Checking the Measuring Cell Heaters

1. Check fuses F16 and F17 (see "Technical Specifications").
   If the fuses are OK, continue to step 2.
2. Unplug the connector.
3. Measure the resistance between pins 92 and 93 on connector X16 (see "Technical Specifications").
   The resistance must be between 8 Ω and 11 Ω.

- If the resistance is towards ∞, the heater is defective and must be replaced.
- If the resistance is within the permissible range, the electronics are defective and the base electronics must be replaced.

7.8 Replacing the Measuring Cell and Measuring Cell Heater

Required tools: 1.5 and 2.5 hexagon-socket spanners

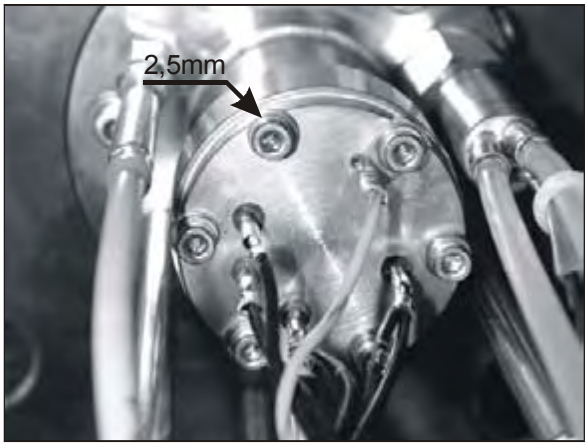


Fig. 7-5:
Sensor unit

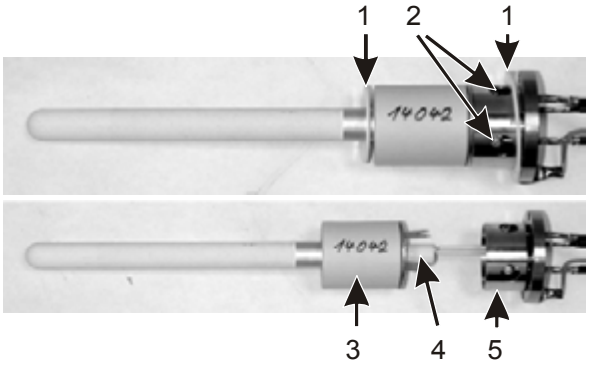


Fig. 7-6:
Measuring cell with heater

1 Teflon seals
2 Sensor contact
3 Sensor
4 Heater
5 Metal sleeve

NOTE

Be extremely careful when replacing the measuring cell or the measuring cell heater because both components are ceramic and are, therefore, EXTREMELY FRAGILE!

1. Remove the probe body (see "Removing the Probe Body").
2. Remove the sensor unit with sensor and heater. To do so, remove the 6 hexagon-socket screws (2.5 hexagon-socket spanner) on the sensor flange.
3. Carefully remove the sensor unit.
4. Remove the sensor contact (1.5 hexagon-socket spanner).
5. Carefully remove the sensor by pushing it forwards.
6. Remove and replace the sensor contact.
7. To install, carry out the above steps in reverse order.

NOTE

When installing the sensor unit in the probe body, do not forget the two Teflon seals (see picture).

During installation, make sure that the sensor does not come into direct contact with the metal sleeve.

8. Reset the heater control to the base value.

To do so, set parameter 104 to "Trigger" and acknowledge with "Enter". Once the command has been executed, parameter 104 returns to "0".

7.9 Cleaning and Replacing the Extraction Device (Incl. Heater)

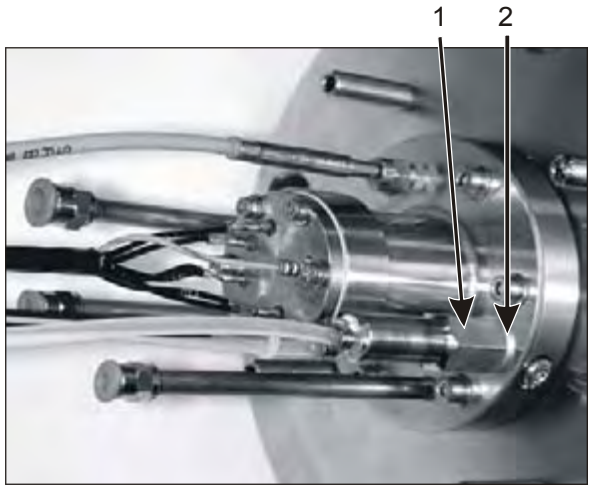


Fig. 7-7:
Probe section (connection side)

1 Extraction device

2 Aluminum seal (other aluminum seal inside)

Required tools: Size 14 spanner

1. Remove the probe body (see above).
2. Remove the extraction device and heater using the size 14 spanner.

NOTE

Blocked gas paths in the extraction device can be unblocked with boiling water.

3. To install, carry out the above steps in reverse order.
   During installation, do not forget the aluminum seals.

7.10 Checking the PT 100 Temperature Sensor

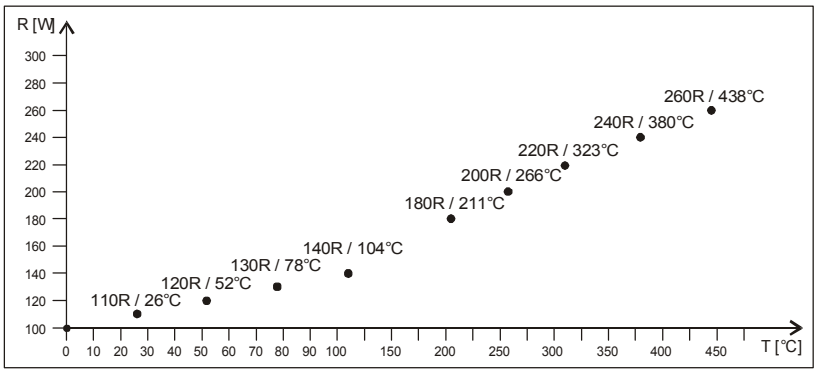


Fig. 7-8:
PT100 table

1. Remove connector X15.
2. Measure the resistance between pins 24 and 26 on connector X15.
   At room temperature, this should be approx. 110 Ω (see graph). If this is not the case, the PT100 is defective and must be replaced.

7.10.1 Replacing the PT100 Thermocouple

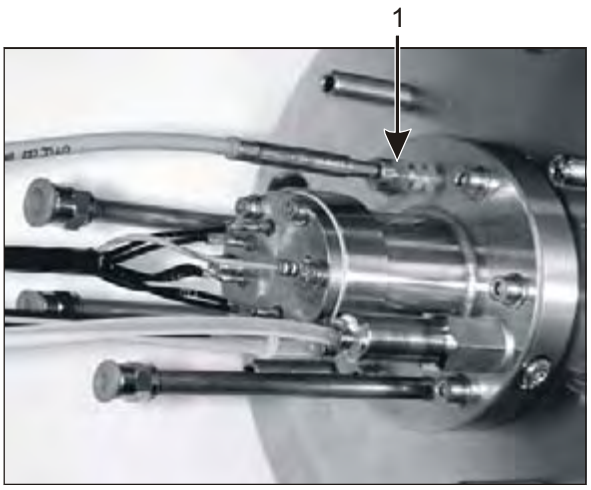


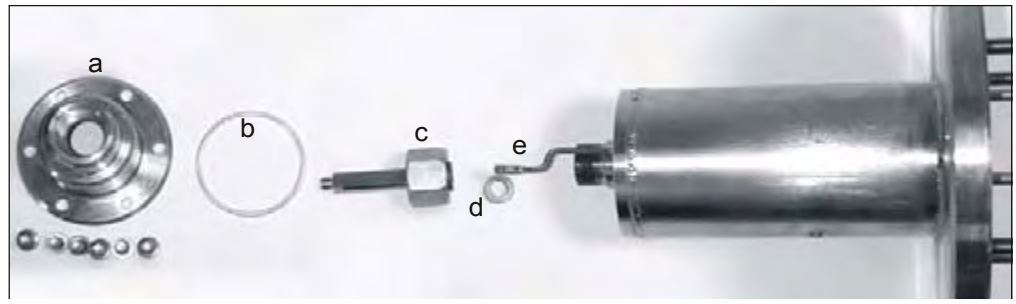
Fig. 7-9:
Probe section (connection side)

1 PT100 thermocouple

Required tools: Size 8 spanner

1. Remove the probe body (see "Removing the Probe Body").
2. Remove the PT100 thermocouple using the size 8 spanner.
3. To install, carry out the above steps in reverse order.

7.11 Replacing the Quartz Glass Measuring Chamber



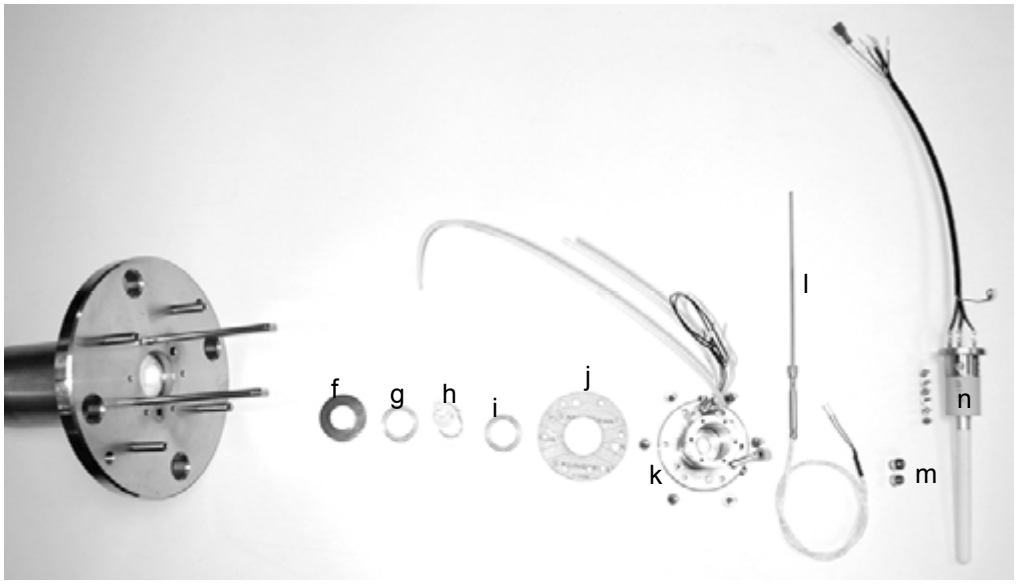


Fig. 7-10:
Components of the probe section

a	Protective pipe intake	**a**	Protective pipe intake
b	Metal O-ring	**b**	Metal O-ring
c	Test gas adapter	**c**	Test gas adapter
d	Graphite seal for measuring chamber	**d**	Graphite seal for measuring chamber
e	Absolute pressure intake pipe	**e**	Absolute pressure intake pipe
f	Disk springs	**f**	Disk springs
g	Aluminum filler ring	**g**	Aluminum filler ring

Required tools:

- Screwdriver: 0.5 x 3.5
- Spanner: 5.5 mm, 8 mm, 10 mm, 13 mm, 14 mm, 24 mm
- Combination pliers
- Hexagon-socket spanners (1.5mm, 3mm, 4mm)

7.11.1 Removing the quartz glass chamber

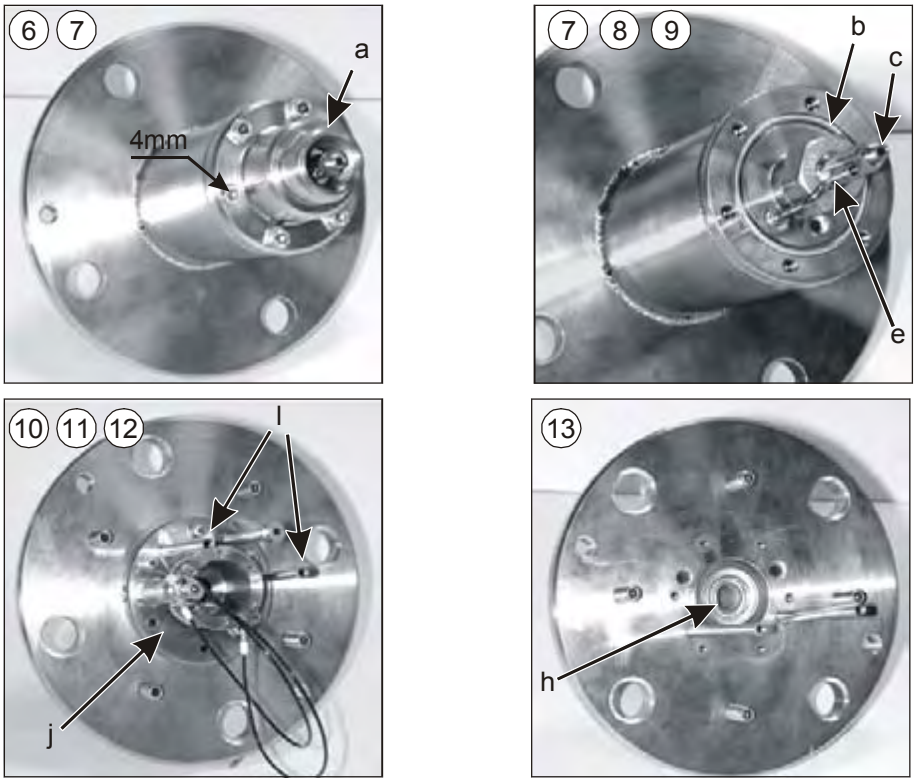


Fig. 7-11:
Removing the quartz glass measuring chamber (work steps specified) (part 1)

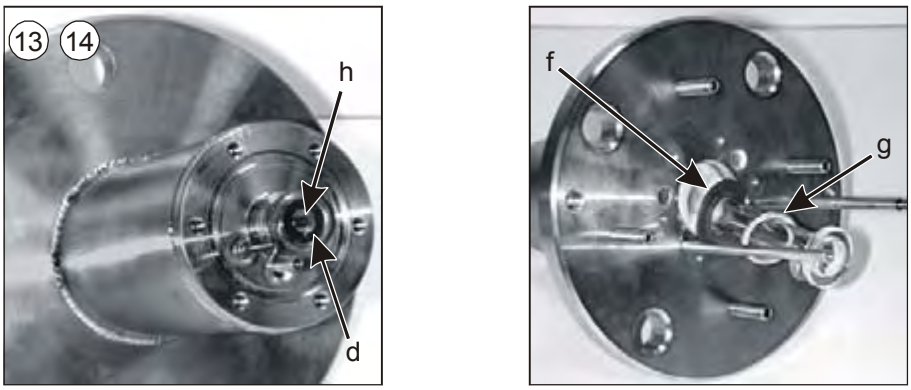


Fig. 7-12:
Removing the quartz glass measuring chamber (work steps specified) (part 2)

1. Remove the protective pipe for the gas extraction device, the gas extraction device, and the absolute pressure capillary.
2. Remove the probe body (see 8.6).
3. For the remainder of the removal procedure, clamp the probe body in the vice.
4. Remove the measuring cell and heater (see 8.8).
5. Remove the PT100 thermocouple (see 8.10).
6. Remove the 6 hexagon-socket-screws of the protective pipe intake (a).
7. Remove the protective pipe intake (a) and the metal O-ring (b).
8. Loosen the absolute pressure intake pipe (e) using the spanner and turn to the side.
9. Loosen the screw cap for the measuring gas adapter (c) using a spanner and remove the measuring gas adapter (c).
10. Remove both hose connections (l).
11. Remove the 6 hexagon-socket screws on the upper flange (j) by rotating them 90° (diagonally opposite sequence).
12. Remove the upper flange (j) with insulation seal and aluminum filler ring (i).
13. Use a blunt object to push the quartz glass measuring chamber (h) out of the probe body.
14. Remove the graphite seal on the inside (d) of the glass chamber.

