Manual

LT3 Lambda Transmitter
LS2 Lambda Probe

Sensors and Systems for Combustion Engineering

LAMTEC
www.lamtec.de

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1 Important Information about the Manual

1.1 Validity of these Instructions

This manual describe the Lambda Transmitter LT3 with all required components. The information in this document applies to the software version V1.09.0.0. If you utilise a different version, this can lead to other effects to your device than those described in this manual.

NOTICE

LT3 Lambda Transmitter cannot be used for LAMTEC CO/O_2 Control.

1.2 Information on Using this Operating Manual

NOTICE

Before starting work, you absolutely must read these instructions!
Carefully observe all warning notes!

They contain important data and information, the compliance with which will ensure the function of the device and, in turn, reliable measurement results.

The device described here corresponds with the standard configuration.

Particular attention must be paid to **information** and **warnings**. These are indicated by respective pictograms. They serve to safeguard your personal safety and help you to avoid operating errors.

This operating manual contains the information required for the product to be used in a manner that is compliant with its intended use. It is intended for technically qualified personnel who are appropriately trained and who possess the relevant knowledge in the area of measurement, control and steering technology.

This operating manual is an inherent part of the delivery. For reasons of clarity, it is not possible to cover all possible designs of the described system. Please contact us if you wish to set up, operate, or maintain the device differently from the instructions given here.

2 General Safety Instructions

2.1 Classification of the Safety Instructions and Warnings

The following symbols are used in this document to draw the user's attention to important safety information. They are located at points where the information is required. It is essential that the safety information is observed and followed, and that applies particularly to the warnings.

⚠ DANGER!

This draws the user's attention to imminent danger. If it is not avoided, it will result in death or very serious injury. The plant including its surroundings could be damaged.

⚠ WARNING!

This draws the user's attention to the possibility of imminent danger. If it is not avoided, it may result in death or very serious injury. The plant including its surroundings could be damaged.

⚠ CAUTION!

This draws the user's attention to the possibility of imminent danger. If it is not avoided, it may result in minor injuries. The plant including its surroundings could be damaged.

NOTICE

This draws the user's attention to important additional information about the system or system components and offers further tips.

The safety information described above is incorporated into the instructions.

Thus, the operator is requested to:

1 Comply with the accident prevention regulations whenever work is being carried out.

2 Do everything possible within his control to prevent personal injury and damage to property.

2 General Safety Instructions

2.2 Proper Use - Conditions of Use

Operation

The LT3 Lambda Transmitter is an all-purpose O_2 measuring device based on microprocessor for direct measurement of the O_2 concentration under super-stoichiometric range (λ > 1) used together with Lambda Probe LS2

Operation

The Lambda Transmitter is an electronic data interpreting device which is used in conjunction with the Lambda Probe LS2for the continuous measurement of the O_2 concentration in non-combustible gases in the superstoichiometric area.

Prerequisites

It is assumed that plant planning, mounting, installation, commissioning, maintenance, and service work will be carried out by sufficiently trained personnel and that this work will be checked by responsible skilled personnel. It must be particularly noted that

- the operation complies with the technical data and specifications regarding permissible use, mounting, connection, and environment and operating conditions (refer to the contract documents, the device user information, rating plates, etc.).
- work will be carried out in accordance with the local, plant-specific circumstances and with regard to the operational risks and directives.
- all the measures required to preserve the value, e.g. for transportation and storage as well as maintenance and service, are maintained.

Intended use

The product described here has left the factory in a flawless, safe and checked condition and it must be maintained exclusively in the manner that is described by the manufacturer. Equally, the proper transportation, correct storage and setup as well as the careful operation and maintenance, are critical for the flawless and safe operation of the device. Sufficiently qualified personnel must be used to install and operate this product. They must be familiar with the security advice and warnings specified here and ensure they can be implemented flawlessly. Unqualified persons working on the device or the warning information provided here or on the device not being observed could result in serious personal injury and / or damage to property. The device is being used as intended if the device is being used solely for the application specified in the technical description. Auxiliary devices or those from other manufacturers must be recommended or authorised by LAMTEC. Provided the safety information and operating directives specified in this manual are observed, this device should not present any risks in terms of damage to property or the health of personnel.

2.3 Permissible Users

Qualified personnel

The person responsible for safety absolutely must guarantee that

- only qualified personnel perform work on the system parts.
  Due to their training, education, experience, or instruction and due to their knowledge of pertinent standards, provisions, accident prevention regulations, and system conditions, qualified personnel are authorized to perform these tasks by the person responsible for the safety of people and the system. It is decisive that this personnel must be able to recognise and prevent risks on time.

  Experts are considered to be people according to DIN VDE 0105 or IEC 364 or directly comparable standards like DIN 0832.
- These persons must have access to the provided operating manual and any pertinent order-related documentation during all work and observe these documents within the scope of preventing risks and damage.

User groups

For the handling of the Lambda Transmitter LT3, three user groups are required:

- Service technicians of LAMTEC or its OEM customers and/or trained customer personnel:
  - Qualified technicians/engineers → have very good knowledge of the device.
  - SERVICE access level - password-protected
- Operators, customer fitters, technicians for instrumentation and control technology, electricians, and electronic engineers → have introductory knowledge of the device.
  - CUSTOMER access level - password-protected
- Operating personnel with basic knowledge
  - OPERATION access level - no password

2.4 Safety Equipment/Safety Measures

Hazards from electrical equipment

The LT3 Lambda Transmitter and the Lambda Probe LS2 is equipment for use in industrial electrical power installations. Always switch off the power when working on mains connections or mains voltage. If shrouding (for electrical safety) has been removed, reattach it before switching on the power supply again. Damage to health or equipment may result from improper use or improper handling.

NOTICE

To avoid damage, always observe the respective security notices.

Preventive measures for improving operating safety

If the LT3 is used in conjunction with control and monitoring technology, the operator must ensure that any breakdown or failure of the LT3 device does not cause inadmissible damage or dangerous operating states. To avoid faults which could cause direct or indirect personal or material damage, the operator must ensure that:

- the responsible maintenance personnel can be reached at any time and as quickly as possible
- the maintenance personnel are trained to correctly respond to faults with the LT3 Lambda Transmitter and the associated malfunctions
- in the case of doubt, the faulty equipment can be switched off immediately
- A switch-off does not lead to direct follow-up problems.

Avoiding consequential damages

To avoid consequential damages in the event of failure, which could cause direct or indirect personal or material damage, the owner must ensure that qualified personnel can assess the faults and initiate appropriate measures to tackle them.

Protect against gas leakage from the gas-bearing channel

The Lambda Probe LS2 is fitted directly to the gas-bearing channel via the probe installation fitting (PIF). If the Lambda Probe LS2 or the installation fitting (PIF) are removed there is a chance that hot and/or noxious gases, which could be hazardous to health, could egress through the open orifice in the flue - this is particularly like where the gases in the flue are at positive pressure. A risk assessment should be carried out and precautions taken to eliminate any hazardous situation occurring. For prevention, suitable protective measures must be taken in advance.

⚠ WARNING!

Discharge of hot, corrosive gases !

In the event of high pressure and temperatures higher than 200 °C (392 °F) in the gas duct, gas escapes when the LS2 Lambda Probe or the probe installation fitting (PIF) is removed.

▶ Switch OFF the application before opening.

▶ Wear protective clothing and a protective mask.

▶ Affix appropriate warnings near by.

▶ Close aperture immediately after finishing work.

2 General Safety Instructions

⚠ WARNING!

Danger of electric shock!

The device contains live parts that may cause an electric shock if touched.

▶ Before opening the housing, disconnect the mains plug!

Decommissioning/recommissioning

The Lambda Transmitter LT3 Lambda Probe LS2 are a high-quality, electronic measuring system. It therefore requires careful handling in all situations - decommissioning, transport, and storage.

NOTICE

Do not switch off the Lambda Transmitter LT3 as long as the LS2 Lambda Probe is mounted. Not even if the associated plant has been brought to a standstill. Residual gases will cause corrosion and could damage the probe.

▶ Do not store the device outside without any protection!

▶ Always store in a dry location and, if possible, keep in the original packaging.

▶ When uninstalling, protect the ends of cables and the connectors from corrosion and soiling. Corroded connectors can cause malfunctions.

▶ If possible, always transport in the original packaging.

3 Product Description

3.1 Applications

Operation

The LT3 Lambda Transmitter is an all-purpose O_2 measuring device based on microprocessor for direct measurement of the O_2 concentration under super-stoichiometric range (λ > 1) used together with Lambda Probe LS2

3.2 Product Matrix

The LT3 Lambda Transmitter with the LS2 Lambda Probe is suitable for gas measurements with a low percentage of combustible components (< 10,000 ppm), e.g., in the flue gases of combustion systems.
Permissible fuels:

- Residue-free, gaseous hydrocarbons
- Domestic fuel
- Lignite/coal
- Biomass (wood)

Direct measurements in ’combustible gases’ are not possible.

Design	Application	Probe Installation Fitting (PIF)	Gas Extraction Device (GED)
LT3 in wall mounting housing type 657R51... in combination with: Lambda Probe LS2 in standard housing, 2 m (6.5 ft) connecting cable, type 650R1000 probe installation fitting gas extraction device	Flue gas temperature < 300 °C (572°F)	Male coupling G1¼“ type 655R1010 optional counterpart: halve sleeve G1¼“ for welding type 655R1012	GED 150 mm (5.91" in) type 655R1001 GED 300 mm (11.81" in) type 655R1002 GED 450 mm (17.72" in) type 655R1003 GED 1,000 mm (39.37" in) type 655R1004
LT3 in wall mounting housing type 657R51... in combination with: Lambda Probe LS2-HT (high temperature) 2 m (6.5 ft) connecting cable, type 650R1515 counter flange flange seal flue gas bypass tube	Flue gas temperature < 1.200 °C (2192 °F) in combination with a flue gas bypass tube	Counter flange, inner tube diameter 80 mm (3.15" in), tube length 70 mm (2.76" in), material: Steel, black through cathodic dipping, pitch circle corresponds with DN65 PN6, type 655R0179 Counter flange, inner tube diameter 80 mm (3.15" in), tube length 70 mm (2.76" in), material: Stainless steel 1.4571, pitch circle corresponds with DN65 PN6, type 655R0180	See chapter *4.2.4 Flue Gas Bypass Tube for LS2-HT*

3 Product Description

Design	Application	Probe Installation Fitting (PIF)	Gas Extraction Device (GED)
LT3 in wall mounting housing type 657R51... in combination with: Lambda Probe LS2 without housing, 2 m (6.5 ft) connection cable, type 650R1004	Flue gas temperature < 450 °C (842 °F) flue gas channel diameter max. 200 mm (7.87" in)	Without PIF mounting thread M18 x1,5 screw-in adapter M18x1,5 i for ¾" (optional) type 655R1013	

3.3 Design and Accessory LS2 Lambda Probe

The Lambda Probe LS2 provide the in situ (direct in the flue gas) measurement of O_2 concentration in exhaust gases in the super-stoichiometric range (λ>1).