7.11.2 Installing the quartz glass chamber

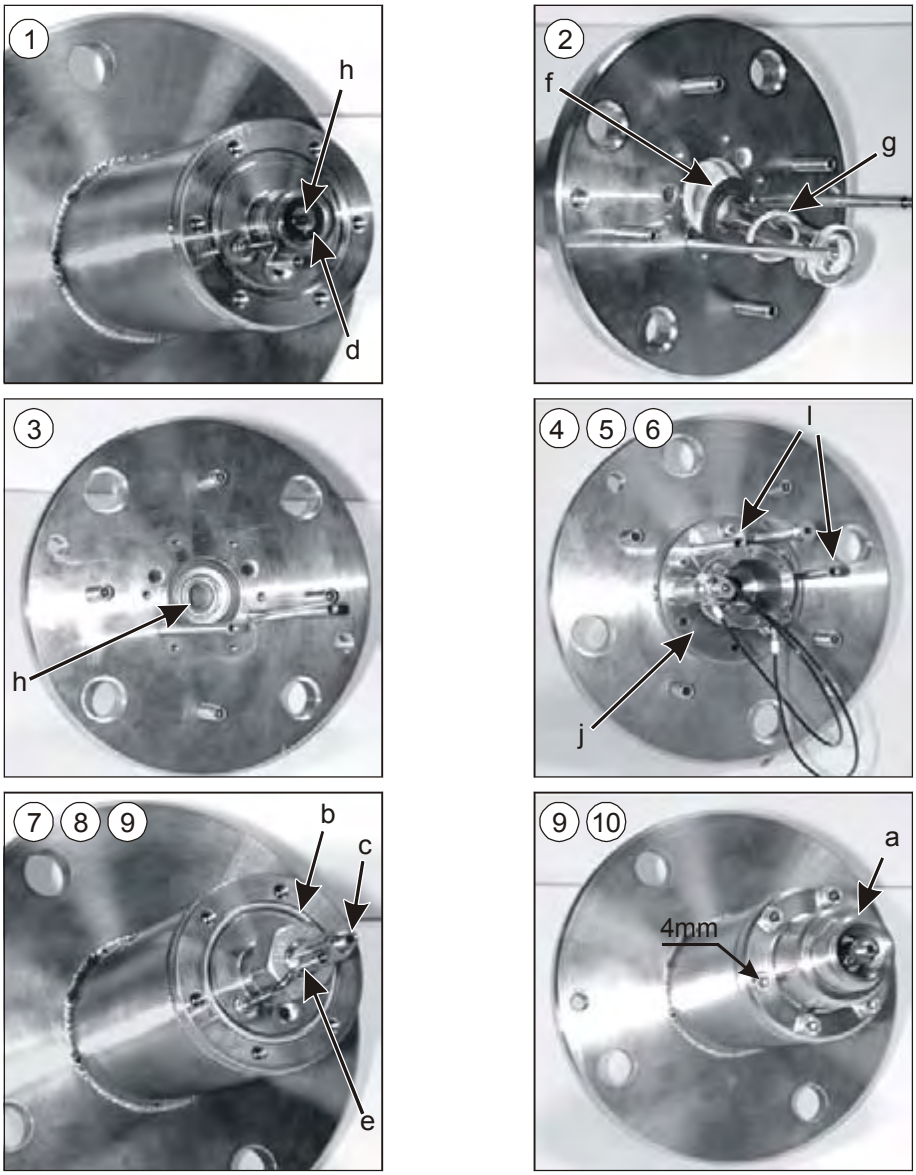
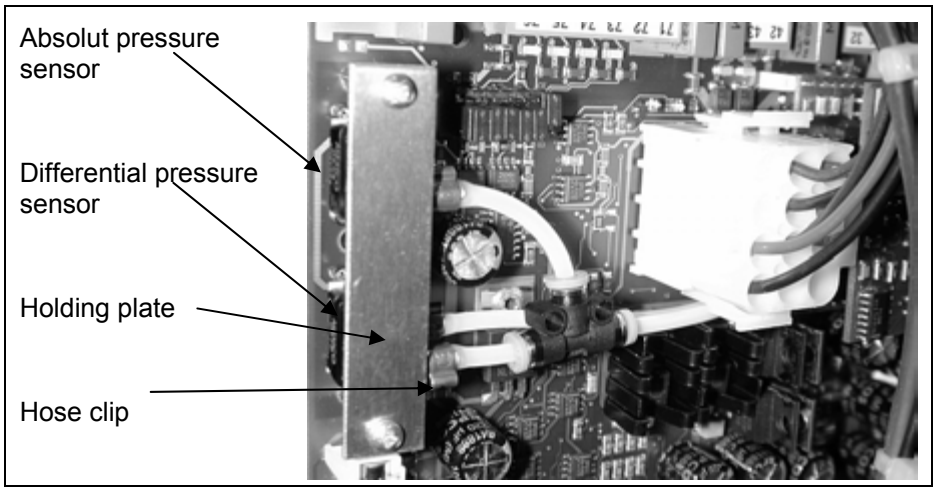


Fig. 7-13:
Installing the quartz glass measuring chamber (work steps specified)

1. Insert the new graphite seal (d) in the probe body.
2. Insert the disk springs (f) in the probe body with the curved side facing the glass flange.
3. Insert the new quartz glass measuring chamber with the new aluminum filler ring (g).
4. Place the upper flange (j) with insulation seal and aluminum filler ring (i) on the measuring chamber.
5. Secure the 6 hexagon-socket screws on the upper flange (j) by rotating them 90° (in diagonally opposite sequence).
6. Install both hose connections (l).
7. Insert the measuring gas adapter (c) and secure the screw caps (17 Nm). Tighten with a different spanner.
   The flat side of the measuring gas adapter (c) must face the absolute pressure intake pipe.
8. Align the absolute pressure intake pipe (e) and secure with a spanner.
9. Insert a new metal O-ring (b) and insert the protective pipe intake (a).
10. Secure the 6 hexagon-socket screws on the protective pipe intake (a) by rotating them 90° (in diagonally opposite sequence).
11. Install the PT100 thermocouple (see 8.10).
12. Install the measuring cell and heater (see 8.8).
13. Install the probe body (see 8.6).
14. Install the protective pipe for the gas extraction device, the gas extraction device, and the absolute pressure capillary.

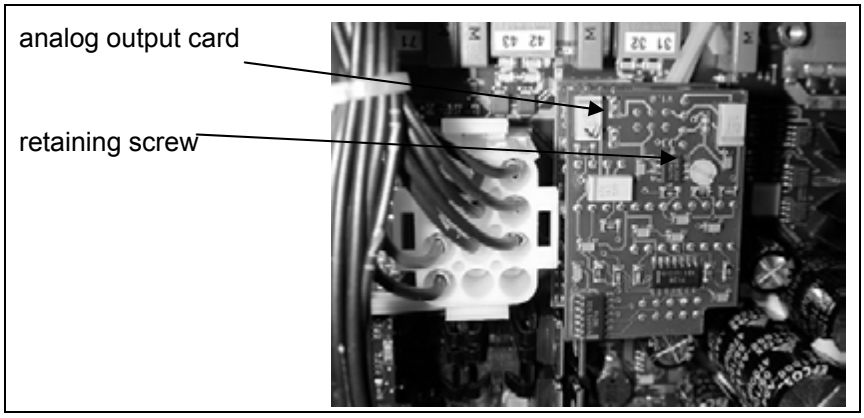
7.12 Replacement of the pressure sensors



The pressure sensors are placed on the base electronic of the LAMBDA TRANSMITTER P. They are plug-in types and by a holding plate secured.

- Remove holding plate.
- Remove hose connection, may be the hose clips must be cut.
- Remove pressure sensors.
- With the plug-on of the pressure sensors, attend to the correct seat in the socket.
- Plug-on hose connection (maybe use new hose clips).
  Hose clips are in the small accessories kit of the LAMBDA TRANSMITTER P (see spare parts)
- Attach the holding plate.

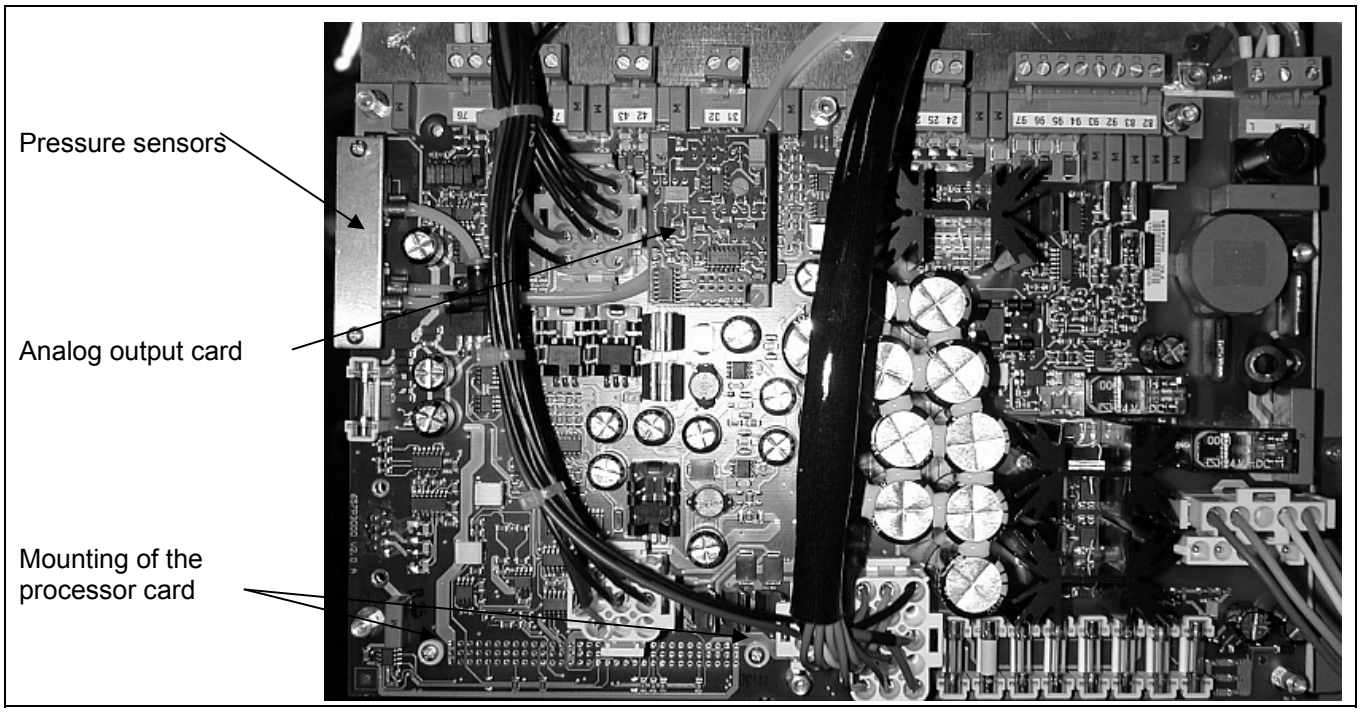
7.13 Replacement of the analog output card



The analog output card is placed on base electronic. It is plug-in type and by a retaining screw secured..

- Remove retaining screw
- Remove analog output card
- Plug-on the new card an secure
- See also chapter 12.5.2

7.14 Replacement of the base electronic



- Remove both pressure sensors (do not remove the hoses)
- Remove analog output card
- Unscrew the mounting of the processor card and remove processor card out of the 96-pole socket. Be careful.
- Remove all plug-in connectors
- Unscrew the 7 fastening bolts of the base elctronic
  (use a pin type socket wrench size 5,5)
- Exchange base electronic
- To install, carry out the above steps in reverse order.

8 Disposal

The LAMBDA TRANSMITTER P oxygen analyzer was designed to minimize the impact on the environment. The individual modules can be easily separated and sent for recycling.

9 Optional Accessories

9.1 LSB-Module with 4 Analog Outputs Voltage, alternatively Current

9.1.1 Functional Description

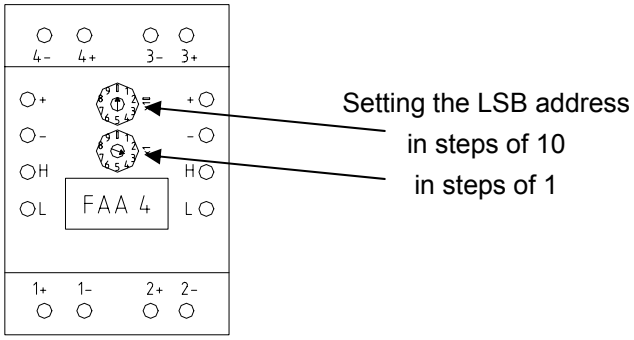
- Module voltage: 4 analog outputs 0 - 10 V DC
- Modul current: 4 analog outputs 0 - 20 mA
- Jumper plugs enable rapid wiring of several modules
- Can be used without programming

The LSB-modules are output modules with a wide range of applications. They are controlled by LSB (setting P3895) (see section 4.5). **These modules cannot be controlled by CAN**. The module is triggered by a variable address (1 - 99) and the status of outputs is transferred to the data bits. If an analog output module with the same address is used in the system, the voltage/current measured there will be reproduced at the corresponding output.

The 4 analog output values (1 to 4: P530 to P569) are output to the analog output module (activate using P3820). The address to be set is shown in parameter 3820. If voltage modules are used, 10 V is equal to 20 mA.

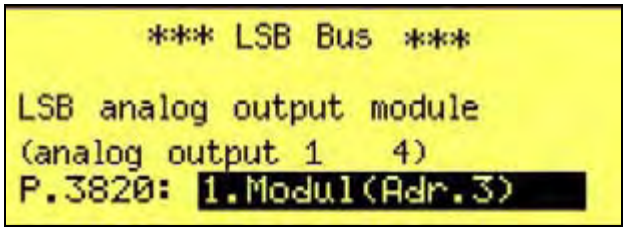
NOTE

Make sure that the address you set is not the same as another LSB module address!



9.1.2 Setting the Parameters for analog output module (with Software Version 4V24 or More Recent)

Activation of analog output module	Analog output 1	Analog output 2	Analog output 3	Analog output 4
P3820 P3895 on LSB	P530-P539	P540-P549	P550-P559	P560-P569



9.1.3 Parameter 530 / 540 / 550 / 560

Here, enter the measured value that is to be output at the analog output. The following settings are possible for each output:

- Off
- Measured O_2 value
- Configurable measured value 1 - 6
- Probe temperature
- Probe absolute pressure
- Probe current
- Probe voltage
- Internal O_2 value

9.1.4 Parameter 531 / 541 / 551 / 561

Here, set the measurement range for each analog output. The following settings are possible:

- 0-20 mA / 0-10 V
- 4-20 mA
- 4-20 mA / error 0 mA
- 4-20 mA / error + maintenance 0 mA

9.1.5 Parameter 532 / 542 / 552 / 562

Here, set the start of the measurement range for each analog output.

- E.g. “0” for 0% O_2

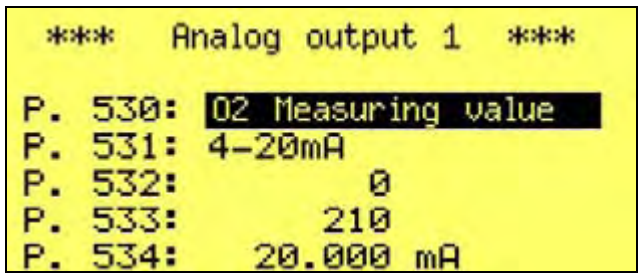
9.1.6 Parameter 533 / 543 / 553 / 563

Here, set the end of the measurement range for each analog output.

- E.g. “210” for 21% O_2

9.1.7 Parameter 534 / 544 / 554 / 564

- Output value for each analog output in “mA”



9.1.8 Technical Specifications

Output Module

• Rated voltage UN	24 V DC
• Current consumption	50 mA
• Power consumption	1.2 W
• Operating voltage range	0.8 - 1.1 x UN
• Operating temp. range	0 °C to +55 °C (-4 °F to 130 °F)
• Storage temp. range	-25 °C to +70 °C (-13 °F to 158 °F)
• Suppressor circuit	Polarity reversal protection for operating voltage
• Function display	Green LED for BUS activity and supply voltage
• Operation display	Red LED for BUS error messages
• Item number voltage module	663R4025S (with connection cable)
• Item number current module	663R4029S (with connection cable)
• Item number of external power pack	663R4024

Analog Outputs (Voltage)

• Output current (10 V DC) (Analog output)	5 mA
• Output voltage	0 - 10 V DC
• Measurement error/tolerance	U = {(N/32) x 9.9165 mV ±20 mV} ±1.1% U = output voltage in V N = numerical value (BUS)
• Response time (from receiving to sending)	15 ms (msec)
• Recovery time	550 ms (msec)

Analog Outputs (Current)

• Output current	0-20 mA
• Accuracy	1%
• Load	max. 300 Ohm
• Response time (from receiving to sending)	15 ms (msec)
• Recovery time	550 ms (msec)

Housing

• Connection cross-section of device terminals	• 2.5 mm² (0.038 in^2)
• Connection cross-section of screwable plug-in terminals (BUS, power supply)	• 1.5 mm² (0.023 in^2)
• Weight	• 95 g (0.2 lb)
• Housing dimensions (W x H x D)	• 35 x 68 x 60 mm (1.4 x 2.7 x 2.4 in)

9.2 LSB-Module with 4 Analog Inputs

9.2.1 Functional Description

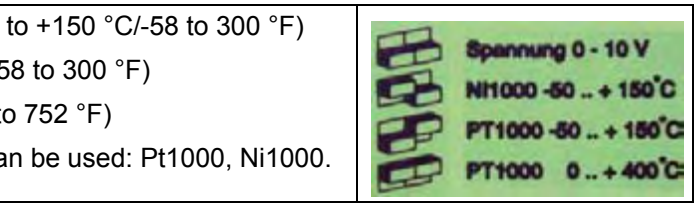
- 4 analog inputs
- Jumper plugs enable rapid wiring of several modules
- Can be used without programming

The LSB-modules are analog input modules with a wide range of applications. They are controlled by LSB (setting P3895) for installation on a DIN rail (see section 4.5). **These modules cannot be controlled by CAN**. The module is triggered by a variable address (1 - 99) and the status of inputs is transferred to the data bits. If the input status changes, a message is immediately sent to the LSB.

Inputs can be switched from voltage input to temperature measurement input. The following settings can be made for every input using a DIP switch:

- 0 - 10 V DC, Ni1000 (-50 to +150 °C/-58 to 300 °F)
- Pt1000 (-50 to +150 °C/-58 to 300 °F)
- Pt1000 (0 to +400 °C/-4 to 752 °F)

Temperature sensors that can be used: Pt1000, Ni1000.

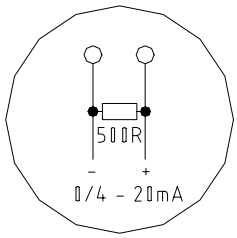


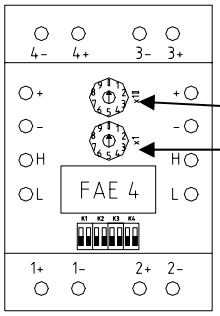
To use the analog input module configured using P3821, “LSB input1” to “LSB input4” must be set as the desired analog input in P572 (582, 592, 602). This enables asynchronous balanced mode with integrated analog inputs and LSB inputs, which is necessary with the LAMBDA TRANSMITTER P, since input 4 is assigned entirely to temperature measurement. If the module or LSB fails, the analog values will fall to 0 after approximately 3 seconds. The address to be set is stored in parameter 3821.

NOTE

Make sure that the address you set is not the same as another LSB module address!

The conversion factor is always 20 mA<->10 V.





Setting the LSB address
in steps of 10
in steps of 1

NOTE for current input:

0 - 3 mA → 0 - 1.5V, 3 - 4 mA → 1.5 - 2 V, 4 - 20 mA → 2 - 10 V

9.2.2 Setting the Parameters for Analog Input Module (with Software Version 4V24 or More Recent)

Activation of analog input module	Analog input 1	Analog input 2	Analog input 3	Analog input 4
P3821 P3895 on LSB	P572	P582	P592	P602

9.2.3 Technical Specifications

Input Module

• Rated voltage UN	24 V DC
• Current consumption	50 mA
• Power consumption	1.2 W
• Operating voltage range	0.8 - 1.1 x $_{UN}$
• Operating temp. range	0 °C to +55 °C (-4 °F to 130 °F)
• Storage temp. range	-25 °C to +70 °C (-13 °F to 158 °F)
• Suppressor circuit	Polarity reversal protection for operating voltage
• Function display	Green LED for BUS activity and supply voltage
• Operation display	Red LED for BUS error messages
• Input/BUS test voltage	no disconnection
• Item number	663R4026S (with connection cable)
• Item number of external power pack	663R4024

Analog Inputs

• Connectable temperature sensor	• Pt1000, Ni1000
• Temperature meas. range Resolution Tolerance	• -50 °C to +150 °C (-50 to 300 °F) -50 °C to +150 °C 10 bit (appr. 0.2 °C) -50 °C to +150 °C approx. ±0.2 °C
• Additional meas. Range Resolution Tolerance	• Pt1000 0 °C to +400 °C (32 to 750 °F) 0 °C to +400 °C 10 bit (approx 0.5 °C) 0 °C to +400 °C approx. ±0.5 °C
• Voltage measurement range	• 0 - 10 V DC
• Resolution	• 10 bit (10 mV/bit)
• Tolerance	• Approx. ±20 mV
• Input resistance	• 200 kΩ
• Response time (from receiving to sending)	• 15 ms (msec)
• Analog value updates	• at least every 3 s
• Recovery time	• 550 ms (msec)

Housing

• Degree of protection (EN 60529)	• Housing: IP50, terminals: IP20
• Range of relative humidity acc. to IEC60721-3-3	• Environment class 3k3
• Connection cross-section of device terminals	• 2.5 mm² (0.038 in^2)
• Connection cross-section of screwable plug-in terminals (BUS, power supply)	• 1.5 mm² (0.023 in^2)
• Weight	• 95 g (0.2 lb)
• Housing dimensions (W x H x D)	• 35 x 68 x 60 mm (1.4 x 2.7 x 2.4 in)

9.3 LSB-Moduel with 4 Digital Outputs

9.3.1 Functional Description

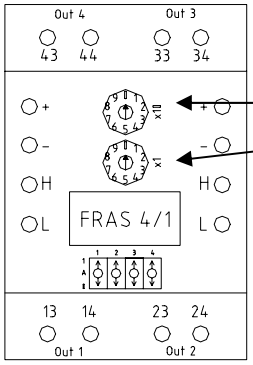
- 4 relay outputs of 250 V, 6 A
- Jumper plugs enable rapid wiring of several modules
- Manual emergency operation level
- Can be used without programming

The LSB-modules are digital output modules with a wide range of applications. They are controlled by LSB (setting P3895) for installation on a DIN rail (see section 4.5). **These modules cannot be controlled by CAN**. The module is triggered by a variable address (1 - 99) and the databits are informed whether data is required or commands are to be carried out.

The 7 relay outputs can be output to 2 LSB relay modules, output 1 to 4 on the module set in P3822, and output 5 to 7 on the modules selected in P3823. You can find the address to be set in parameter 3822 and P3823.

NOTE

Make sure that the address you set is not the same as another LSB module address!



Setting the LSB address
in steps of 10
in steps of 1

Manual emergency operation level

Position “1” → output contact always closed

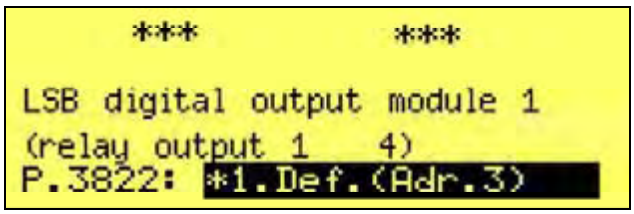
Position “A” → output contact switched via LSB bus

Position “0” → output contact always open

9.3.2 Setting the Parameters for Digital Output Modules (with Software Version 4V24 or More Recent)

Activation of digital output module 1	Relay output 1	Relay output 2	Relay output 3	Relay output 4
P3822 P3895 on LSB	P1030-P1039	P1040-P1049	P1050-P1059	P1060-P1069

Activation of digital output module 2	Relay output 5	Relay output 6	Relay output 7	
P3823 P3895 on LSB	P1070-P1079	P1080-P1089	P1090-P1099	



9.3.3 Parameters for Digital Outputs

Up to 7 digital outputs can be configured freely on the LAMBDA TRANMITTER P . The same parameters are available for the configuration of each digital output. These are:

- Off position
- Four functions (ORed) that trigger a switching operation
- Display of the current relay position

Factory assignment of digital outputs:

- Output 1: general fault
- Output 2: general alarm and/or maintenance
- Output 3: calibration
- Output 4: limit value 1 (LI 1)
- Output 5: not configured
- Output 6: not configured
- Output 7: not configured

Parameter 1030 / 1040 / 1050 / 1060

Set the idle setting here. This setting is used when none of the four functions triggers a switching operation. The “diagnostics mode” setting allows the idle setting to be changed by means of the “position” parameter.

- Low (open-circuit current principle)
- High (closed-circuit current principle)
- Diagnostics mode

Parameters 1031-1034 / 1041-1044 / 1051-1054 / 1061-1064

The four functions are more or less identical and an operating status can act as a switching criterion. If a “limit value” (LI 1-4) is selected as a switching criterion, the output will switch when the limit value output is set. If “calibration” is selected as a switching criterion, for example, the output is not set to the off position during calibration.

Each function (A, B, C, D) can have all of the operating statuses as switching criteria, although limit values LI1-4 or measuring gases are only allocated to individual functions. “Limit value 1” and “measuring gas 1” can only be allocated to “function A”; similarly “limit value 2” and “measuring gas 2” can only be assigned to “function B” etc. However, the OR operation used for the four functions allows all combinations to be varied.

The following operating statuses can be selected as switching criteria:

Alarm, fault, calibration, check, cold start, measurement, maintenance, limit values 1 – 4, measuring gas 1 - 2

Parameter 1039 / 1049 / 1059 / 1069

This parameter displays the current switching state. If the parameter is changed in diagnostics mode, the output can be switched manually.

9.3.4 Limit Value Monitoring (LI)

Exceeding/Undershooting the Limit Value Display

See section 5.5

Parameter 930 / 940 / 950 / 960

Selection of the variable to be monitored for limit value 1 (2, 3, 4)

0 = off, 1 = measured O_2 value, 2-7 = configurable measurement value 1-7, 8 = temperature probe, 9 = absolute pressure probe, 10 = probe current, 11= probe voltage

Parameter 931/932 / 941/942 / 951/952 / 961/962

Form for maximum comparison value for LI 1 (2, 3, 4)

0 = off, 1 = constant value, 2-13 = calculated analog value 1-12

Form for minimum comparison value for LI 1 (2, 3, 4)

0 = off, 1 = constant value, 2-13 = calculated analog value 1-12

Parameter 933 / 943 / 953 / 963

Constant for maximum comparison value for LI 1 (2, 3, 4)

(only when 931, 941, 951, 961= constant value)

Parameter 934 / 944 / 954 / 964

Constant for minimum comparison value for LI 1 (2, 3, 4)

(only when 932, 942, 952, 961= constant value)

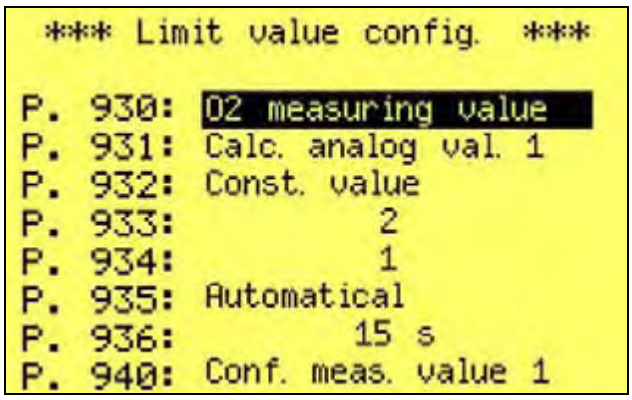
Parameter 935 / 945 / 955 / 965

Reset mode for limit value 1 (2, 3, 4)

0 = automatic, 1 = manual, 2 = acknowledge

Parameter 936 / 946 / 956 / 966

Trigger delay for limit value 1 (2, 3, 4)



9.3.5 Technical Specifications

Output Module

• Rated voltage UN	• 24 V DC
• Current consumption	• 100 mA
• Power consumption	• 2.4 W
• Operating voltage range	• 0.8 - 1.1 x U_N
• Response time (from receiving to relay switching)	• 15 ms (msec)
• Release time (from receiving to relay switching)	• 15 ms (msec)
• Recovery time	• 200 ms (msec)
• Operating temperature range	• 0 °C to +55 °C (-4 °F to 130 °F)
• Storage temperature range	• -25 °C to +70 °C (-13 °F to 158 °F)
• Suppressor circuit	• Polarity reversal protection for operating voltage
• Relay status display	• LED
• Function display	• Green LED for BUS activity and supply voltage
• Operation display	• Red LED for BUS error messages
• Special features	• Manual operation level with confirmation via BUS
• Item number	• 663R4027S (with connection cable)
• Item number of external power pack	• 663R4024

Digital Outputs

• Output contact/material	4 NO contacts / AgNI
• Switching voltage	• max. 250 V
• Max. making/breaking current	• 12 A / 4 s at 10 % on period
• Continuous current	• 6 A/relay, but max. 12 A/module
• Protection of contacts	• 6 A
• Mechanical durability	1x107 operating cycles
• Contact life	1x105 operating cycles
• Permissible number of operations (cycles) per hour	• 360 at nominal load
• Insulation in accordance with VDE 0110	C
• Rated voltage	250 V
• Overvoltage category	II
• Contamination level	2
• Coil/contact test voltage	• 4,000 V AC 50 Hz 1 min
• Contact/contact test voltage	• 1,000 V AC 50 Hz 1 min