Fig. 3-1 Lambda Probe LS2 standard design

1 Lambda Probe LS2 in standard housing up to 300 °C (572 °F)
Default cable length is 2 m (6.5 ft), FEP, with connecting plug
2 Probe installation fitting (PIF)
3 Gas Extraction Device (GED)

Fig. 3-2 Lambda ProbeLS2-HT for manual purging (for application in high dusty environments)

1 Lambda Probe LS2-HT up to 300 °C (572 °F)
Temperature at probe heat max.100 °C (212 °F)
Default cable length is 2 m (6.5 ft), FEP, with connecting plug
2 High dust reception flange with pneumatic connections

4 Technical Data

4.1 Technical Data Lambda Transmitter LT3

LT3 at wall mounting housing with User Interface UI-LT	
Housing	Mounting house of sheet steel, powder-coated
Protection class acc.to DIN 40050	IP54 with display in the front door
Dimensions (HxWxD)	300x300x120 mm / 11.81"x11.81"x4.72" in
Useful life	10 years
Colour	Light grey RAL 7035
Weight	approx. 6 kg/13.23 lb
Control elements	User Interface UI-LT with LCD-Graphic Display 45x27 mm (BxH) / 1.77"x1.06" in (WxH) LSB-Remote-Software (Option)
Power supply	120 VAC / -30 % ... 230 VAC / +10 %, 50 ... 60 Hz **Use only in earthed networks!**
Power consumption	30 W typical, 69 W maximum
Resolution	O_2: 0.1 Vol. % O_2
Time for standby	In case of initial startup of the LS2 60 minutes, otherwise about 10 minutes after power ON
Analogue outputs	**Optional**
Analogue outputs by additional module Precision: 1% Load: 300 Ω/output	Analogue output 1 (measured O_2 values) - Setting range: 0 … 25 % O_2 - Factory setting: 0 … 10 Vol. % $O_2 \rightarrow$ 4 … 20 mA, fault 0 mA
Digital outputs	**Optional**
Digital outputs by additional module	- 4 floating contacts no, functions can be adjusted by User Interface - Switching voltage 250 V maximum - Switching current 6 A, 12 A/module maximum
Digital inputs	**Optional**
Digital inputs by additional module	- 4 digital inputs 24 VDC, floating - Functions can be adjusted by LSB Remote Software
HART communication	**Optional**
HART communication by additional module	- 1 Analogue outputs 0/4 ... 20 mA for indication of O_2 - HART communication (read/write) by analogue output 1
Efficiency calculation	**Optional**
Calculation of the combustion efficiency via additional module	- 2 Pt100 inputs for connecting of the flue gas and inlet air temperature 0 °C ... 400 °C/32 °F ... 752 °F - 2 Analogue outputs 0/4 ... 20 mA for the output of the flue gas air temperature and efficiency

4 Technical Data

Field bus connection	Optional
Field bus connection to PROFIBUS DP via additional module	- Reading of values, statuses, faults, and warnings - Reset of faults and warnings - Setting of digital outputs
Interfaces	
Interfaces	LAMTEC SYSTEM BUS (LSB)

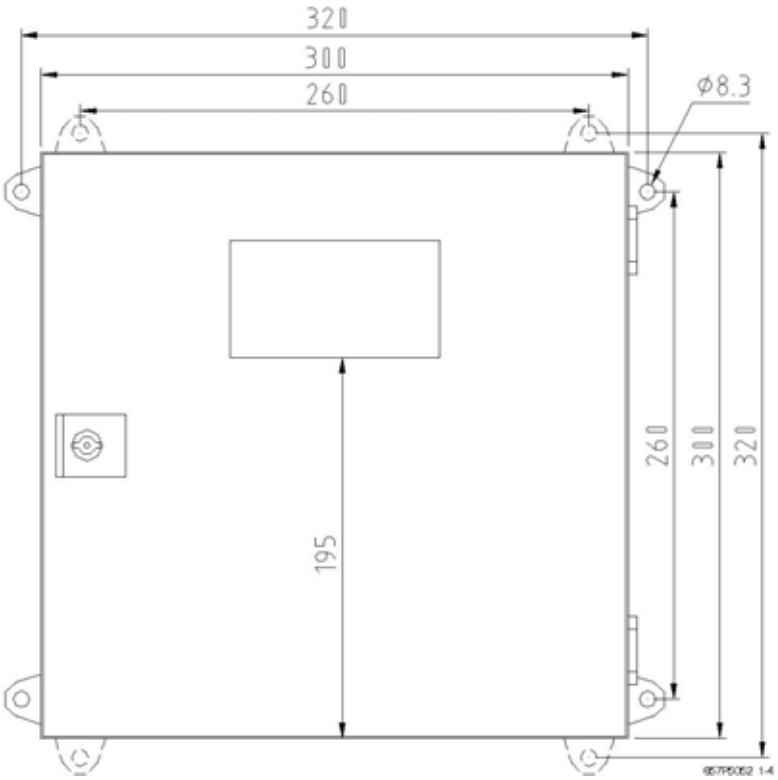


Fig. 4-1 Dimensional drawing of housing with wall brackets vertical/horizontal

4 Technical Data

4.2 Technical Data LS2 Lambda Probe

4.2.1 Technical Data Lambda Probe LS2 without Housing

Fig. 4-2 LS2 Lambda Probe without housing

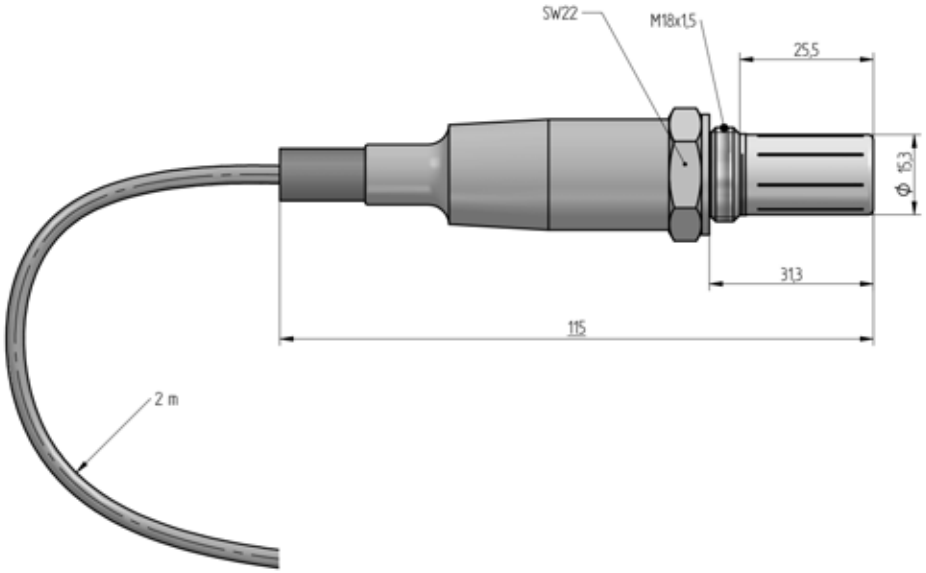
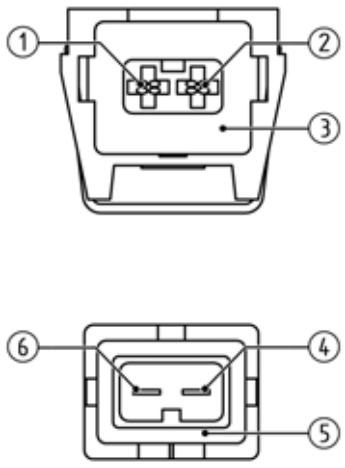


Fig. 4-3 Dimensions LS2 Lambda Probe without housing

1	LS2 Lambda Probe without housing	650R1004
2	Sealing washer	
3	Probe head	



1 = (+) Probe signal (black)
LT3 terminal 11/PCB terminal 34)

2 = (-) Probe signal (grey)
LT3 terminal10/PCB terminal 33

3 = Socket for sensor signal

4 = Probe heating (white)
LT3 terminal 13/PCB terminal 35)

5 = Plug for probe heating

6 = Probe heating (white)
LT3 terminal 14/PCB terminal 36)

Fig. 4-4 Terminal assignment for probe connection plug

4 Technical Data

Characteristics *	
Measurement range	**O_2:** 0 ... 21 % O_2
Measuring precision	**O_2:** ± 5 % of measured value - not better than ± 0,3 Vol. %
Sensor signal	**O_2:** -15 ... +150 mV (0,01 ... 21 Vol. % O_2)
Response time	**O_2:** t_{60}: < 3 s t_{90}: < 9 s
Relaxation time (measurement readiness after overload)	**O_2:** t_{90}: < 8 s
Offset in ambient air	**O_2** < 0,3 Vol. %
Hysteresis	**O_2** < 1 % from measured value
Linearity	**O_2** < 1 % from measured value
Repeat accuracy	**O_2** < 0,1 % deviation from measured value
Ambient pressure dependency	**O_2** < 0,1 % from measured value (of normal pressure at sea level in comparison with pressure at altitude 200 m/656,17 ft i.e. op = -200 mbar/-2,9 psi)
Differential pressure dependency	**O_2** < -1,8 mV U_{O2} pro 100 mbar (1.45 psi) overpressure in the measuring chamber in comparison with environment
Drift	**O_2** < 1,7 % from measured value (after 1000 h of operation in EL light fuel oil and 1004 switching cycles on/off)
Cross sensitivity **	**O_2:** to CO_2 (15 Vol. %) < 0,1 Vol. % **O_2:** to CO (874 ppm) < 0,1 Vol. % **O_2:** to CH_4 (76 ppm) < 0,1 Vol. % **O_2:** to SO_2 (76 ppm) < 0,1 Vol. % **O_2:** to NO (245 ppm) < 0,1 Vol. %
Influence of humidity	**O_2:** < 2,3% from measured value
Influence of the measuring gas	Change of -1,6 mV/100 mbar
Internal resistance of probe	15 … 30 Ω (ZrO_2-measuring cell in the air in case of 22 W heating output)
Probe voltage in air	0 ... -15 mV (ZrO_2-measuring cell in the air in new condition in case of 17 W heating output)
Heating consumption	16 ... 22 W (according to design, measuring gas temperature, and measuring speed)
Power supply voltage heating	Polarity is changed cyclically if P_H 18 VA → 11,4 V if P_H 20 VA → 12,34 V if P_H 25 VA → 14,8 V
Heating power for T = 350 °C (662 °F)	approx. 17 W
heating current for P_H 20 VA	approx. 1,6 A approx. 5 A short-term during heating PTC characteristic
Insulation resistance	> 30 MΩ (between heating and probe connections)
Useful life	> 3 years (for fuel oil and natural gas)
Weight	600 g (1.32 lb) with housing 290 g (0.64 lb) without housing
Material probe housing	1.4571/1.4301

4 Technical Data

Characteristics *	
Material connecting pipework	cooper strand nickel-plated Insulation FEP
Measurement principle	zirconium dioxide cell (ZrO_2) potentiometric (voltage probe)
Heating time	10 min up to operation temperature

* Information accordance to EN 16340:2014 D

** O_2:Information assumes an operating gas composition of 5 Vol. % O_2, rest is N_2

Conditions for use	
Mounting position	Horizontal to vertical
Mounting / measuring gas extraction device	Directly in exhaust gas channel / in situ
Seal tightness	$q_L \leq 100\ cm^3/h$ *
Permissible fuels	Residue-free, gaseous hydrocarbons, light fuel oil, lignite and coal, biomass (according to design)

Environmental Conditions	
Permissible flue gas temperature on probe head	< 450 °C (842 °F)
Permissible operating temperature	< 150 °C (302 °F) on connecting cable
Permissible storage temperature	-20 ... +70 °C (-4 °F ... +158 °F)
Permissible measuring gas speed	< 6 m/s (measured at measuring gas temperature 25 °C (77 °F). In case of smaller measuring gas temperatures it might be necessary to protect the probe from the incident flow)
degree of protection	IP42 (according to DIN 40050)

* In accordance with DIN V 18160-1:2006-01 seal tightness towards environment through housing and fastening.

NOTICE

The limits of the technical data must be strictly adhered to.

4.2.2 Technical Data Lambda Probe LS2 Standard Type 650R1000

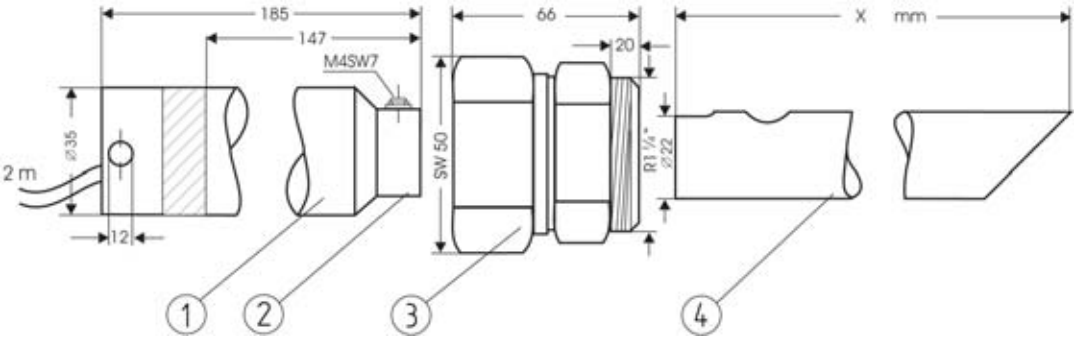


Fig. 4-5 Lambda Probe LS2 in housing with gas extraction device (GED) and probe installation fitting (PIF)

1	LS2 Probe in housing	650R1000 / 650R1007
2	Probe heat	
3	Probe installation fitting 1 ¼"	655R1010
4	Gas extraction device length X = 150 mm/5.91" in	655R1001
	Gas extraction device length X = 300 mm/11.81" in	655R1002
	Gas extraction device length X = 450 mm/17.72" in	655R1003
	Gas extraction device length X = 1,000 mm/39.37" in	655R1004

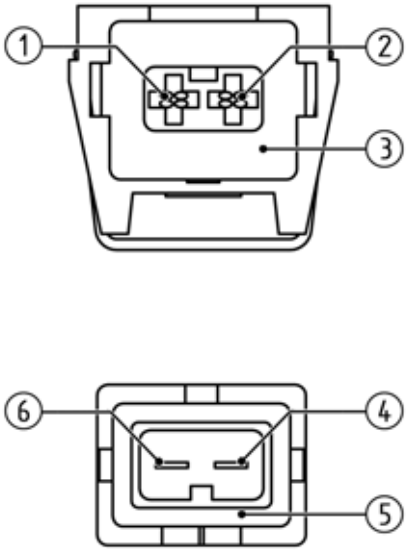


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Fig. 4-6 Terminal assignment for probe connection plug

4 Technical Data

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Drift	**O_2** < 1,7 % from measured value (after 1000 h of operation in EL light fuel oil and 1004 switching cycles on/off)
Cross sensitivity **	**O_2:** to CO_2 (15 Vol. %) < 0,1 Vol. % **O_2:** to CO (874 ppm) < 0,1 Vol. % **O_2:** to CH_4 (76 ppm) < 0,1 Vol. % **O_2:** to SO_2 (76 ppm) < 0,1 Vol. % **O_2:** to NO (245 ppm) < 0,1 Vol. %
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Conditions for use	
Mounting position	Horizontal to vertical
Mounting / measuring gas extraction device	Directly in exhaust gas channel / in situ
Seal tightness	$q_L \leq 100\ cm^3/h$ *
Permissible fuels	Residue-free, gaseous hydrocarbons, light fuel oil, lignite and coal, biomass (according to design)

Environmental Conditions	
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Permissible measuring gas speed	< 6 m/s (measured at measuring gas temperature 25 °C (77 °F). In case of smaller measuring gas temperatures it might be necessary to protect the probe from the incident flow)
degree of protection	IP42 (according to DIN 40050)

* In accordance with DIN V 18160-1:2006-01 seal tightness towards environment through housing and fastening.

NOTICE

The limits of the technical data must be strictly adhered to.

4.2.3 Technical Data LS2-HT Lambda Probe

Fig. 4-7 Lambda Probe LS2-HT with flue gas bypass tube

4 Technical Data

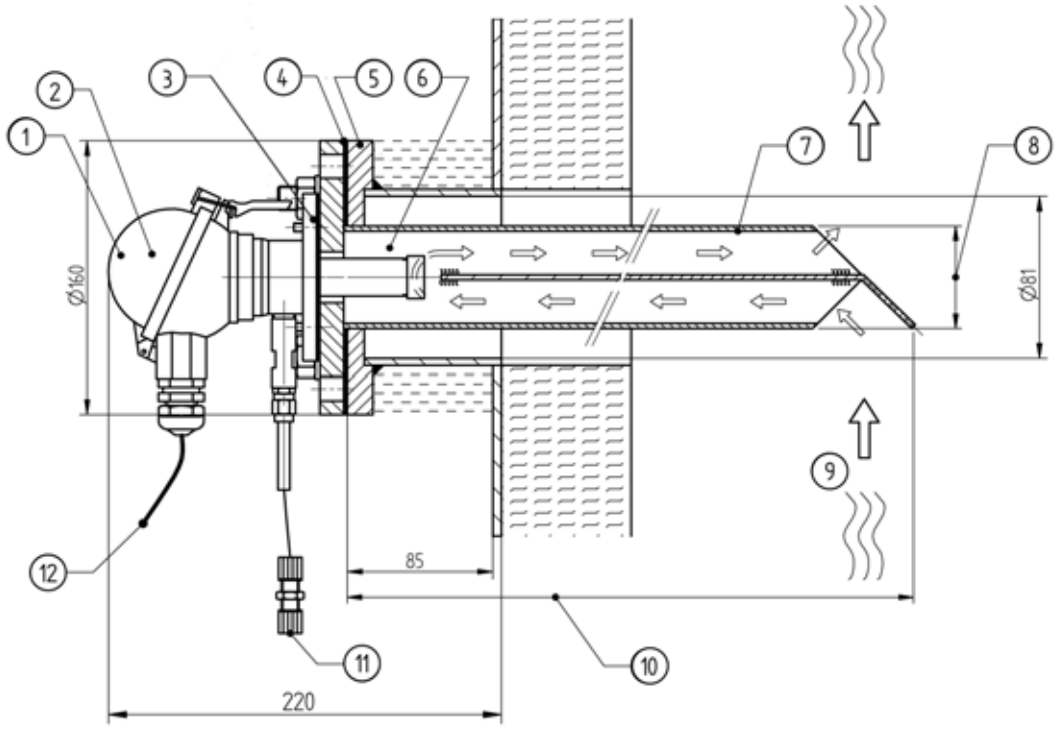


Fig. 4-8 Dimensional drawing Lambda Probe LS2-HT with flue gas bypass tube

1 Lambda Probe LS2-HT type 650R1515

2 Connection head max. 100 °C/212 °F

3 Flange seal Novaphit type 656P0263

4 Flange seal graphite type 655P4211

5 Counter flange with tube socket KTL coated type 655R0179 or
Counter flange with tube socket stainless steel 1.4571 type

6 Flue gas temperature at the probe head max. 450 °C/842 °F

7 Flue gas bypass tube

8 Diameter/diagonal maximum. 70 mm/2.76 "in

9 Gas velocity:
1 ... 16 m/s
(from 16 m/s: increasing measurement inaccuracy)
(from 30 m/s: maximum length 1.000 mm/39.370" in)

10 Length: 500 ... 2.000 mm/19.68 ... 78.74" in)

11 Hose connection 4/6 mm (0.16" in/0.24" in) for calibration gas

12 Connecting cable with plug, length 2 m/6.6 ft.

4 Technical Data

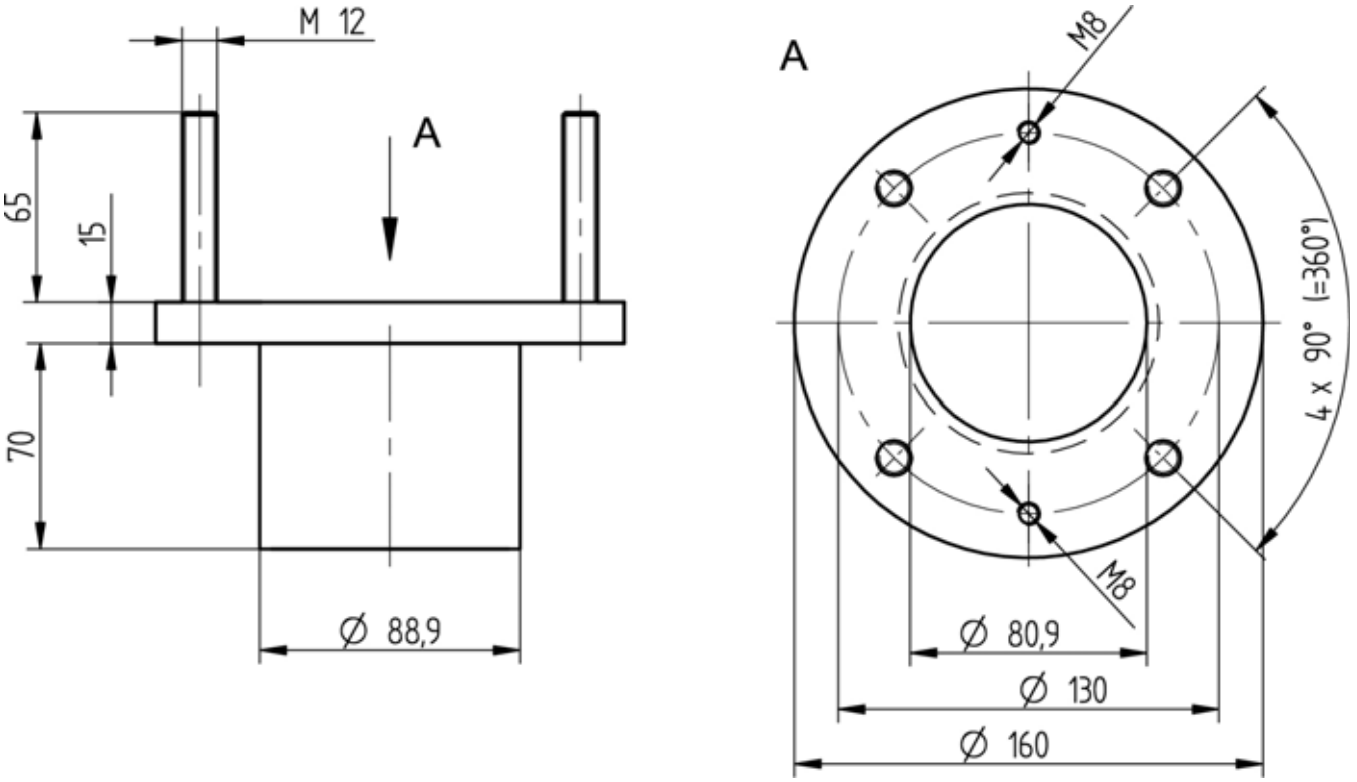


Fig. 4-9 Dimensions of counter flange with tube socket

Technical data*	
Measuring range	0 ... 21 Vol. % O_2
Measuring precision	±5 % of measured value – not better than ± 0.3 Vol. %
Sensor signal	- 30 ... + 150 mV
Response time	t_{60}: < 3 s t_{90}: < 9 s
Response time LS2-HT with flue gas bypass tube **	$t_{60AUR} = \Delta t_{AUR} + t_{60}$ (see *Fig. 4-10 Flue gas bypass tube delay time as function of the velocity in the exhaust air channel depending on the varying lengths of the flue gas bypass tube*)
Relaxation time (measurement readiness after overload)	t_{90}: < 8 s
Offset to environment	< 0,3 Vol. %
Hysteresis	< 1 % from measured value
Linearity	< 1 % from measured value
Repeating precision	< 0.1 % deviation from measured value
Ambient pressure dependency	< 0.1 % from measured value (of normal pressure at sea level in comparison with pressure at altitude of 2000 m, i.e., Δp -200 mbar)
Differential pressure dependency	< -1.8 mV U_{O2} per 100 mbar overpressure in the measuring chamber in comparison with environment
Drift	< 1.7 % from measured value (after 1000 h of operation in EL light fuel oil and 1004 switching cycles on/off)

4 Technical Data

Technical data*	
Cross sensitivity***	to CO_2 (15 Vol. %) < 0,1 Vol. % to CO (874 ppm) < 0,1 Vol. % to CH_4 (76 ppm) < 0,1 Vol. % to SO_2 (76 ppm) < 0,1 Vol. % to NO (245 ppm) < 0,1 Vol. %
Humidity	< 2.3 % from measured value
Influence of the installation position	None if LS2 is installed according to the information in the operating instructions.
Influence of the mains voltage	None if LS2 is installed according to the information in the operating instructions.
Influence of leakage	None if LS2 is installed according to the information in the operating instructions.
Internal resistance of probe	15 … 25 Ω (ZrO_2 measuring cell in the air in case of 22 W heating output)
Heating consumption	10 ... 25 W, (at T_{Gas} 350 °C/662 °F approx. 18 W) (according to design, measuring gas temperature and measuring speed)
Supply voltage for heating	AC/DC At P_H 18 VA → 11,4 V At P_H 20 VA → 12,34 V At P_H 25 VA → 14,8 V
Heating current P_H 20 VA	approx. 1.6 A approx. 5 A short term during heating PTC characteristic
Insulation resistance	< 30 MΩ (between heating and probe connection)
Lifetime	> 3 years (in case of light fuel oil and natural gas)
Weight Probe LS2-HT	 1300 g/2.867 lb
Material of probe housing Material connecting housing	1.4571 Aluminium
Material of connecting line	Nickel-plated copper strand FEP insulation
Operating temperature of the measuring cell (sensor) at 13 V heating voltage in the air (20 °C/68 °F)	650 °C/1202 °F
Measuring principle	Zirconium dioxide cell (ZrO_2) potentiometric (voltage probe)
Heating time	10 min until operating temperature is reached

* Information according to EN 16340:2014 D

** Test report LTC-14-IB-09-V1.0 upon request

*** O_2: Information assumes an operating gas composition of 5 vol. % O_2, rest is N_2

4 Technical Data

Conditions for use	
Mounting / measuring gas extraction device	Directly in exhaust gas channel/ in situ
Seal tightness	$q_L \leq 100\ cm^3/h$*
Mounting position	up to 85° against vertical
Permissible fuels	Residue-free, gaseous hydrocarbons, light fuel oil, heavy fuel oil (HFO), lignite and coal, biomass (according to design)
Permissible exhaust gas temperature on probe head	< 450 °C/842 °F
Permissible measuring gas speed	< 16 m/s/52.493 ft/s (higher measurement speed increases the measurement error). Current safety measures can be deployed. **Attention:** With flue gas bypass tube length > 1 m/3.3 ft, a high current speed (> 30m/s/98.425 ft/s) can lead to flutter and vibration of flue gas bypass tube. **Attention:** An ejector acceleration must be used for measuring speeds < 1 m/s.