Housing

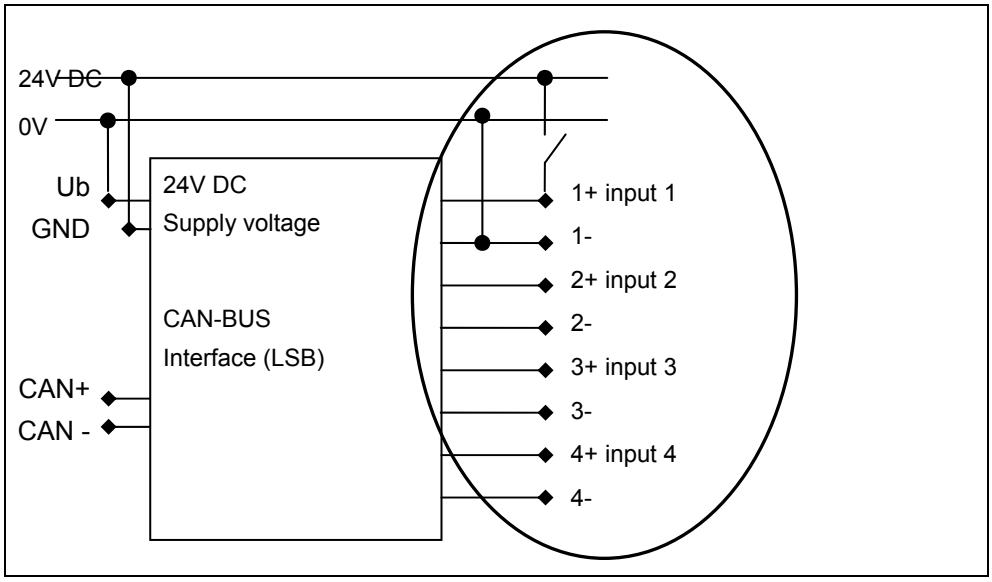
• Degree of protection (EN60529)	• Housing: IP50, terminals: IP20
• Connection cross-section of device terminals	• 2.5 mm² (0.038 in^2)
• Connection cross-section of screwable plug-in terminals (BUS, power supply)	• 1.5 mm² (0.023 in^2)
• Weight	• 95 g (0.2 lb)
• Housing dimensions (W x Hx D)	• 35 x 68 x 60 mm (1.4 x 2.7 x 2.4 in)

9.4 LSB-Module with 4 Digital Inputs

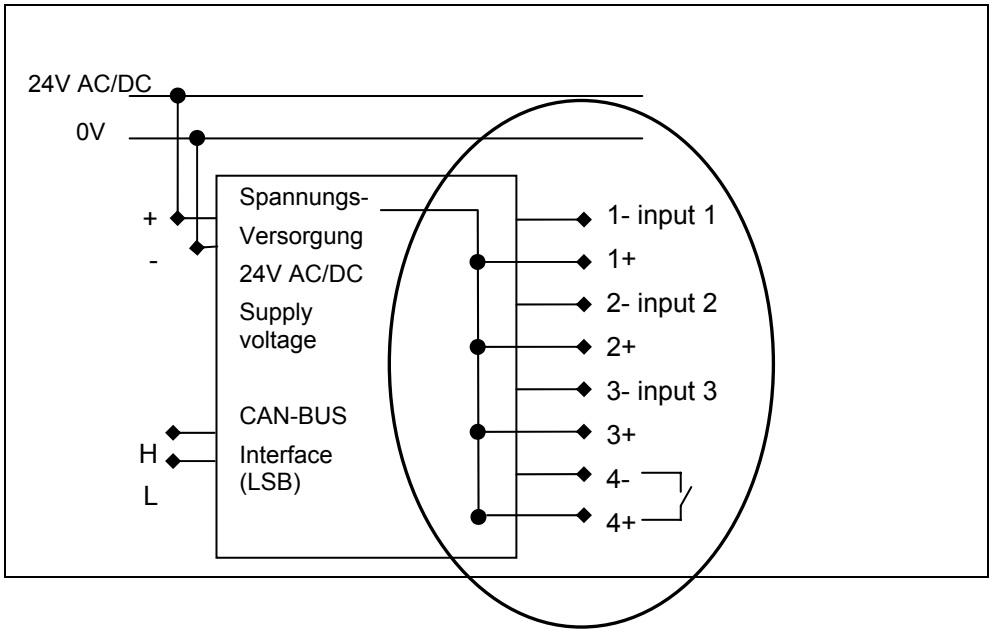
IMPORTANT!

The module 663R4228 can not be used, without re-wiring, as a spare part for the module 663R4028.

Pin assignment of the module **663R4028 (deliverable till December 2007)**



Pin assignment of the module **663R4228 (deliverable from January 2008)**



9.4.1 Functional Description 663R4028/663R4228

4x 24 V DC digital inputs
Inputs are made as 24 V DC voltage inputs with electrically isolation (663R4028) / without electrically isolation (663R4228).

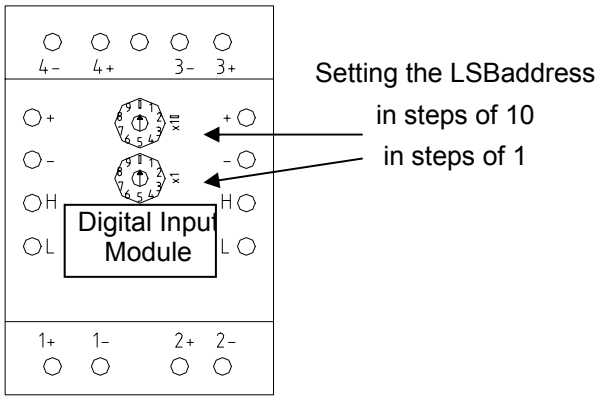
- Jumper plugs enable rapid wiring of several modules
- Manual emergency operation level
- Can be used without programming

The LSB modules are input modules with a wide range of applications. They are controlled by LSB (setting P3895) for installation on a DIN rail (see section 4.5). **These modules cannot be controlled by CAN**. The module is triggered by a variable address (1 - 99) and the status of inputs is transferred to the data bits. If the input status changes, a message is immediately sent to the BUS.

Digital inputs can be specified via 2 LSB modules: the module set in P3824 specifies inputs 1 to 4, the module set in P3825 specifies 5 to 8. If communication fails or a module is missing, the input signals change to 0 and timeout occurs after 3 seconds. The address to be set is stored in parameter 3824 and P3825.

NOTE

Make sure that the address you set is not the same as another LSB module address!



Manual emergency operation level

Position “1” → input always on HIGH

Position “A” → input switched extraneously via contact

Position “0” → input always on LOW

9.4.2 Setting the Parameters for Digital Input Module (with Software Version 4V24 or More Recent)

Activation of digital input module 1	Digital input 1	Digital input 2	Digital input 3	Digital input 4
P3824 P3895 on LSB	P1170-P1175	P1180-P1185	P1190-P1195	P1200-P1205

Activation of digital input module 2	Digital input 5	Digital input 6	Digital input 7	Digital input 8
P3825 P3895 on LSB	P1210-P1215	P1220-P1225	P1230-P1235	P1240-P1245

9.4.3 Parameters for Digital Inputs

Eight digital inputs can be configured for the LAMBDA TRANSMITTER P . All 8 digital inputs are identical in structure and function. They are configured using the parameters listed below.

Factory assignment of digital inputs:

- Input 1 – pump on
- Input 2 – triggers calibration
- Input 3 – triggers check
- Input 4 – triggers cyclical calibration
- Input 5 – resets faults
- Input 6 – fuel 2
- Input 7 – fuel 3
- Input 8 – fuel 4

Idle Level Parameters 1170/1180/1190/1200/1210/1220/1230/1240

Here you can set the idle setting for digital inputs. If the setting deviates from the one that is set, the actions specified in the functions (A,B,C,D) will be carried out If set here, the parameter can be used to trigger the functions (A,B,C,D) for the corresponding digital input.

- Low (open-circuit current principle), i.e. the corresponding digital input is only set when a voltage of +24 V is flowing.
- High (closed-circuit current principle), i.e. the corresponding digital input is only set when the voltage is 0 V or the input is open.
- Diagnostics mode, i.e. the input status can be changed manually.

Function A, B, C, D; Parameters 1171 – 1174 / 1181 – 1184 / 1191 – 1194 / 1201 – 1204 / 1211 – 1214 / 1221 – 1224 / 1231 – 1234 / 1241 - 1244

The four functions are the same in structure; however, limit values LV 1 - 4 and fuels are only assigned to individual functions (A, B, C, D). Limit value 1 and fuel 1 can only be reset in function A; similarly limit value 2 and measuring gas 2 can only be reset in function B and so on. The following actions are possible:

- None
- Pump on — Activates the measuring gas pump.
- Calibration — Triggers automatic calibration.
- Check — Triggers an automatic check.
- Cycl. calibration — An internal counter counts up, automatically triggering calibration when it reaches a certain value (parameter 272). The counter is then reset to zero.
- Fault reset — Acknowledges faults present.
- Alarm reset — Acknowledges alarms present.
- LV 1-4 reset — Function A resets limit value 1, functions B, C, D reset limit values 2, 3, 4.
- Fuel 1 — Function A only selects fuel 1, function B, C, D select fuels 2, 3, 4.
- No cal. — If there is a signal at this input, the device cannot carry out calibration. If calibration is still ongoing, it is stopped immediately.
- PID controller ON/OFF — Switches off PID controller.

Status Parameter 1175 / 1185 / 1195 / 1205 / 1215 / 1225 / 1235 / 245

This parameter displays the digital input status. The two possible statuses are “set” (the set functions will be triggered) and “not set”. The digital input status can be set manually with this parameter, as long as the “idle level” parameter (see 10.4.3.2) is set to “Diagnostics mode”.

9.4.4 Technical Specifications

Input Module

• Rated voltage UN	• 24 V/DC
• Current consumption	• 50 mA
• Power consumption	• 1.2 W
• Operating voltage range	• 0.8 - 1.1 x U_N
• Operating temp. range	• 0 °C to +55 °C (-4 °F to 130 °F)
• Storage temp. range	• -25 °C to +70 °C (-13 °F to 158 °F)
• Suppressor circuit	• Polarity reversal protection for operating voltage
• Function display	• Green LED for BUS activity and supply voltage
• Operation display	• Red LED for BUS error messages
• Special features	• Manual operation level with confirmation via BUS
• Input/BUS test voltage	• 2,500 V/AC 50 Hz 1 min
• Item number	• 663R4028S (till December 2007) 663R4228S (from January 2008) with connecting cable
• Item number of external power pack	• 663R4024

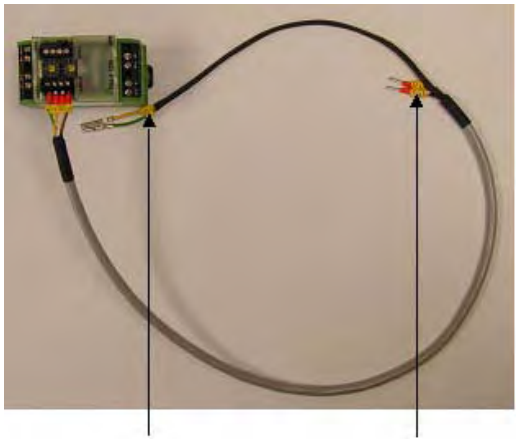
Digital inputs

• Input voltage (control input)	• 30 V/DC
• Input current (24 V DC) (control input)	• 6 mA
• High-signal detection	• >7 V/DC
• Low-signal detection	• <3 V/DC
• Response time (from receiving to sending)	• 15 ms (msec)
• Recovery time	• 550 ms (msec)

Housing

• Degree of protection (EN60529)	• Housing - IP50, terminals - IP20
• Range of relative humidity acc. to IEC60721-3-3	• Environment class 3k3
• Connection cross-section of device terminals	• 2.5 mm² (0.038 in^2)
• Connection cross-section of screwable plug-in terminals (BUS, power supply)	• 1.5 mm² (0.023 in^2)
• Weight	• 95 g (0.2 lb)
• Housing dimensions (W x H x D)	• 35 x 68 x 60 mm (1.4 x 2.7 x 2.4 in)

9.5 Internal Connection of the LSB-Module (max. 2 Pieces)



Wire + / - Wire No. 72 / 73

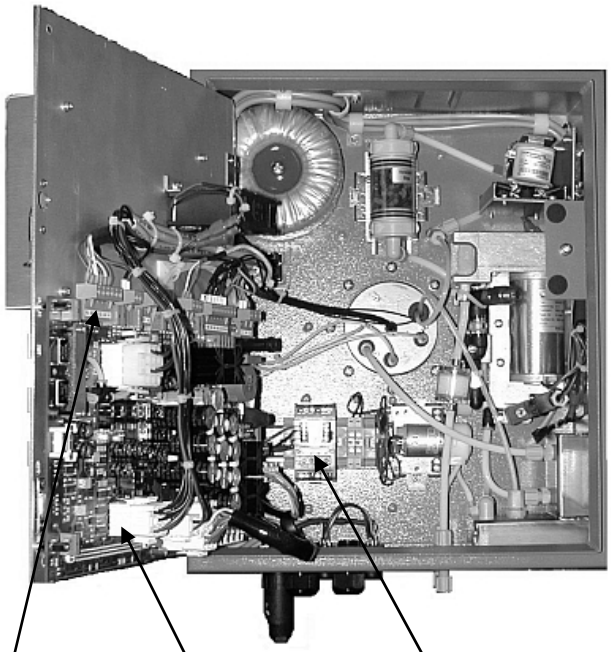


Fig. 9-1:
LSB module in sheet-steel housing

1. Attach the LSB module (without the terminating resistor) onto the mounting rail. If more than one module is to be installed, connect these using the jumper plugs provided.

2. Accomplish the cable from the LSB module under the air fan and strap it with cable ties.

3. Connect the wires numbered 72 and 73 with the X12 plug to numbers 72 and 73.

4. Die Connect wires labeled + / - to the X206 plug (pin 3 = - , pin 9 = +) for the power supply..

5. Set the parameters in LAMBDA TRANSMITTER P (see chapter 4.5, 10.1 – 10.4)

6. Check the plug-in jumpers on the base electronic (see chapter 12.5.1)

9.6 External LSB-Module Connections

NOTE:

Any external LSB module connections must also have an external power supply. Modules can be connected in rows without any clearance. Once there are 15 modules in a row, a new external connection to the power supply must be made.

More than 15 modules would overload the jumper plugs and cause them to burn out.

If an external power supply is used, ensure that sufficient protection is available since there are no mains fuses.

1. Install the LSB module in the required position. If more than one module is to be installed, connect these using the jumper plugs provided.

2. Attach the 120 ohm LSB terminating resistor to the last module.

3. Connect the LSB module to the external power supply (24 V DC) and the LSB Ext. power supply for DIN-rail mounting type 663R4024

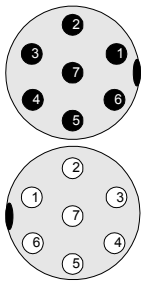
NOTE:

The maximum cable length between the LAMBDA TRANSMITTER P and the LSB module is 500 m.

The module is connected to the LSB using the 7-pin connector on the housing. See also section 3.4.

7-pin LSB/CAN connection to the gas extraction device and filter heater

7-pin LSB/CAN connection to other devices with a LSB/CAN terminal



1 - NC
2 - CAN-GND
3 - CAN low
4 - CAN high
5 - GND from EVU
6 - +24V from EVU
7 - PE

4. Set the parameters in LAMBDA TRANSMITTER P (see chapter 4.5, 10.1 – 10.4)

5. Check the plug-in jumpers on the LAMBDA TRANSMITTER P base electronic (see chapter 12.5.1)

Recommendations for lengths and cross-sectional areas of LSB cables are listed below:

0 - 40m	1 x 2 x 0,22 mm^2, stranded in pairs, shielding, 120 Ω
40 - 300 m	1 x 2 x 0,34 mm^2, stranded in pairs, shielding, 120 Ω
300 - 500 m	1 x 2 x 0,5 mm^2 , stranded in pairs, shielding, 120 Ω

9.7 Activating of LSB-Modules

Examination at the LSB module

- Make sure, that CAN low and CAN high, also the 24V-supply voltage ars correctly connected.
- Make sure, that at the freely connection side between CAN low and CAN high a 120R-termination resistor is connected.
- Set the LSB address at the module (up 10er, down 1er), which is specified in parameter 3820...3825 in LAMBDA TRANSMITTER P.
  No address may be assigned doubly.
- With digital modules the switches of the hand control level must be set to „A“ .