Environmental Conditions			
Operation	Permissible temperature range	on cable lead	< 100 °C/212 °F
		on connecting cable	< 100 °C/212 °F
Transport	Permissible temperature range		-40 ... +90 °C/-40 ... 194 °F
Storage	Permissible temperature range		-20 ... +70 °C/-4 °F ... 158 °F
Degree of protection	According to DIN EN 60529		IP65 (in mounting condition)

* According to DIN V 18160-1:2006-01 Seal tightness towards environment through housing and fastening

NOTICE

The limits of the technical data must be strictly adhered to.

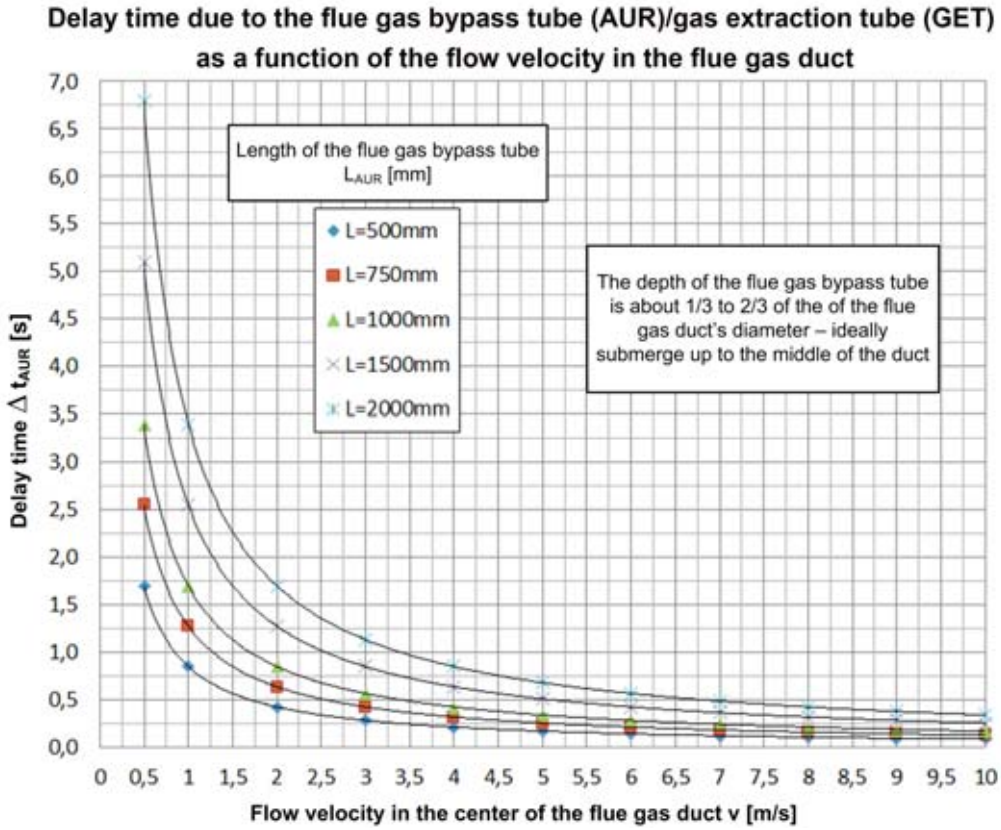
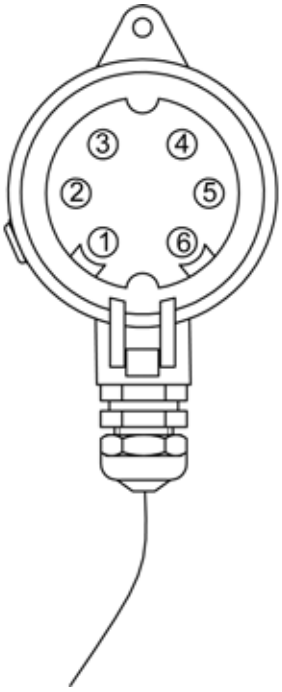


Fig. 4-10 Flue gas bypass tube delay time as function of the velocity in the exhaust air channel depending on the varying lengths of the flue gas bypass tube

The figure shows the delay time $\Delta \mathbf{t}_{EGDT}$ [s] resulting from the length of the flue gas bypass tube $\mathbf{L}_{EGDT}$ [mm] as a function of a flow velocity in the middle of the flue air channel v [m/s].

4.2.3.1 Terminal Assignment Terminal Socket for Probe HT



1	(+) Probe signal (black)
2	without configuration
3	Probe heating (white)
4	Probe heating (white)
5	not equipped
6	(-) Signal (grey)

Fig. 4-11 Terminal socket LS2-HT from 6/ 2015

4.2.4 Flue Gas Bypass Tube for LS2-HT

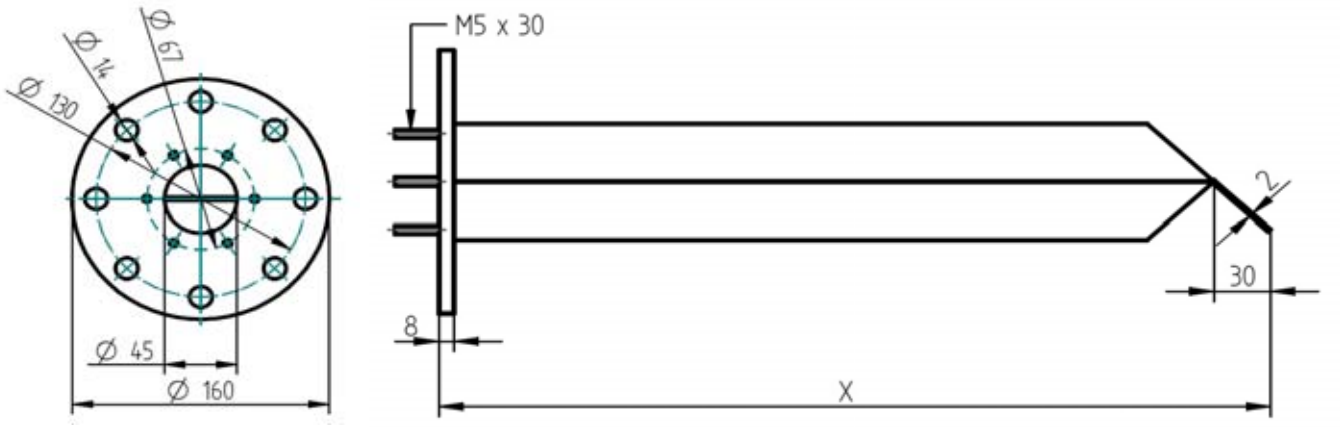


Fig. 4-12 Dimension drawing type 656R1014 … 656R1023

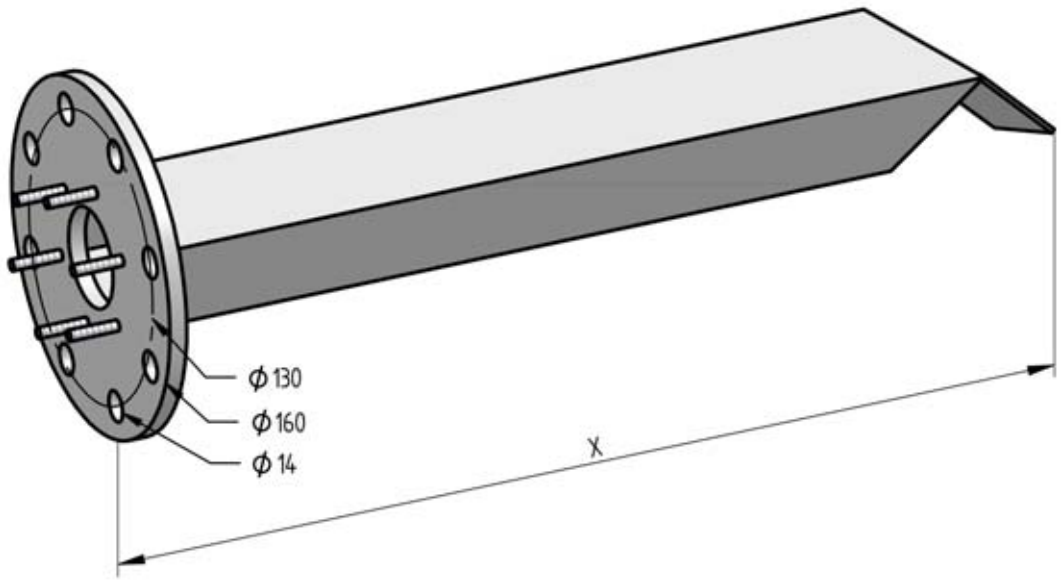


Fig. 4-13 Type 656R1014 ... 656R1023

Length X	Installation depth 500 mm (19.69 " in), 1,000 mm (39.37" in) or 1,500 mm (59.05" in)
Pipe cross-section:	Approx. 72 mm (2.83" in)

4.2.5 Technical Data High Dust Mounting Flange

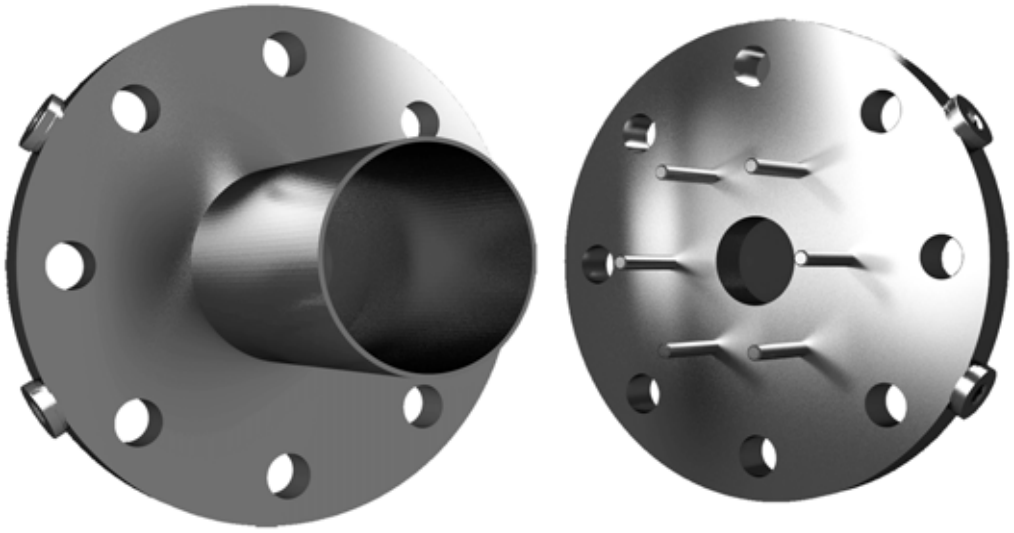


Fig. 4-14 High dust mounting flange SO656R1010 (use only in combination with HT probe in flange housing, for manual purge with compressed air)

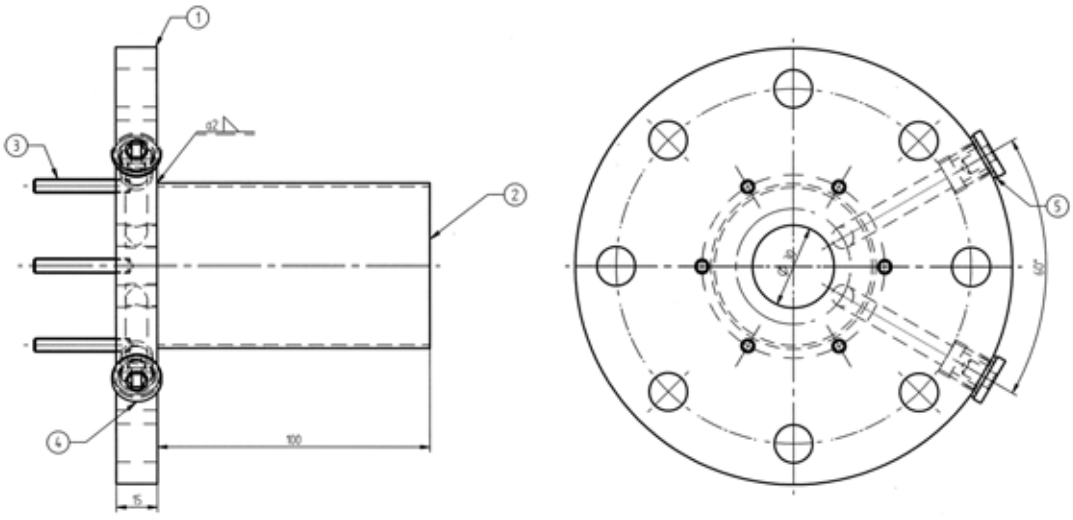


Fig. 4-15 dimensional drawing high dust mounting flange SO656R1010

No.	Description
1	Support flange DN65PN6 with purge function, material 1.4571
2	Tube 60.3x2.6 mm [2.37x0.102 in], welded, material 1.4571
3	Set screw DIN913 M5x35 A4
4	Compressed air connection optional G 1/4 " i, mounting provided by customer, closed at delivery
5	Seal

4 Technical Data

Technical Data	
Hole circle	DN65PN6
Material	1.4571
Pneumatic connection	G 1/4"in
Pre pressure	6 bar [87.02 psi]
Outside diameter flange	160 mm [6.30 in]
Outside diameter tube	60.3 mm [2.37in]
Tube length	100 mm [3.93 in]
Total length incl. bolt	128 mm [5.04 in]
Weight	2.25 kg [4.96 lb]

4.3 LSB Terminal Resistance

NOTICE

The termination resistor (120 Ω) **must** be installed and activated on the first and the last BUS device (see Chapter *4.3 LSB Terminal Resistance*).

Avoid stub line!

4.3.1 Without LSB Modules (Inputs/Outputs)

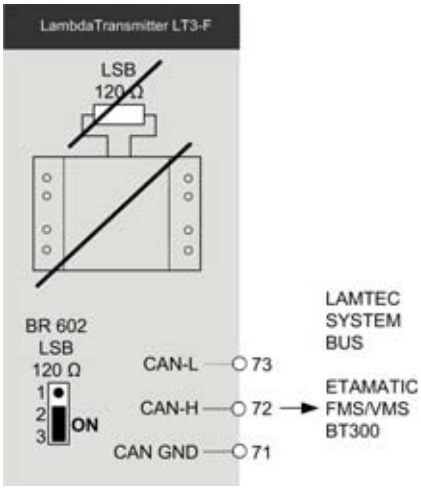


Fig. 4-16 LSB termination resistor without inputs/outputs (LSB modules)

Without installed LSB modules the termination resistor for LSB must be activated on the main-board. Jumper BR602 must be set to position 2-3.

4.3.2 With LSB Modules (Inputs/Outputs)

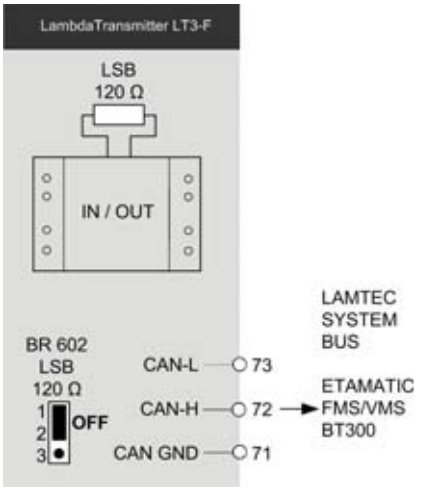


Fig. 4-17 LSB termination resistor with inputs/outputs (LSB modules)

With input/output modules, the termination resistor for LSB must be activated on the last LSB module. The jumper BR602 must be set to position1-2.

4.4 EU Declaration of Conformity

Sensoren und Systeme für die Feuerungstechnik

LAMTEC

EU-Konformitätserklärung

EU Declaration of Conformity
Déclaration de Conformité UE

Wir We / Nous	**LAMTEC Meß- und Regeltechnik für Feuerungen GmbH & Co. KG** **Wiesenstraße 6** **D-69190 Walldorf (Baden)**
erklären, dass das Produkt declare that product / déclarons que produit	**LT3 – Lambda Transmitter**
inklusive inclusive / y compris	**Varianten** variants / variants
	LT3 im Wandaufbaugehäuse LT3 in wall mounting housing / LT3 coffret mural — 657R51
	ohne Anzeige (IP66) Without display / sans affichage — 657R51-00...
	mit erweiterter Bedieneinheit (IP65) With extended display and operation unit / Avec Unité d'affichage et de opération étendue — 657R51-10...
	mit User Interface UI300 (IP54) With User Interface UI300 / avec User Interface UI300 — 657R51-20...
	Sonden probes / sondes
	LS2 — 650R100X
	LS2-HT — 650R1515
	mit Optionen with options / avec options
	Sondenanschlusskasten Probe connection box / Bôtier de raccordement de sondes — 655R1025
	Feldbusmodul PBM100 für PROFIBUS DP Field bus Module PBM100 for PROFIBUS DP / Module bus de terrain PBM100 PROFIBUS DP — 657R5950

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E-Mail: info@lamtec.de

Sensoren und Systeme für die Feuerungstechnik

LAMTEC

auf welche sich diese Erklärung bezieht, mit den folgenden Norm(en) übereinstimmt
to which this declaration relates conforms to the following standard(s)
sur laquelle cette déclaration se réfère, et conformément aux dispositions de la norme(s)

DIN EN 16340: 2014-10
DIN EN 60730-1: 2012-10

gemäß den Bestimmungen der folgenden Richtlinie(n).
according to the provisions of the following directive(s) / conformément aux dispositions de la directive(s)

Nummer (Number / Numéro)	Text (Text / Texte)
2014/35/EU 2014/35/EU/ 2014/35/UE	Niederspannungsrichtlinie Low Voltage Directive Directive basse tension
2014/30/EU 2014/30/EU 2014/30/UE	EMV-Richtlinie EMC Directive Directive CEM
2011/65/EU 2011/65/EU 2011/65/UE	RoHS RoHS RoHS

Das Datenblatt und gegebenenfalls die Basisdokumentation sind zu beachten.
The data sheet and basic documentation, if any, have to be considered.
La consultation de la fiche technique, et éventuellement de la documentation technique de base, est requise.

Hinweise zur Anwendung der Richtlinie 2014/30/EU:
Die Konformität mit 2014/30/EU gilt für die Verwendung in industrieller Umgebung.

Remarks regarding the application of directive 2014/30/EU:
Conformity with 2014/30/EU only in industrial environment.

Remarques sur l'application des directives 2014/30/UE:
La conformité avec la 2014/30/UE est valable dans un environnement industrielle

Anbringung der CE-Kennzeichnung: **Ja**
Placing of the CE marking / L'apposition du marquage CE

Walldorf, 27.07.2017
H.J. Altendorf, Geschäftsführung

Rechtsverbindliche Unterschrift
Authorized signature / Signature autorisée

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5 Design and Functions

5.1 Theoretical Background

Fundamentally, the Lambda Probe consists of a zirconium dioxide-ceramic electrochemical cell. The cell operates as an electrochemical concentration chain, and generates direct voltage that depends on the absolute temperature T and the logarithm of the O_2 concentration or the O_2 partial pressure ratio at the inner and outer electrodes.
If the outer electrode is supplied with test gas and the inner electrode is supplied with reference gas with a known O_2 concentration e.g. air (20.96 %), then assuming the temperature is held constant, we obtain the logarithmic relationship between probe voltage U_{O2} and the oxygen concentration of the test gas as shown below.
The characteristic curves for two different temperatures T_1 and T_2 show clearly that when using the voltage probe, the temperature affects the measured value in the cell's active part. In addition, the curves show that the probe is preferentially suitable for measuring low oxygen concentrations, since sensitivity and accuracy increase with decreasing O_2 concentration because of the logarithmic relationship.
Each Lambda Probe is factory-tested under real-life conditions, in a gas-combustion system with an exhaust temperature of approx. 150 °C (302 °F). The test protocol is enclosed with each probe. The sensor temperature recorded in the protocol should be input into the Lambda Transmitter during commissioning. Calibration with test gases is not required. During operation it is possible to check and compensate for the measured values through counter measurement.

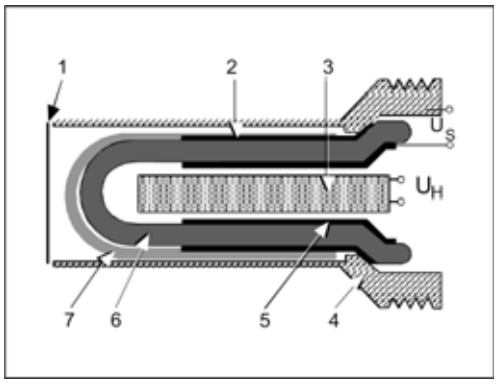


Fig. 5-1 Schematic construction of the ZrO_2 oxygen probe

1 Gas intake
2 Working electrode
3 Probe heating
4 Housing

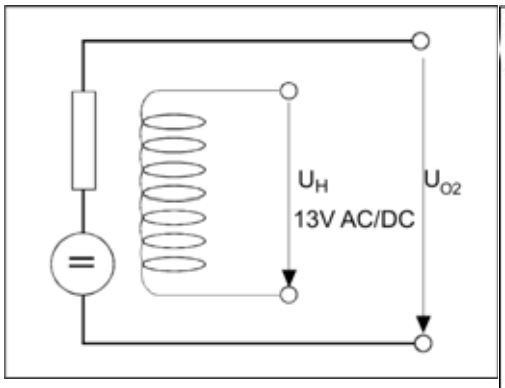


Fig. 5-2 The voltage probes equivalent electric circuit diagram

5 Reference electrode (Pt)
6 Zirconium oxide ceramic
7 Protective layer

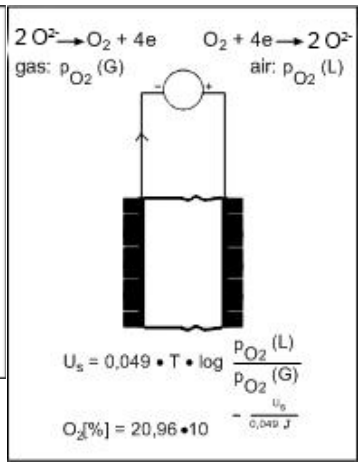


Fig. 5-3 The voltage probes working principle

The curve shown below demonstrates that oxygen measurements require knowledge of the proportionality factor and the probes temperature. In practice this means adjusting the probe during commissioning with is possible simply through air voltage compensation (offset compensation) and entering the cell temperature which was obtained during final testing in accordance with the test protocol enclosed with the probe (usually approx. 1000 K). Individual deviations are compensated during commissioning by adjusting the air voltage (offset compensation) and entering the sensor temperature which was obtained during the final testing and recorded in the test protocol.
The probe can only be used in a gas temperature up to 1200 °C (2192 °F). Probe ageing in long-term operation leads to stretching of the characteristic curve. However, this can be recognised from the fact that the internal resistance increases. The internal resistance is measured and displayed permanently by the Lambda Transmitter and controlled to limit values.

NOTICE

For simple handling and maintenance-free operation the LT3 LS2 O_2 measurement is designed for calibration in ambient air.
The accuracy of the calibration without test gas is about ± 10 % of the measuring value, not better than ± 0.3 Vol.% (see chapter *8.1.3 Checking/Calibrating with Test Gas*).