Examination of the parameters in LAMBDA TRANSMITTER P
(see chapter 10.1...10.4)

- One or more parameter 3820...3825 (depending from numbers of modules) must be activted
  P3820 – Activated a LSB module with 4 analog outputs
  P530...539 configured analog output 1
  P540...549 configured analog output 2
  P550...559 configured analog output 3
  P560...569 configured analog output 4
- P3821 – Activated a LSB module with 4 analog inputs
  P570...579 configured analog input 1
  P580...589 configured analog input 2
  P590...599 configured analog input 3
  P600...609 configured analog input 4
- P3822 – Activated a LSB module with digital outputs 1...4
  P1030...1039 configured relay output 1
  P1040...1049 configured relay output 2
  P1050...1059 configured relay output 3
  P1060...1069 configured relay output 4
- P3823 – Activated a LSB module with digital outputs 5...7
  P1070...1079 configured relay output 5
  P1080...1089 configured relay output 6
  P1090...1099 configured relay output 7
- P3824 – Activated a LSB module with digital inputs 1...4
  P1170...1175 configured digital input 1
  P1180...1185 configured digital input 2
  P1190...1195 configured digital input 3
  P1200...1205 configured digital input 4
- P3825 – Activated a LSB module with digital inputs 5...8
  P1210...1215 configured digital input 5
  P1220...1225 configured digital input 6
  P1230...1235 configured digital input 7
  P1240...1245 configured digital input 8
- Parameter 3895 in LAMBDA TRANSMITTER P must be set to „LSB“.

Setting of the plug-in jumpers in LAMBDA TRANSMITTER P (see chapter 12.5)

- The jumpers BR10..14 (selection CAN/RS422) on the base electronic must be set to „CAN“.
- The jumper BR15 (termination resistor ON/OFF) on the base electronic must be set to „R“ (ON).
- The jumpers BR12 and BR13 (selection CAN/RS422) on the processor card must be set to „C“ (CAN).

Setting of the plug-in jumpers in connection with a opionally power pack for GED and pre-filter heater (see chapter 12.5)

- The jumpers BR10..14 (selection CAN/RS422) on the base electronic must be set to „CAN“.
- The jumper BR15 (termination resistor ON/OFF) on the base electronic must be set to „CAN“ (OFF).
- The jumpers BR12 and BR13 (selection CAN/RS422) on the processor card must be set to „C“ (CAN).
- The jumper JP2 (termination resistor ON/OFF) on the power pack electronic board must be set to “2-3“ (ON).
  see chapter 4.6.3
- The DIP switch 1 on the power pack electronic board must be set to „ON“ (LSB operation)

After power on the following condition must be present

- Red LED at LSB module is OFF
- Green LED at LSB module is blinking
- CAN Rx/Tx-LEDs am LT10P are jittering

If not, the following problem solutions

- No LED at LSB module is flashing
  - No 24V supply voltage
- Green LED at LSB module steady light, red LED is blinking
  - LSB module without address
  - No or wrong parameter 3820...3825 is activated
- Green and red LED at LSB module steady light
  - Wrong addresse at LSB module is setted
  - Parameter 3895 set to „CAN“, must be set to „LSB“
  - Jumpers BR10...14 on base electronic in position „RS422“

9.8 Gas Extraction Kit with Heater for Gas Extraction Device

The gas extraction device heater must be used in the following cases:

- Test gas temperatures below the water/acid dew point
- Penetration of brick stacks with very thick walls where there is a risk of the temperature in the capillary falling below the dew point.

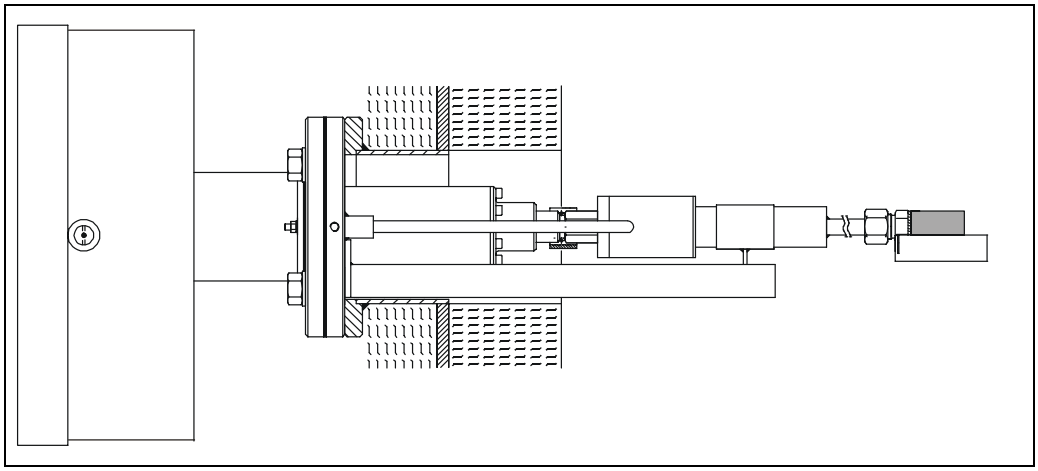


Fig. 9-2:
Protective pipe for gas extraction device with heater and protective pipe

Length	Type	Length of the connecting cable	Material
800 mm (31.5 in)	6 57 R 3051	2 m (6.6 ft)	Stainless steel 1.4571
1,000 mm (39.4 in)	6 57 R 3052	2 m (6.6 ft)	Stainless steel 1.4571
1,400 mm (55.1 in)	6 57 R 3053A	2 m (6.6 ft)	Stainless steel 1.4571
1,800 mm (70,9 in)	6 57 R 3054A	2 m (6.6 ft)	Stainless steel 1.4571
Type corrosion-resistant-steel (REA) on request			1.4539
Additional protective pipe fpr Type REA-steel on request			Polyester
Cable connector for extension the connecting cable 657R3168.			

9.9 Gas Extraction Kit with Gas Extraction Device and Filter Heater

The heater for the sintered metal filter attachment must be used when measuring gas temperatures fall below the dew point.

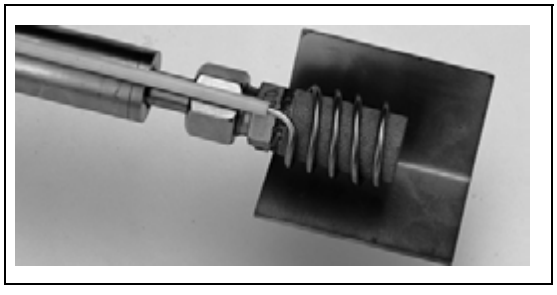


Fig. 9-3:
Heater for sintered metal filter attachment

Length	Type	Length of the connecting cable
800 mm (31.5 in)	6 57 R 3061	2 m (6.6 ft)
1,000 mm (39.4 in)	6 57 R 3062A	2 m (6.6 ft)
1,400 mm (55.1 in)	6 57 R 3063A	2 m (6.6 ft)
1,800 mm (70,9 in)	6 57 R 3064A	2 m (6.6 ft)

Cable connector for extension the connecting cable 657R3167.

9.10 Protective Pipe for High-Dust Applications

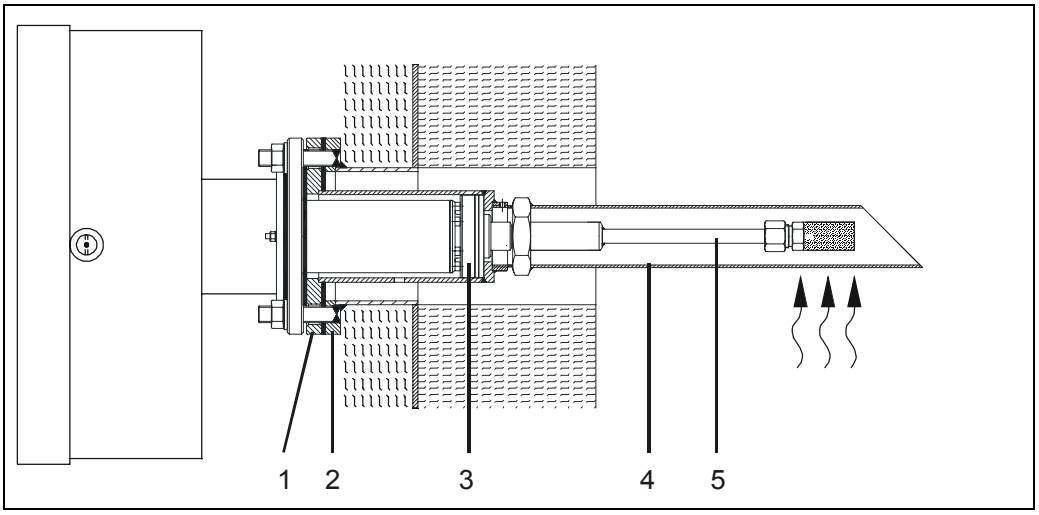


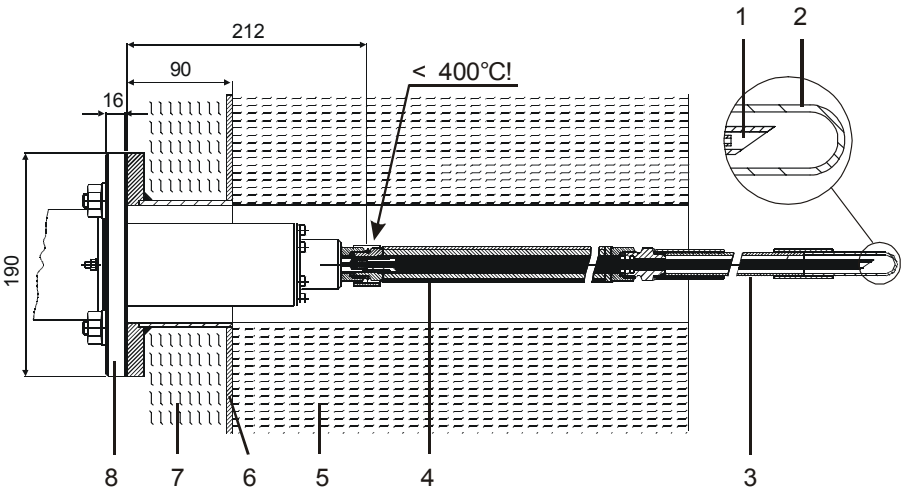
Fig. 9-4:
Protective pipe for high-dust applications

No.	Component	Type
1	Connection flange for protective pipe for high-dust applications	657R3511/R3512
2	Counterflange	657R3506/R3507
3	Pressure disks with disk springs and graphite seal	657P3530
4	Protective pipe for high-dust applications (standard material: stainless steel 1.4571) External diameter 60mm Internal diameter 55mm	500mm (19,7 in) 657 R 3560 800mm (31,5 in) 657 R 3561 1000mm (39,4 in) 657 R 3562 1400mm (55,1 in) 657 R 3563 1800mm (70,9 in) 657 R 3564
5	Gas extraction kit (standard material: stainless steel 1.4571)	500mm (19,7 in) 657 R 3010 800mm (31,5 in) 657 R 3011 1000mm (39,4 in) 657 R 3012 1400mm (55,1 in) 657 R 3013 1800mm (70,9 in) 657 R 3014

Pressure disks with disk springs and graphite seal are contained in the scope of delivery of the connection flange enthalten.

9.11 Ceramic Gas Extraction Device

For measuring gas temperatures of between 950°C and 1400 °C (1750°F…2550°F), a ceramic gas extraction device must be used in conjunction with a ceramic protective pipe.



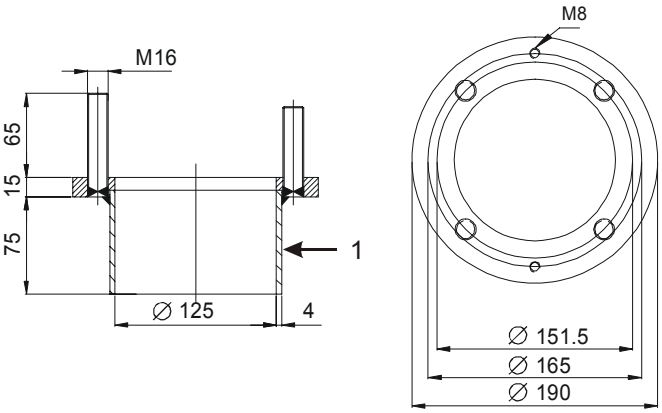
1 Gas extraction tube
2 Ceramic filter (filter mesh: 50µm)
3 Ceramic protective pipe with filter
4 Protective pipe to prevent heat transfer
5 Cladding/insulation
6 Boiler wall
7 Insulation
8 Flange

Fig. 9-5:

Ceramic gas extraction device with ceramic protective pipe

Immersion depth	Type
500 mm (19.7 in)	6 57 R 3030
800 mm (31.5 in)	6 57 R 3031
1,000 mm (39.4 in)	6 57 R 3032
1,400 mm (55.1 in)	6 57 R 3033A
1,800 mm (70,9 in)	6 57 R 3034A

9.12 Counterflange



1 Seamless steel tube

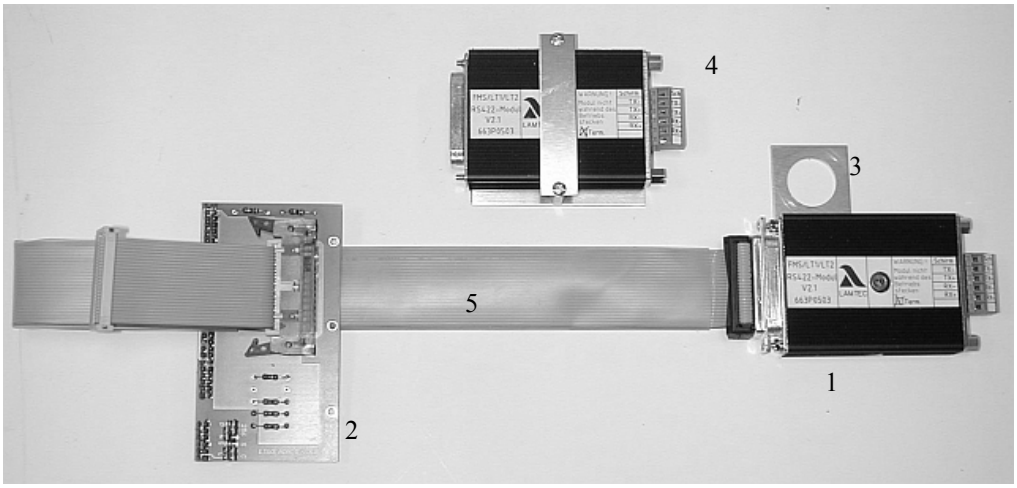
Fig. 9-6:
Counterflange

Type	Material
657 R 3506	Steel (electrogalvanized or painted black)
657 R 3507	Stainless steel 1.4571 (V4A)

9.13 Optional Second RS422 Interface, Type K6029318

An RS422 module, a connection cable, an adapter board and a holding plate must be used for this option. Two holding plates are always supplied to cover both housing types (sheet steel and cast aluminum).

See also section 4.5.



1 RS422 module

2 Adapter board

3 Bracket for LAMBDA TRANSMITTER P in sheet-steel housing

4 Bracket for LAMBDA TRANMITTER P in cast-aluminum housing

5 Connection cable

Fig. 9-7:
Components of the 2nd RS422 interface

The second RS422 interface is required if a GM31 analyzer is to be connected and the CAN or LSB interface is already assigned to an Evaluation unit or gas extraction device and filter heater, or an LSB module. If the CAN or LSB interface is not assigned, the RS422 interface provided (X12 on board) can be used. It must first be set via plug-in jumpers, however (see section 12.5.1).