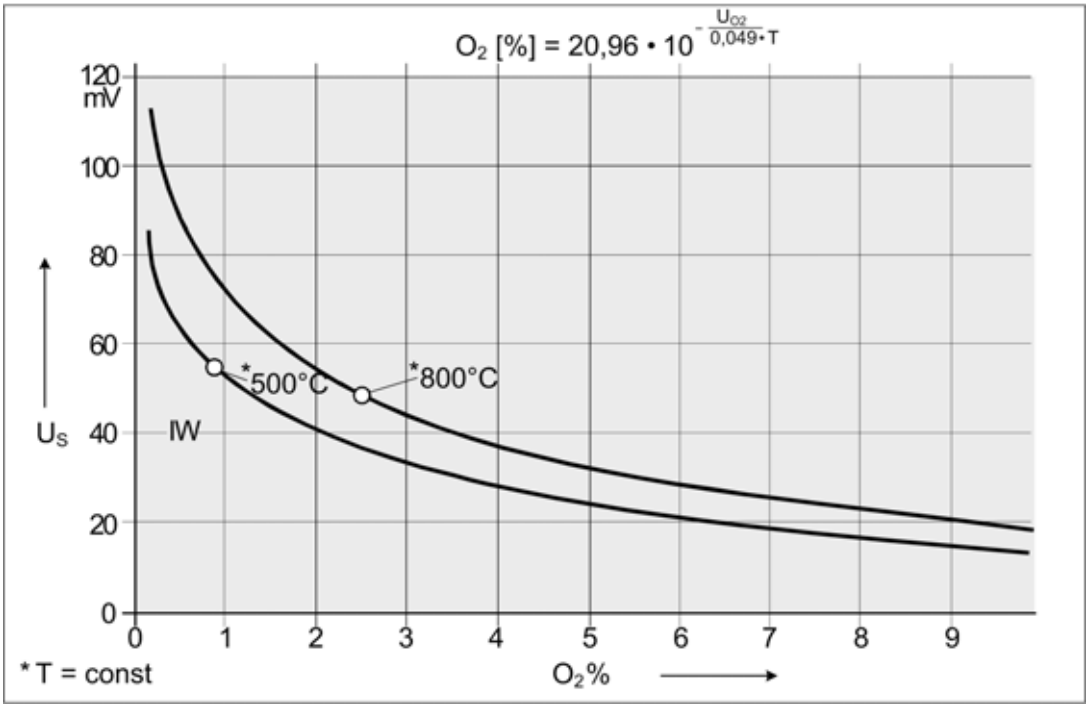


Fig. 5-4 Measurement and calibration diagram of the oxygen probe - the effect of temperature on the probes characteristic curve.

NOTICE

For higher specified measurement accuracy it's possible to calibrate with reference measurement or test gas.
The specified accuracy with reference measurement or test-gas lies at ± 5 % of measurement value, not better than ± 0.3 Vol.%.

5.2 Technical Description of the Lambda Transmitter LT3

The LT3 is a microprocessor-based measuring transducer with diagnosis function. LT3 regulates the temperature of the LS2 Lambda Probe depending on the internal resistance of the sensor. It permanently monitors the LS2 Lambda Probe for sensor states or missing connections. Malfunctions are detected by the electronics and lead to a fault or warning message.

5.3 LT3 Structure

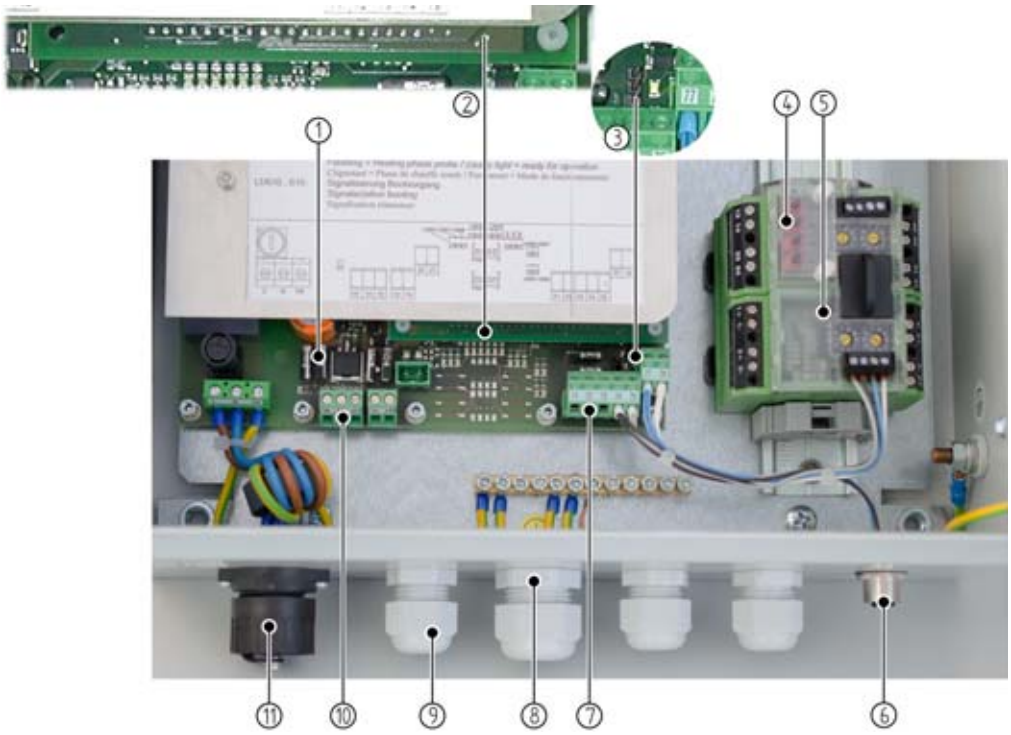


Fig. 5-5 LT3 inner view

1 Basic board

2 Processor board

3 Jumper BR602 for LAMTEC SYSTEM BUS – Terminating resistance (see chapter *4.3 LSB Terminal Resistance*)

4 LSB module with 4 analogue outputs

5 LSB module with 4 digital outputs (option)

6 LSB connection on 5-pole round male plug for LSB Remote Software

7 LSB connection on terminals

8 M20 screwed cable gland for probe heating

9 M16 screwed cable gland for probe signals

10 Terminal for probe connection
terminal assignment (see chapter *7.2.5.4 Assignment of Internal Terminals*)

11 Mains connection (see chapter *7.2.5.3 Power Supply*)

NOTICE

The internal wiring is voltage-resistant up to 110 V.

5.4 Connection Extension

For distances longer than 2 m extension cables in the length 2 m (type 655R1006) and 5 m (type 655R1007) and 10 m (type 655R1008) available.

Distances of more than 10 m require a probe connection box PCB (type 655R1025).

NOTICE

The maximum distance between LT3 and Lambda probe LS2 may not exceed 25 m. With longer distances the approval of the system for continuous operation expires.

For distances longer than 25 m the risk of EMC increases.

LAMTEC assumes no responsibility for correct, error-free functions.

See chapter *7.2.5.2 Probe Connection via PCB*.

5.5 Probe Connection Box (PCB)

For use at large distances (> 2 m/6.562 ft) between probe and analyser, where no customised cable is employed.

Input: Probe plug

Output: Terminal strip

The PCB contains a terminal strip and conversion to the probe and heating plugs.

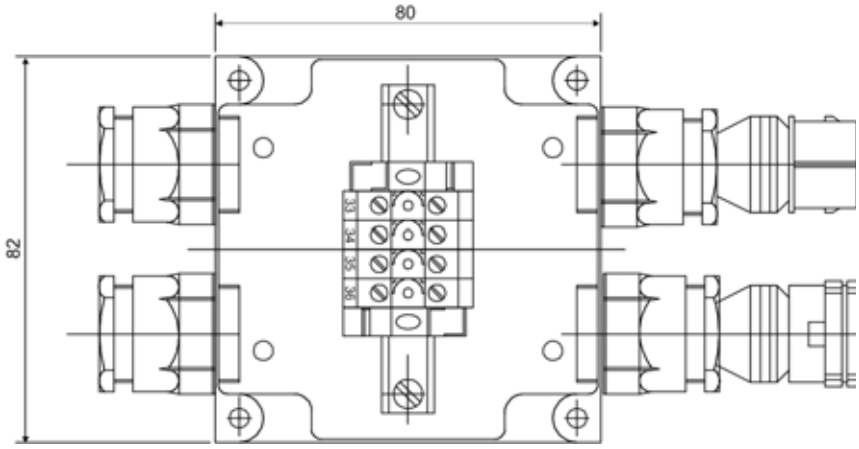


Fig. 5-6 PCB-Dimension diagram high: 55 mm (2.166" in) protection class: IP66

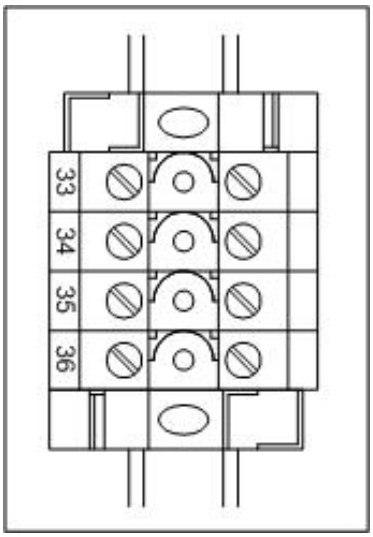


Fig. 5-7 PCB-Connection diagram

33 Probe signal -

34 Probe signal +

35 Probe heater

36 Probe heater

6 Display and Operational Controls

To display and operate LT3, the user interface is integrated into the front door of LT3 (included in the standard).

Functions:

- Reading of the O_2 measured values
- Password entry
- Information → regarding the probe, fuel, warnings, faults, software version, CRC, and serial number
- Calibration of measurement
- Settings → maintenance, filter time, analogue output, probe replacement, display, limit values, and digital outputs

Fig. 6-1 LT3 user interface

Fig. 6-2 Housing with user interface

6 Display and Operational Controls

6.1 Operation

Using the arrow keys you can navigate within the menus.

The keys and mov their selection to the right or the left hand.

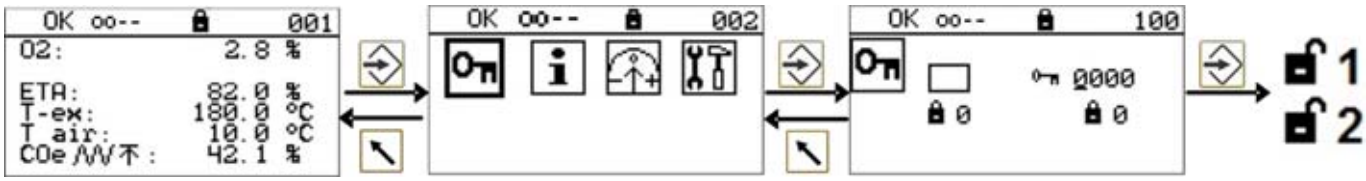
ENTER ENTER takes you to menu entries or to the edit mode in the case of selected parameters or values.

With the keys and the currently selected value can be changed accordingly Hold down the respective key and the value will count automatically up or down.

BACK BACK leaves the window, menu, or edit mode.

6.2 Menu Structure

6.2.1 Password Entry Menu Structure

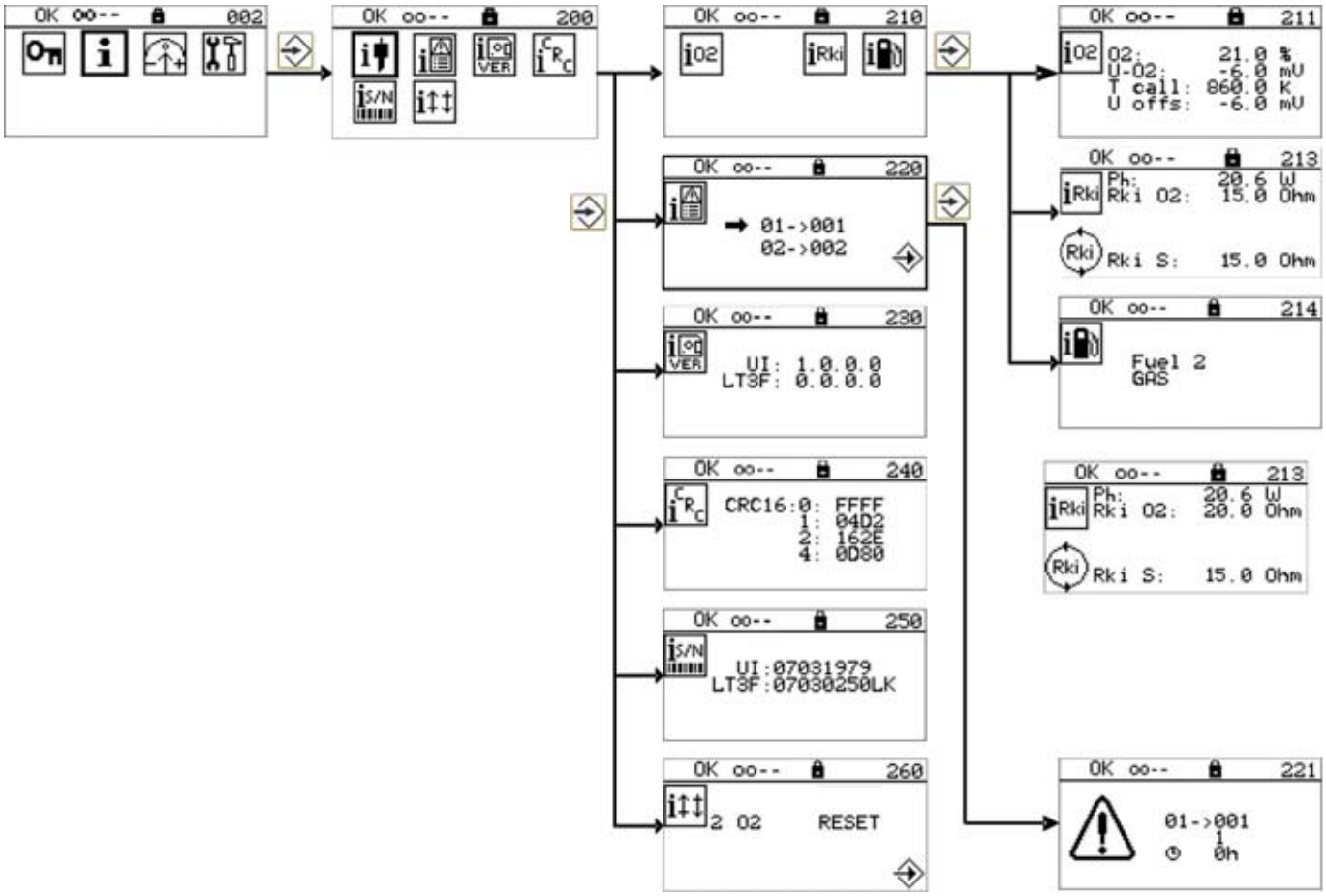


No access level necessary

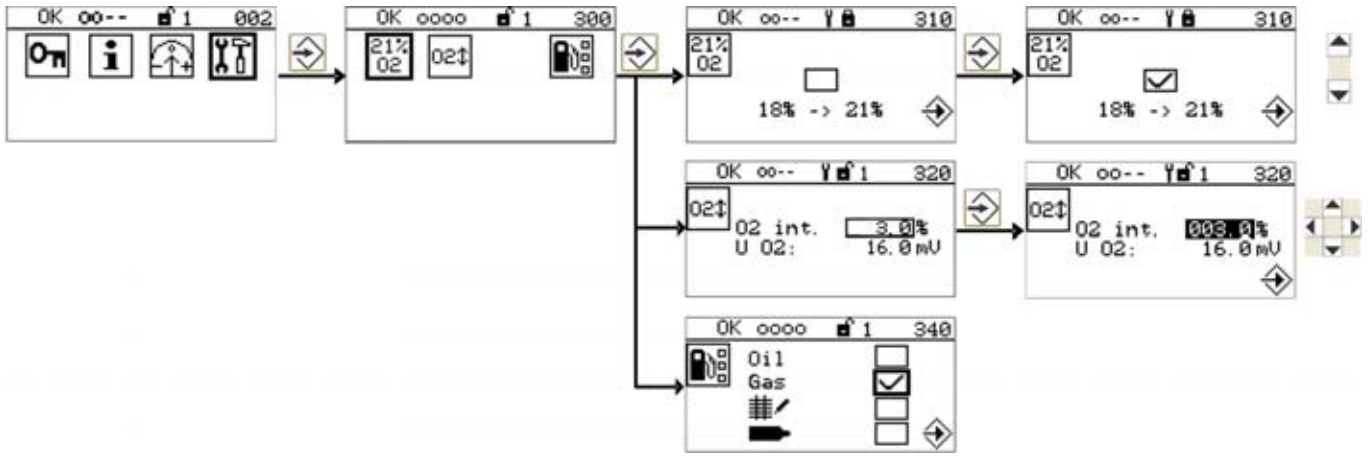
1 Access level ’Customer’

2 Access level ’Service’

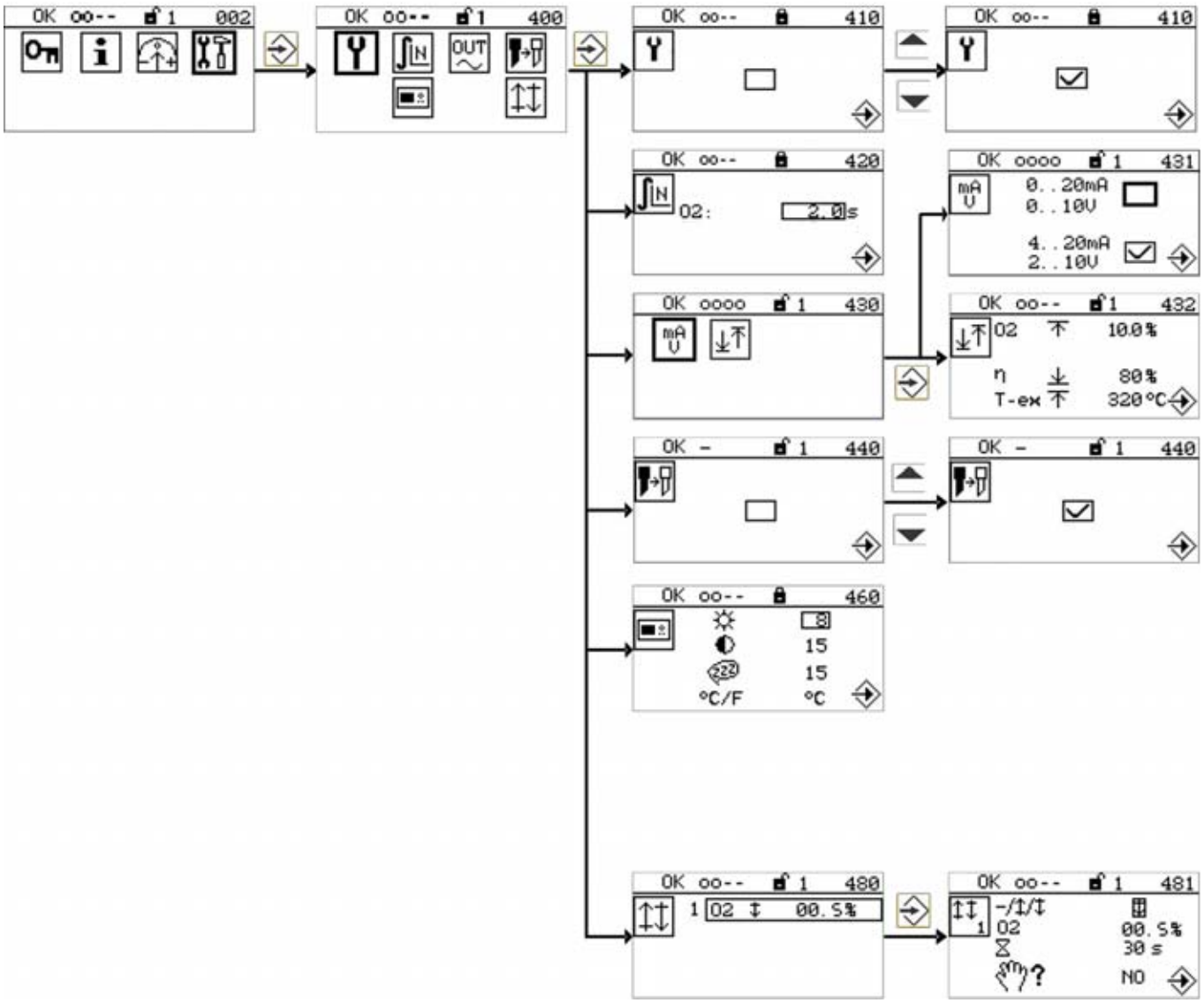
6.2.2 Information Menu Structure



6.2.3 Calibration Menu Structure



6.2.4 Settings Menu Structure

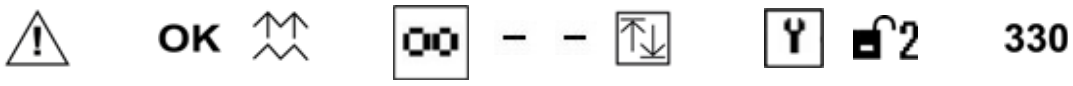


6.3 Status Line

The status line contains information about LT3, including the device family.

Fig. 6-3 UI-LT front view status line

1. Status line

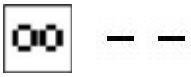


Description status line:

 Active fault/warning

OK Operating mode OK

 Heat-up (cold start)

 Status of limit values 1-4*

 Active limit value not triggered

– Non-active limit value (off)

 Active limit value undershot/exceeded

 Active maintenance mode

 Without access level

 Access level 1 - Customer

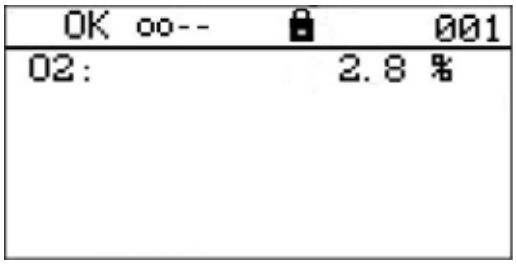
 Access level 2 - Service

330 Window number

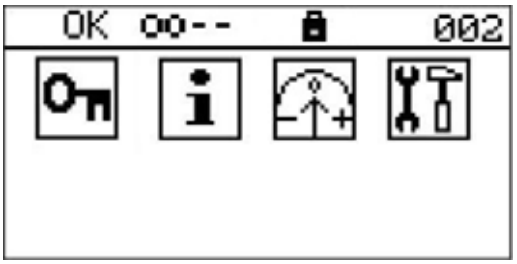
* If a limit value is exceeded the display shows an upward or downward arrow.

6.4 Main Menu

Basic display



Main menu



The display shows the O_2 value, resolution 0,1 %

Press ENTER to access the main menu.