9.13.1 Installing the 2nd RS422 Interface

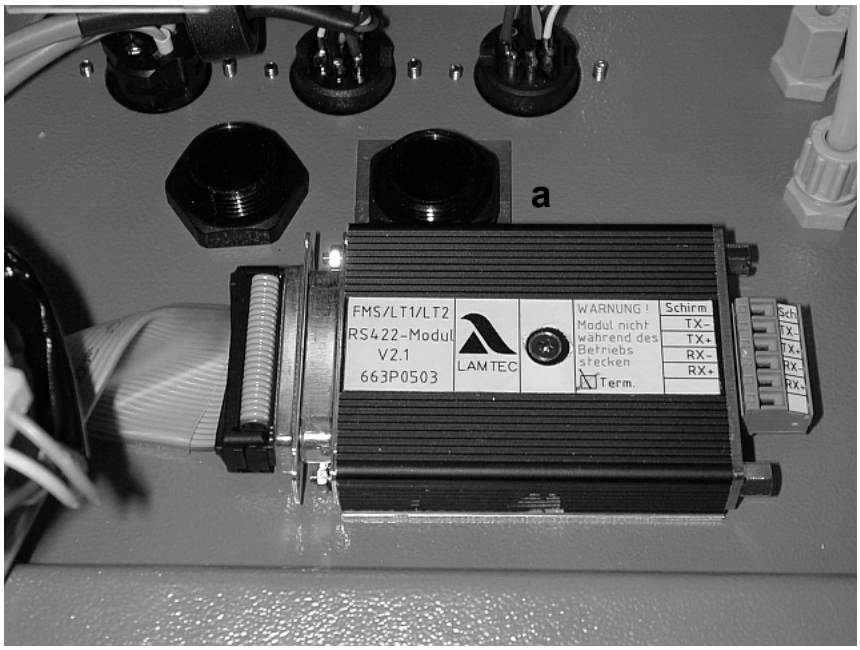


Fig. 10-8:
Installing the Second RS422 Interface in Sheet-Steel Housin

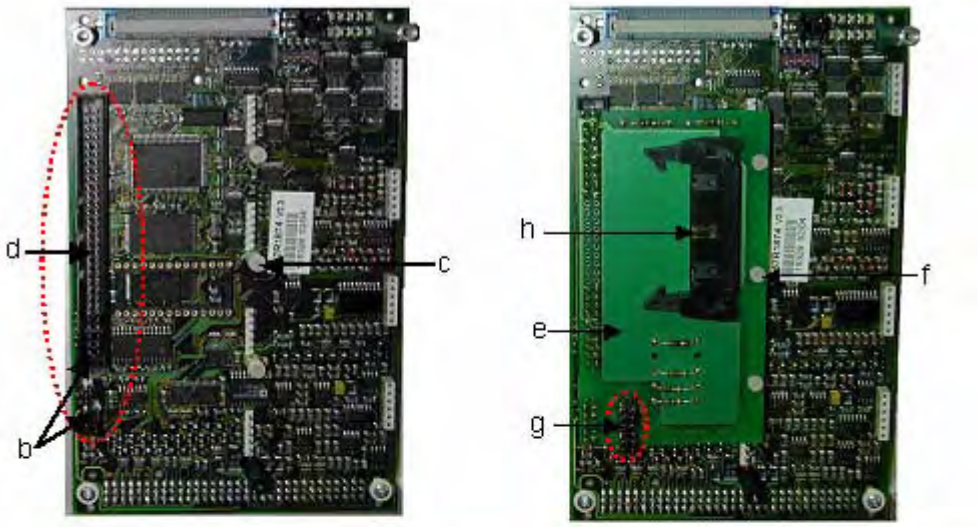


Fig. 10-9:
Installing the adapter board on the processor board

Fig. 10-10:
Connecting and laying the connection cable

IMPORTANT!

Never connect the RS422 module when it is energized. It may be destroyed!!

1. Switch off the power supply to the LAMBDA TRANSMITTER P.
2. Open the LAMBDA TRANSMITTER P housing and front plate.
3. Secure the holding plate (3), with the RS422 module (1) attached, to the cable connection (a). See Fig. 10-8.
4. Plug the connection cable (5) into the RS422 module and route it under the front plate to the front side of the LAMBDA TRANSMITTER P. Then close the front plate.
5. Remove the Perspex disk protecting the processor board. To do this, you must loosen three 3 screws.
6. Remove the jumpers (x 9) from the processor board (b). See Fig. 10-9.
7. Unscrew the three plastic screws (c) from the spacer on the processor board.
8. Plug the adapter board (2) into the socket of the processor card (d) (e).
9. Screw the adapter board (2) back together with the spacer (f).
10. Snap off and remove the small lugs on the jumpers (g).
11. Connect the RS422-module connection cable (5) to the adapter board (2)(h). See Fig. 10-10.
12. The ribbon cable can be trimmed as needed since this will also be used in the LAMBDA TRANSMITTER E in cast-aluminum housing.
13. Affix the cable run (i) and secure the connection cable to it.
14. Screw the Perspex disk back on to the processor board (j).
15. Close the LAMBDA TRANSMITTER P housing and reconnect the power supply.

10 Spare Parts and Consumables

NOTE

* Recommendation: place spare parts in storage

(1) The operator must decide upon suitable storage measures.

(2) Spare part for optional components.

(3) Available in other lengths (specifications in the price lists or available on request)

10.1 Consumables

- * 1 ZrO_2 measuring cell with contact
  Average service life: 2 to 4 years (depending on fuel)
  Type 6 57 R 3201
- * 1 heater measuring cell
  Average service life: 2 to 4 years
  Type 6 57 R 3203
- 1 replacement pack for pump protection filter (x 10)
  Type 657 R 0791
- * 1 measuring gas pump
  Average service life: > 2 to 4 years (depending on fuel)
  Type 657 R 4161
- * 1 calibration gas pump
  Average service life: > 3 years
  Type 657 R 0837
- * 1 mounting paste (anti-seize paste)
  (x 5)
  Type 6 50 R 1090
- * 1 condensate pump
  Average service life: > 2 to 4 years
  Type 657 P 0398
- * 1 sampling filter for gas extraction device up to 950 °C
  Type 6 55 R 0028
- * 1 sintered metal filter insert 50 µm (x 10)
  For sampling filter type 6 55 R 0028,
  Type 6 55 R 2803
- * 1 filter attachment for probe installation fittings
  - Filter mesh: 20µm (standard) Type 6 55 R 0212
  - Filter mesh: 10µm Type 6 55 R 0211
  - Filter mesh: 40µm Type 6 55 R 1210
  - Filter mesh: 2µm Type 6 55 R 0208

10.2 Spare Parts

- (1) 1 "measuring chamber" repair kit
  Type 6 57 R 3206
- (1) 1 “seal set measuring chamber”
  Type 6 57 R 3212
- (1) 1 “seal set measuring sensor "
  Type 6 57 R 3213
- (1) Extraction device (complete) with heater
  Type 6 57 R 4202
- (1) 1 PT 100 temperature sensor - for probe temperature (capillary)
  Type 6 57 R 3205
- (1) 1 gas extraction device up to 950°C (1750°F) for following insertion depths:
  300 mm (11,8 in) Type 6 57 R 3315
  500 mm (19,7 in) Type 6 57 R 3310
  800 mm (31,5 in) Type 6 57 R 3311
  1000 mm (39,4 in) Type 6 57 R 3312
  1400 mm (55,1 in) Type 6 57 R 3313
  1800 mm (70,9 in) Type 6 57 R 3314
- (1) 1 ceramic/metal-ceramic gas extraction device up to 1,400°C (2550°F) for following insertion depths:
  500 mm (19,7 in) Type 6 57 R 3330
  800 mm (31,5 in) Type 6 57 R 3331
  1000 mm (39,4 in) Type 6 57 R 3332
  1400 mm (55,1 in) (1000 mm ceramic) Type 6 57 R 3333
  1800 mm (70,9 in) (1000 mm ceramic) Type 6 57 R 3334
- (1) 1 securing mechanism for protective pipe for gas extraction device
  Type 6 55 R 0630
- (1) 1 protective pipe (standard) for gas extraction device, material: 1.4571 (V4A), incl. sintered metal pre-filter, securing mechanism, and seal for measuring gas temperatures up to 700°C (1300°F) , for following insertion depths:
  500 mm (19,7 in) Type 6 57 R 3410
  800 mm (31,5 in) Type 6 57 R 3411
  1000 mm (39,4 in) Type 6 57 R 3412
  1400 mm (55,1 in) Type 6 57 R 3413
  1800 mm (70,9 in) Type 6 57 R 3414
- (1) (2) 1 protective pipe (Inconell 600) for gas extraction device, incl. sintered metal pre-filter, securing mechanism and seal for measuring gas temperatures up to 950°C (1750°F), for following insertion depths:
  500 mm (19,7 in) Type 6 57 R 3420
  800 mm (31,5 in) Type 6 57 R 3421
  1000 mm (39,4 in) Type 6 57 R 3422
  1400 mm (55,1 in) Type 6 57 R 3423
  1800 mm (70,9 in) Type 6 57 R 3424
- (2) 1 protective pipe (ceramic/metal-ceramic version) for gas extraction device for measuring gas temperatures up to 1400°C (2550°F), incl. pre-filter for following insertion depths:
  500 mm (19,7 in) Type 6 57 R 3430
  800 mm (31,5 in) Type 6 57 R 3431
  1000 mm (39,4 in) Type 6 57 R 3432
  1400 mm (55,1 in) Type 6 57 R 3433
  1800 mm (70,9 in) Type 6 57 R 3434
- (1) (2) 1 replacement measuring gas sampling heater complete with protective pipe without sintered metal pre-filter for following insertion depths:
  Material: Stainless steel 1.4571
  800 mm (31,5 in) Type 6 57 R 3451
  1000 mm (39,4 in) Type 6 57 R 3452
  1400 mm (55,1 in) Type 6 57 R 3453
  1800 mm (70,9 in) Type 6 57 R 3454
  Type corrosion-resistant steel 1.4539 on request
  Additional protective pipe polyester on request

- (1) (2) 1 replacement heater for sintered metal filter attachment for following insertion depths:
  800 mm (31,5 in) Type 6 57 R 3471
  1000 mm (39,4 in) Type 6 57 R 3472
  1400 mm (55,1 in) Type 6 57 R 3473
  1800 mm (70,9 in) Type 6 57 R 3474
- (1) (2) 1 replacement electronics for gas extraction device and filter heater (complete)
  Type 6 57 R 3165
- (1) (2) 1 replacement transformer for gas extraction device and filter heater
  Type 6 57 R 3166
- (1) 1 replacement computer electronics
  Type 6 57 R 1874
- (1) 1 replacement analog output card, isolated
  Type 6 57 R 0051
- (1) 1 replacement base electronics, without pressure sensors
  Type 6 57 P 4000
- (1) 1 replacement power pack (transformer)
  Type 6 57 R 3874
- (1) 1 differential pressure sensor
  Type 6 57 P 4001
- (1) 1 absolute pressure sensor
  Type 6 57 P 0549
- (1) 1 small accessories kit (ZIRKOR 302)
  Type 6 57 R 3250
- (1) 1 replacement fuse box
  Type 6 57 R 3190
- (1) 1 solenoid valve
  Type 6 57 P 4105
- (1) 1 replacement air fan
  Type 03 L 0102
- (1) 1 replacement control/display unit
  Type 6 57 P 4130
- (1)(2) External power supply for DIN rail AC230V / DC24V for ext.LSB module
  Type 6 63 R 4024
- (1)(2) 1 replacement LSB module analog output (voltage), without connecting cabel
  Type 6 63 R 4025
- (1)(2) 1 replacement LSB module analog output (current), without connecting cabel
  Type 6 63 R 4029
- (1)(2) 1 replacement LSB module analog input, without connecting cabel
  Type 6 63 R 4026
- (1)(2) 1 replacement LSB module digital output, without connecting cabel
  Type 6 63 R 4027
- (1)(2) 1 replacement LSB module digital input, without connecting cabel
  Type 6 57 R 4028
  Type 6 57 R 4228 (from January 2008)
- (1)(2) 1 replacement RS422 module, without connecting cabel
  Type 6 63 P 0503
- 1 low-pressure hose PTFE 6 x 4mm, natural
  Type 6 50 P 0707, running meter
- 1 PTFE hose 3 x 0.5mm
  Type 6 50 P0228, running meter
- 1 serial connection cable, 9-pin Sub D,
  socket / socket 10 m long (optional)
  Type 6 63 R 0100

11 Appendix

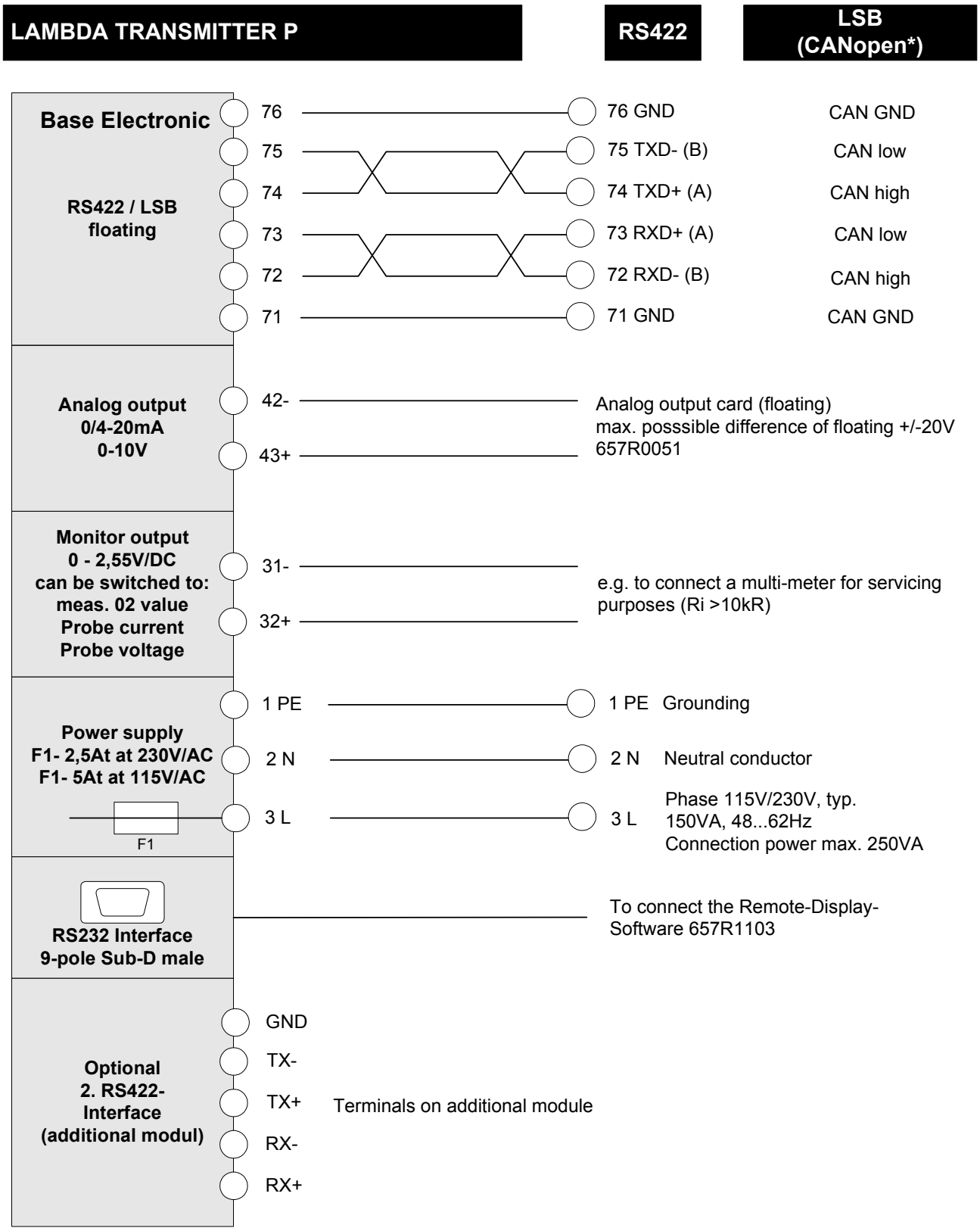
11.1 Technical Specifications

11.1.1 General Specifications

Housing:	• Sheet-steel housing, painted, stainless steel probe section 1,4571 (V4A) • Degree of protection to DIN 40050: IP 65; NEMA 4X • Dimensions (H x W x D): 395 mm x 330 mm x 300 mm • Color: orange • Weight: 27 kg (with 1m gas extraction device) • With GED-Heating 500mm/1000mm additional 4kg/6kg
Ambient temperature:	• Operation: -20°C to +55°C (-4...130°F) • Transportation and storage: -40°C to +85°C
Auxiliary voltage:	• 230 V AC and 115 V AC, +10% / -15%, 48 Hz to 62 Hz **!! To be used only in grounded power line networks !!**
Power consumption: (without heater for gas extraction device and filter)	• Typical: 160 VA • Max.: 250 VA
Measuring principle:	• Zirconium dioxide current probe
Operating temperature of measuring cell:	• 800°C to 1000°C
Sample gas flow rate:	• typical: 0.5 l/h (= 500 mA probe current)
Resolution:	• 0.1 vol.% O_2
Measurement accuracy:	• Better than 0.2 vol.% O_2 across the entire range (0 to 25 vol.% O_2) after previous adjustment
Detection limit	• 0.1 vol.% O_2
Cross-sensitivity:	None vis-à-vis H_2O, CO_2, SO_2, or HCl
Signal interference from combustible gases:	• At concentrations: ≤ 1000 ppm CO≤ -0.05 vol.% O_2 ≤ 1000 ppm NO ≤ -0.05 vol.% O_2 ≤ 1000 ppm CH_4 ≤ -0.2 vol.% O_2
Interference of all gases:	• ≤ +0.2 vol.% O_2
Probe current:	• 0 to 1000 mA, typical value for air: 300 to 600 mA, depending on flow rate
Maximum permissible duration of flue gas temperature:	• Standard gas extraction device 700°C (1300°F) • Inconell gas extraction device 950°C (1750°F) • Ceramic gas extraction device 1,400°C (2550°F) • On request 1,600°C (2900°F)
Time-related drift of zero and reference point:	• < 0.2 vol.% O_2 per maintenance interval
Response time (90% time):	• < 20 s (with standard gas extraction device, 1m long)
Time for ready status:	• < / = 2 hours

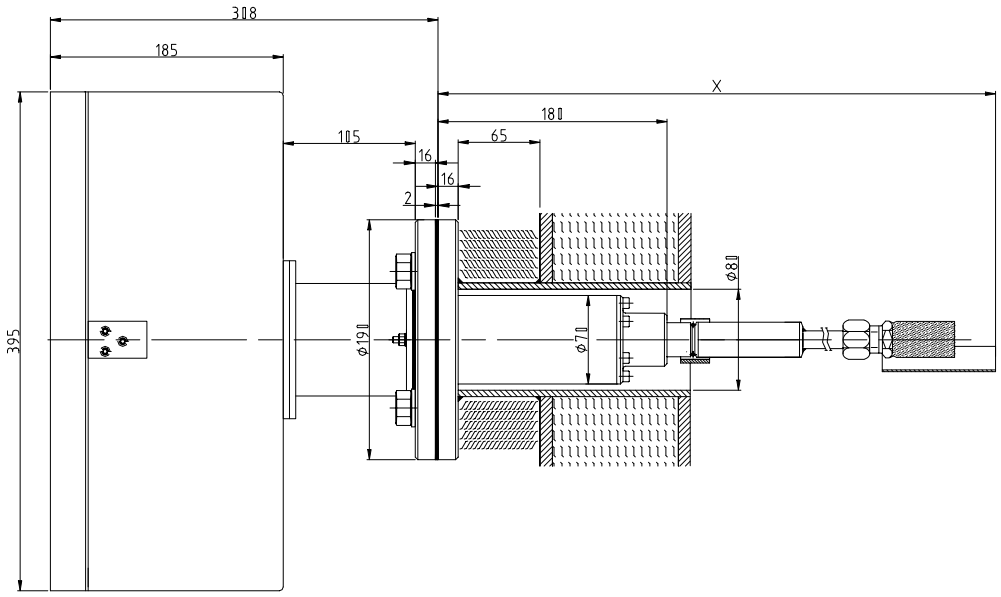
Analog outputs:	• Analog output	0/4 to 20 mA, 0 to 10 V, (floating) max. diff. in potential ± 20 V
	Resolution:	0.01 mA
	Accuracy:	0.01 mA
	Load:	800 Ω
	Factory setting:	4 to 20mA → 0 to 21 vol. % O_2
	• Monitor output	
	- Output:	0 to 2.55 V DC, load >10 kW, <100 nF
	- Accuracy:	2% from meas. value, not better than 0.1vol.% O_2
	- Resolution:	10 mV
	- Factory setting:	0 to 2.55 V DC → 0 to 25.5 vol. % O_2
	- Monitor function:	Can be switched by means of DIP switch to:
	Probe voltage U_S	0 to 255 mV DC (= 0 to 2.55 V)
	Int. probe (cell) resist. R_I	0-255 Ω, equal to 0 to 2.55 V
Analog inputs	• 0...20mA, 0...10V via LSB module possible	
Digital outputs	• via LSB module possible	
Digital inputs	• via LSB module possible	
Controls:	• Display/control unit, multi-function key, maintenance switch and 2 rows of 6 LEDs	
	• Display/control unit (optional)	
	• Remote control unit (optional)	
	• Remote display software (optional)	
Interfaces:	• LSB BUS for connection with other LAMBDA TRANSMITTERs and other devices (alternative: RS422)	
	• Additional 2nd RS422 (optional)	
	• Field bus interfaces (optional): - Profibus DP - Modbus - Ethernet - CANopen - Interbus S	
	• RS 232 for connecting a PC with remote display software	
Conformity with following European guidelines:	89 / 336 / EEC – electromagnetic compatibility 73 / 23 / EEC – electrical equipment designed for use within certain voltage limits	
TUEV qualification test:	TÜV qualification test for emissions measuring devices to Federal German Pollution Control Act (13th and 17th Implementing Ordinance). TÜV type proof no. 936 / 21203535 / A	

11.2 Connection Diagram



*= to be set via parameter 3895

11.3 Dimensions



X Insertion depth, dimension X (see table)

Fig. 11-1:
Dimensions

Insertion depth Dim. X in	Gas extraction kit		
	Standard up to 700°C (1300°F)	Up to 950°C (1750°F)	Ceramic 950°C - 1400°C (1750---1550°F)
300 mm	657R3015	On request	On request
500 mm	657R3010	657R3020	657R3030
800 mm	657R3041	657R3021	657R3031
1000 mm	657R3042	657R3022	657R3032
1400 mm	657R3043A	657R3023A	657R3033A
1800 mm	657R3044A	657R3024A	657R3034A

CAUTION!

With order of replacement GED's always immersion depth starting from flange; never the length of the GED.

11.4 Base Electronic

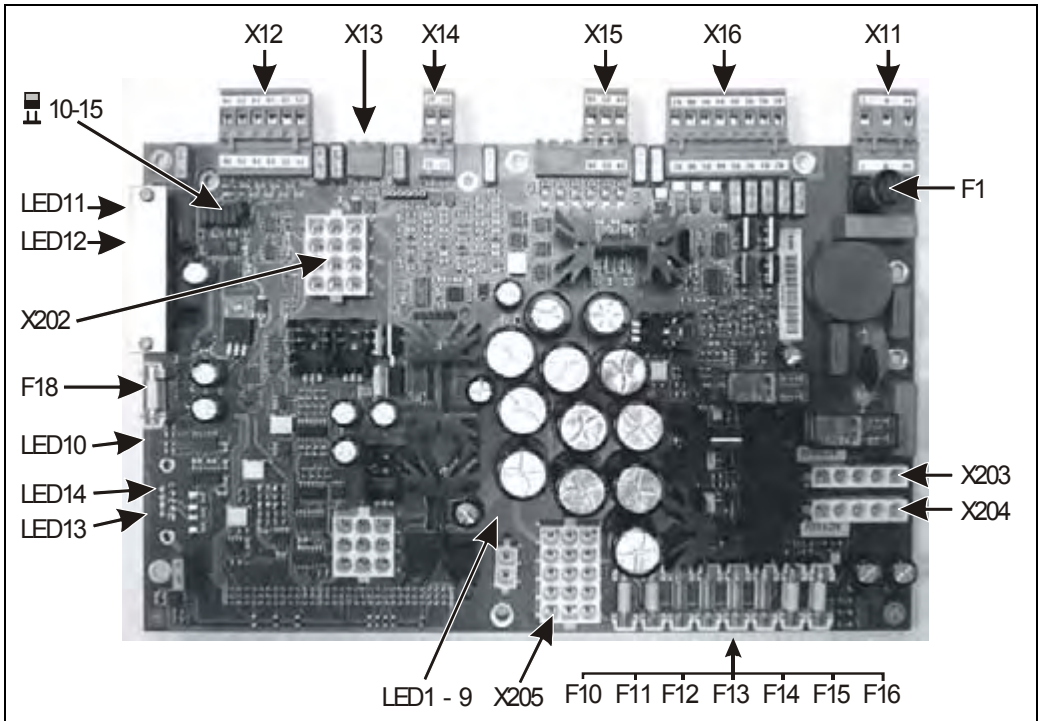
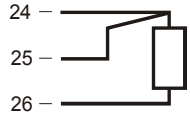


Fig. 11-2:
Base electronic

Fuses and LEDs

Fuse	Value	Monitoring	Function
F1	T2.5A T5A	- -	Primary line fuse at 230 V AC Primary line fuse at 115 V AC
F10	T4A	LED1 green	Operating voltage +12 V DC heater extract.
F11	T2A	LED2 green	Operating voltage +12 V DC solenoid valve
F12	T0.8A	LED3 green	Operating voltage +12 V DC proportional valves
F13	T1.6A	LED4 green	Operating voltage +6 V DC probe
F14	T0.8A	LED5 green	Operating voltage +24 V DC analog section
F15	T1.6A	LED6 green LED7 green	Operating voltage +5 V DC digital section Operating voltage -5 V DC digital section
F16	T4A	LED8 green	Operating voltage 36 V AC probe heater
F17	T4A	LED9 green	Operating voltage 29 V AC emergency probe heater
F18	T375mA	LED10 green	Operating voltage +5 V DC interface LSB/RS422
-		LED11 green	RxD LSB interface
-		LED12 yellow	TxD LSB interface
-		LED13 yellow	TxD0 RS232 interface (9-pin Sub D)
-		LED14 yellow	RxD0 RS232 interface (9-pin Sub D)

Connectors and plugs

Designation	Function	Assignment
X11	Power connection 115/230 V, 50/60 Hz	1 – L 2 – N 3 – PE
X12	LSB BUS interface Can be set with BR10 – BR15 (base electronic) and BR12 – BR13 (processor board)	71 – GND 72 – CAN high 73 – CAN low 74 – CAN high 75 – CAN low
X13	Analog output 0/4-20 mA 0/2-10 V	42- 43+
X14	Monitor output 0-2.55 V, for connecting a multi-meter for servicing purposes	31- 32+
X15	PT100 connection, measurement sensor for capillary temperature 0-820 °C	
X16	Probe connection and extraction device heater	82 – Extraction device heater 83 – Extraction device heater 92 – Probe heater 93 – Probe heater 94 – Measured current + 95 – Measured voltage + 96 – Measured voltage - 97 – Measured current -
X202	Connection of solenoid and proportional valves	1 – MV1 + (calibration) 2 – MV1 - (calibration) 3 – PV1 + (calibration) 4 – MV2 + (air fan) 5 – MV2 - (air fan) 6 – PV1 - (calibration) 7 – Measuring gas pump + 8 – Measuring gas pump -
X203	Transformer connection (primary side) for 230 V AC; F1 – T2.5A	
X204	Transformer connection (primary side) for 115 V AC; F1 – T5A	
X205	Transformer connection (secondary side)	
DS1	Absolute pressure sensor	
DS2	Differential pressure sensor	

11.4.1 Switching over the line voltage from AC230V to AC115V (if required)

1.) Changing main fuse F1
New value 5A slow-blow

2.) Switch over trafo connector from X203 to X204

11.5 Plug-In Jumpers

11.5.1 LSB BUS / RS422

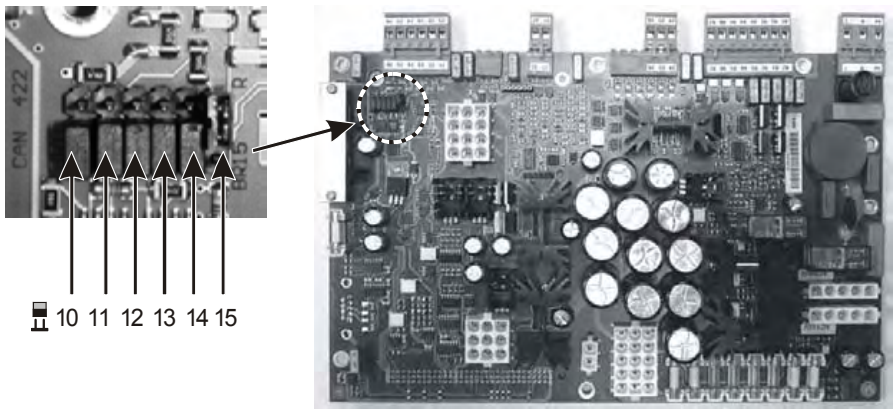


Fig. 11-3:
Plug-in jumpers for LAMBDA TRANSMITTER P base electronic

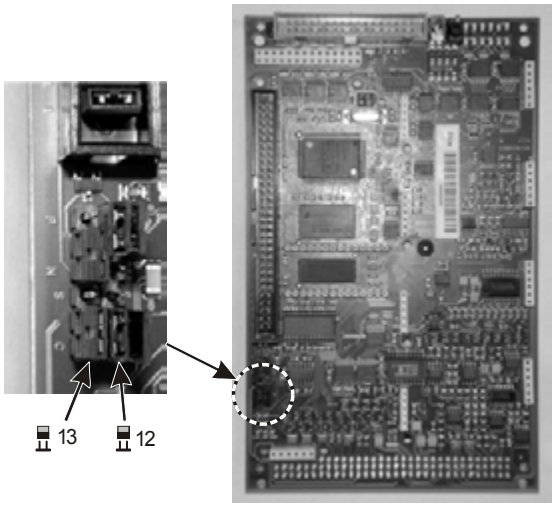


Fig. 11-4:
Plug-in jumpers for LAMBDA TRANSMITTER P processor card

Function	Board	Plug-in jumper	Position
Activate LSB BUS interface	Base electronic Processor card	10 to 14 12 and 13	CAN* C *
Activate RS422 interface	Base electronic Processor card	10 to 14 12 and 13	RS422 S
Testing RS422 interface	Connect terminals 73 with 74 and terminals 72 with 75. Switch ON LAMBDA TRANSMITTER P. LED's 11 and 12 for RS422 communication begin to pulse in the common mode (10ms impuls)		
IMPORTANT! This RS422 interface can only be used if it is connected directly to the motherboard at the X12 connector. If you use devices that are connected at the LSB/CAN bus, you cannot use the RS422 interface in this way and must use the optional second RS422 interface (see 10.13) instead.			
Terminating resistor not activated	Base electronic	15	CAN *
Terminating resistor activated	Base electronic	15	R

* = factory setting

11.6 Analog Output Card

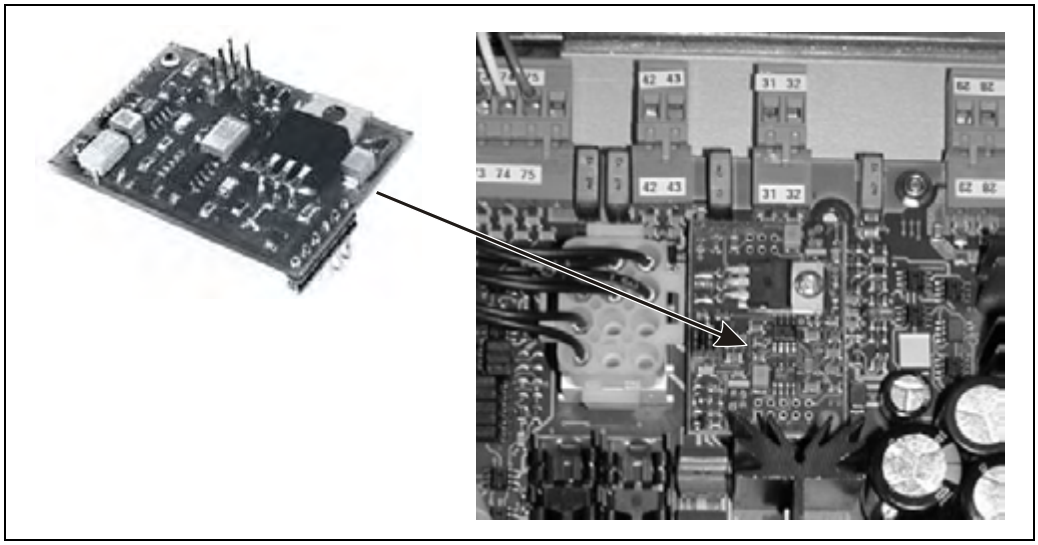


Fig. 11-5:
Analog output card on Base electronic

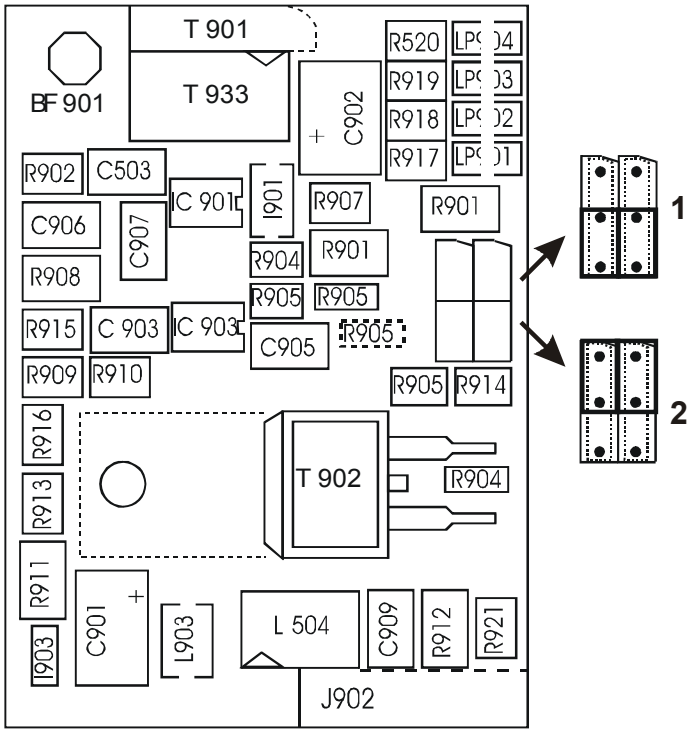


Fig. 11-6:
Plug-in jumpers on analog output card

1 Voltage output : 0/2 to 10 V 2 Current output: 0/4 to 20 mA

Type	657 R 0051 (floating)
Parameter group	530 ... 539
Factory setting	4 ... 20 mA => 0-21% O_2
Output terminals	42- / 43+
Voltage/current output setting:	Plug-in jumpers
Output range setting	
0 or 2 to 10 V or 0 or 4 to 20mA:	Parameter 531

For exchanging the card see chapter 8.12

Parameter 530

Here, enter the measured value that is to be output at the analog output 1. The following settings are possible for each output:

- Off
- Measured O_2 value
- Configurable measured value 1 - 6
- Probe temperature
- Probe absolute pressure
- Probe current
- Probe voltage
- Internal O_2 value

Parameter 531

Here, set the measurement range for each analog output 1. The following settings are possible:

- 0-20 mA / 0-10 V (for voltage output)
- 4-20 mA
- 4-20 mA / error 0 mA
- 4-20 mA / error + maintenance 0 mA

Parameter 532

Here, set the start of the measurement range for each analog output.

- E.g. “0” for 0% O_2

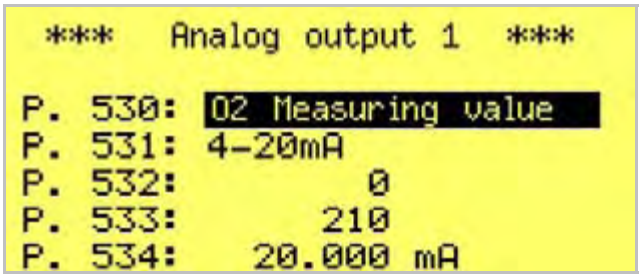
Parameter 533

Here, set the end of the measurement range for each analog output.

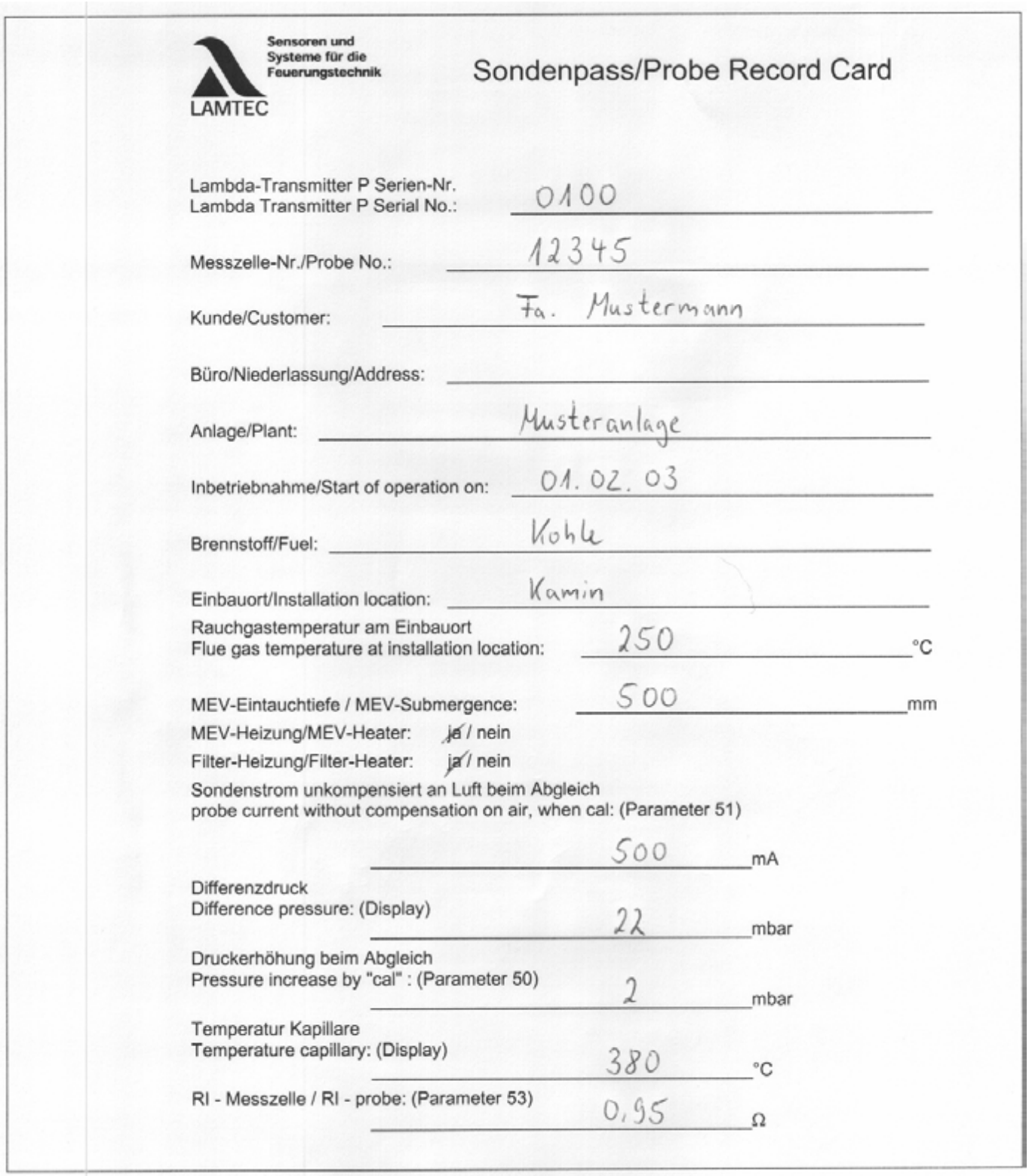
- E.g. “210” for 21% O_2

Parameter 534

- Output value for each analog output in “mA”



11.7 Probe Record Pass (Front)



Sensoren und Systeme für die Feuerungstechnik
LAMTEC

Sondenpass/Probe Record Card

Lambda-Transmitter P Serien-Nr.
Lambda Transmitter P Serial No.: 0100

Messzelle-Nr./Probe No.: 12345

Kunde/Customer: Fa. Mustermann

Büro/Niederlassung/Address:

Anlage/Plant: Musteranlage

Inbetriebnahme/Start of operation on: 01.02.03

Brennstoff/Fuel: Kohle

Einbauort/Installation location: Kamin

Rauchgastemperatur am Einbauort
Flue gas temperature at installation location: 250 °C

MEV-Eintauchtiefe / MEV-Submergence: 500 mm

MEV-Heizung/MEV-Heater: ~~ja~~ / nein

Filter-Heizung/Filter-Heater: ~~ja~~ / nein

Sondenstrom unkompensiert an Luft beim Abgleich
probe current without compensation on air, when cal: (Parameter 51)

500 mA

Differenzdruck
Difference pressure: (Display)

22 mbar

Druckerhöhung beim Abgleich
Pressure increase by "cal" : (Parameter 50)

2 mbar

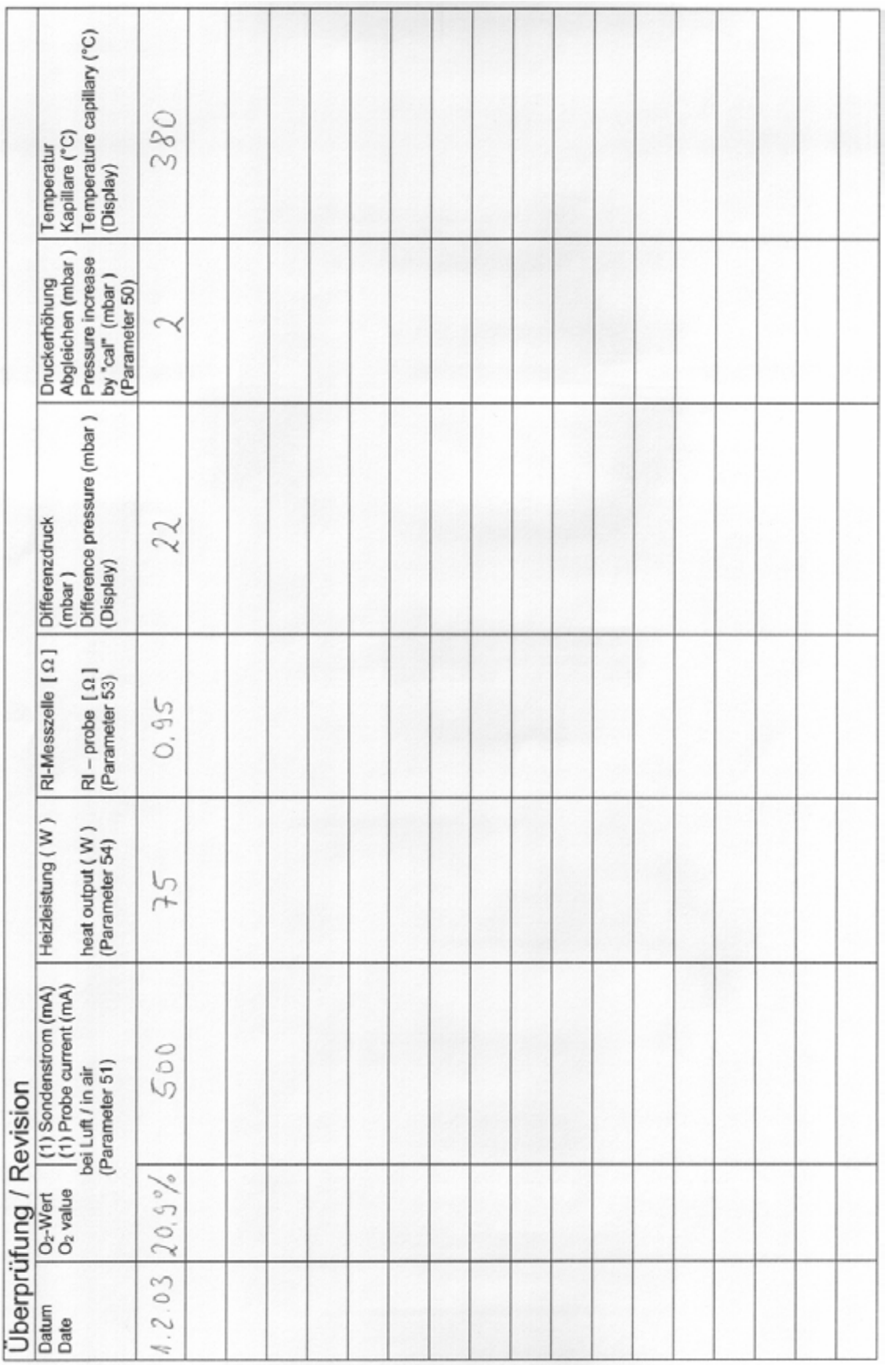
Temperatur Kapillare
Temperature capillary: (Display)

380 °C

RI - Messzelle / RI - probe: (Parameter 53)

0,95 Ω

11.7.1 Probe Record Pass (back side)



Überprüfung / Revision

Datum Date	O_2-Wert O_2 value	(1) Sondenstrom (mA) (1) Probe current (mA) bei Luft / in air (Parameter 51)	Heizleistung (W) heat output (W) (Parameter 54)	RI-Messzelle [Ω] RI – probe [Ω] (Parameter 53)	Differenzdruck (mbar) Difference pressure (mbar) (Display)	Druckerhöhung Abgleichen (mbar) Pressure increase by "cal" (mbar) (Parameter 50)	Temperatur Kapillare (°C) Temperature capillary (°C) (Display)
1.2.03	20.9%	500	75	0.95	22	2	380

ZIRKOR302 P

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