Meaning of the symbols:

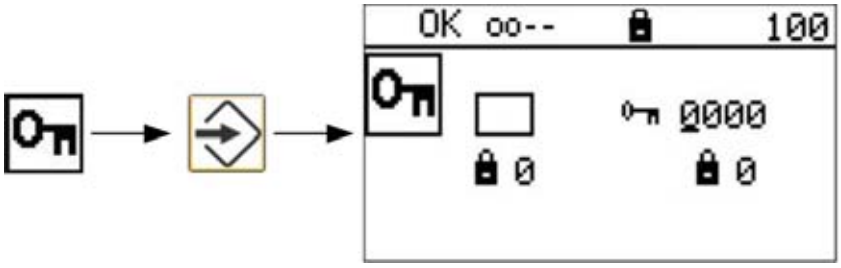
Password entry

Information regarding the probe and fuel, warnings and faults, software version, CRC, and serial number

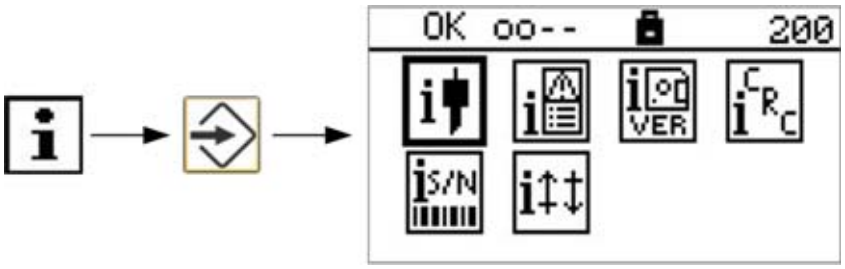
Calibration of measurement

Settings (maintenance, filter time, analogue output, probe replacement, display, limit values and digital outputs)

6.4.1 Main Menu - Password Entry



6.4.2 Main Menu - Information



Meaning of the symbols:

Measured values and probe data

Fault/warning history

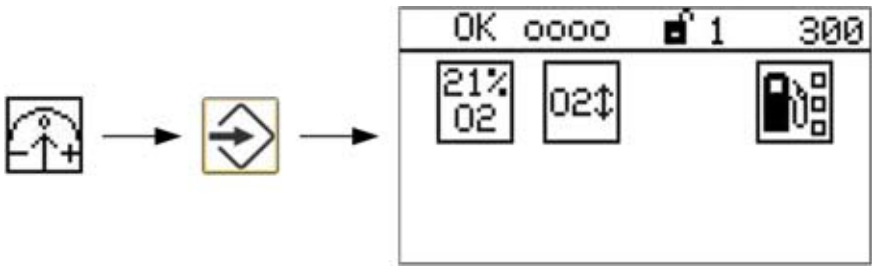
Software version of LT3 and display

CRC checksums

Serial number

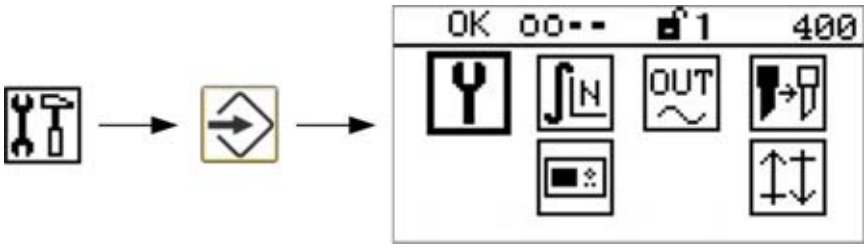
Manual reset of the limit values if they are set to manual reset

6.4.3 Main Menu - Calibration



Meaning of the Symbols	Required Access Level
Offset calibration to 21 % O_2 (calibration in air)	none
O_2 calibration	1 (customer) or higher
Fuel change over	1 (customer) or higher

6.4.4 Main Menu - Settings

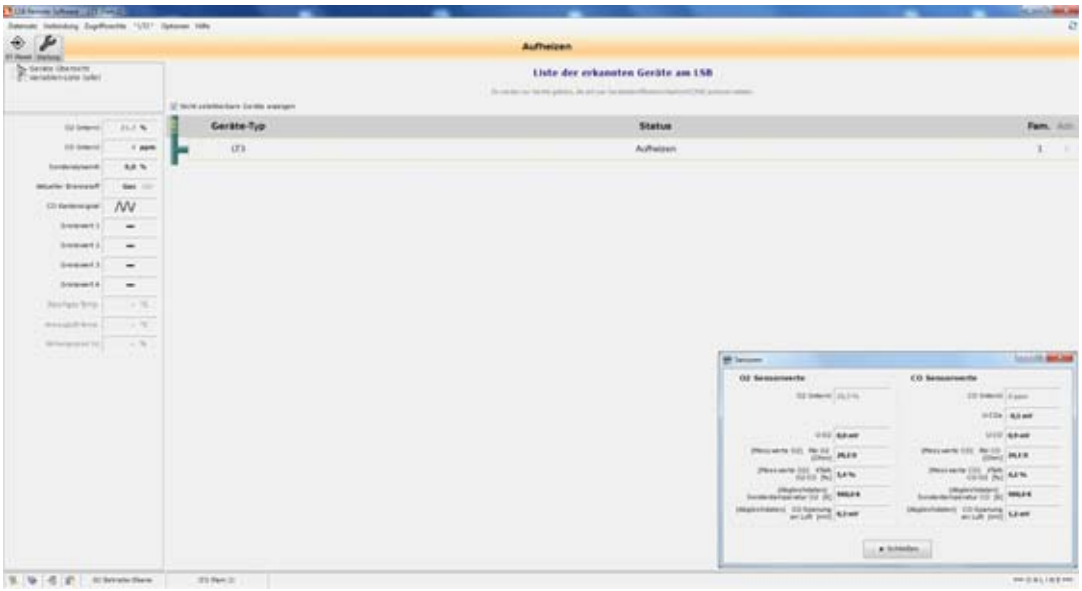


Meaning of the Symbols		Required Access Level
	Maintenance mode	none
	Filter time of the measurement values	none
	Analogue outputs	1 (customer) or higher
	Trigger probe replacement	1 (customer) or higher
	Display parameters	none
	Limit values	1 (customer) or higher

6.5 LSB Remote Software (Optional)

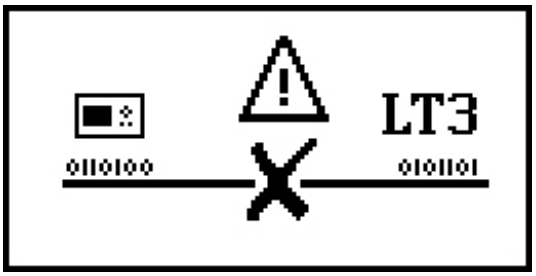
The LSB remote software offers:

- Remote software for PC as of Windows XP
- Full access to the parameter level, password-protected
- Reading, writing, and comparison of data records
- Including connecting cable for USB/CAN module – LT3, length of 4 m (13.12 ft). For connection to the existing 5-pole M12 socket
- Including USB/CAN module type 657R9000
- Without USB/CAN module type 657R9001



A description of the LSB remote software can be found in a separate document.

If the LSB remote software is active, the operation to the user interface is inactive!



6.6 External Operation via Programming Unit (optional)

- Operation and Parameter Settings
- Full access by password to the parameter level
- Read and write datasets
- Including connecting cable, length 4 m, to connect to the existing 5 pole M12 socket.
- Order no. 657R0932

7 Commissioning

⚠ WARNING!

Before commissioning, read the operating instructions carefully and follow the instructions. The measuring system may only be operated by trained and instructed personnel!

Incorrect work/operation can lead to death, serious bodily injury and/or considerable damage to property.

NOTICE

Before commissioning, the LS2 Lambda Probe and all alarm/signal outputs are connected, as described in Chapter *7.2 Installation* in these operating instructions, to the LT3 Lambda Transmitter.

⚠ WARNING!

Danger of electric shock!

The device contains live parts that may cause an electric shock if touched.

▶ Before actuating the main switch for the voltage supply, ensure all housings (electronic evaluation unit and terminal boxes, electrical connection of the probe) must be closed according to the instructions!

7 Commissioning

7.1 Operating Conditions

NOTICE

If the LT3 is being used for O_2 control or the LT3-F for CO/O_2 control, it may happen, that the connected LSB-modules are not be controlled correctly. The LSB modules start to flash red and the output values are disturbed.

To avoid this, the ETAMATIC or when FMS/VMS then the connected communications processor board/field bus module requires a software update to the latest version.

Please check the version before commissioning.

Shown on the ETAMATIC:	Using PC software for remote control → view → version → **Software Version Communication Processor** Software-EPROM on processor board in ETAMATIC
Shown on the FMS/VMS: or	Check on the label **Software** printed on the outside of the housing of communications processor board / field bus module
Using PC software for remote control → view → version →	**Software Version Secondary Communication Processor** Software-EPROM in communications processor board/ field bus

Function up from software version for communication processor for LSB:

When ETAMATIC / ETAMATIC OEM:	B9w001, up from April 2015
When communication processor / PROFIBUS connection for FMS/VMS	A9xxx, up from November 2011
When MODBUS connection RTU for FMS/VMS:	M9xxx, up from April 2015
When MODBUS connection TCP for FMS/VMS:	E9xxx, up from June 2011

If you have any questions, please contact support@lamtec.de or phone +49 6227 605233.

7.2 Installation

⚠ WARNING!

Danger of falling!

The mounted probe may not be used as a step. The maximum permissible bending moment lies at 100 kg. In case of non-observance, the probe can be destroyed.
A fall can result in severe injury or death.

▶ Do not step on the probe! Use appropriate work equipment.

7.2.1 General Information

Suitable for gas measurements with a low percentage (< 10,000 ppm) of combustible components (e.g., in the flue gases of firing systems).
Direct measurements in **combustible gases** are not possible.

Measuring gas temperature

Up to 300 °C (572 °F) type 650R1000

Up to 750 °C ('1382 °F) in combination with flue gas bypass tube made of stainless steel (HT design)

Up to 950 °C (1742 °F) in combination with flue gas bypass tube made of Inconell 600 (HT design)

Up to 1200 °C (2192 °F) in combination with flue gas bypass tube made of Kanthal (HT design)

Higher than 1200 °C (2192 °F) by ejector extraction (refer to document no. DLT3010)

Suitable fuels

– Light hydrocarbons like natural gas, propane, butane
– Light fuel oil
– Heavy fuel oil, coal
– Other fuels, like pyrolysis gases, refuse, etc., only partially, with considerably shorter lifetime

Measuring point

The measuring point must be selected in such a way that representative flue gas (thorough mixing) exists. Flue gas temperature on the measuring point: max. 300 °C.

Gas Extraction Device (GED)

The gas extraction device is simply placed on the probe and fastened with a screw.

NOTICE

The GED does not have to reach into the middle of the flue gas channel. It suffices if representative measuring gas is preset at the incoming flow openings of the GED.

Reverence value:	The length of the problem with GED should amount to 1/3 of the smoke pipe diameter.
Available lengths:	150 mm, 300 mm, 450 mm, 1.000 mm

7.2.2 Mounting LS2 Lambda Probe Standard Type 650R1000

NOTICE

Outdoor mounting:

The measurement site should be protected on site against direct contact with rainwater, through a sufficient large roof.

NOTICE

The connecting cable of the probe has a length of 2 m (6.5 ft). The LT3 or the PCB must be installed in the vicinity of the probe.

⚠ WARNING!

Escape of hot, explosive, and harmful gases!

Hot, explosive, and harmful gases can escape during work on the flue gas channel.

▶ Take suitable protective measures to protect you and your environment from escaping gases.

NOTICE

When making the apertures, any parts falling into the channel may cause damage.

▶ Secure parts to be separated with wires!

Mounting Steps

1. Drill or burn out a hole in the flue channel, with diameter 40 mm (1.575" in.)“.
2. Firmly weld a half-collar, interior thread G 1¼ ’tight’ at the measurement site.

NOTICE

Apply mounting paste 650R1090 to the thread. This prevents seizing and guarantees a problem-free installation and removal of the probe.

3. Screw in the PIF without probe, and tighten.
4. Seal the PIF aperture with a blank plug if necessary.

NOTICE

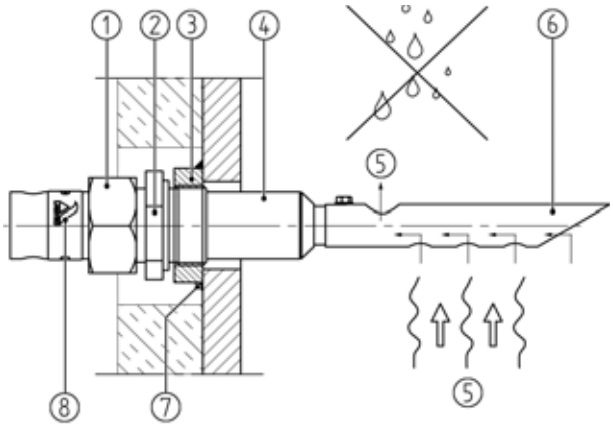
Install the probe just before commissioning. In a built-in state, the probe has to be always heated.

This prevents moisture from settling on the measuring cell, which, among other things, can cause measuring errors and could destroy the probe.

NOTICE

During the installation of the probe and later operation, ensure that the probe does not come into contact with oils, greases, or boiler cleaning agents.
Poisoned and/or dirty probes can be detected by an air voltage of -20 ... -30 mV.

7 Commissioning



1 Union nut
2 Threaded connection (position 1+2 = Probe installation fitting (PIF) type 655R1010)
3 Welding socket
4 Probe
5 Flue gas
6 Gas extraction device
7 Welded
8 Rating plate

Fig. 7-1 Probe installation with GED

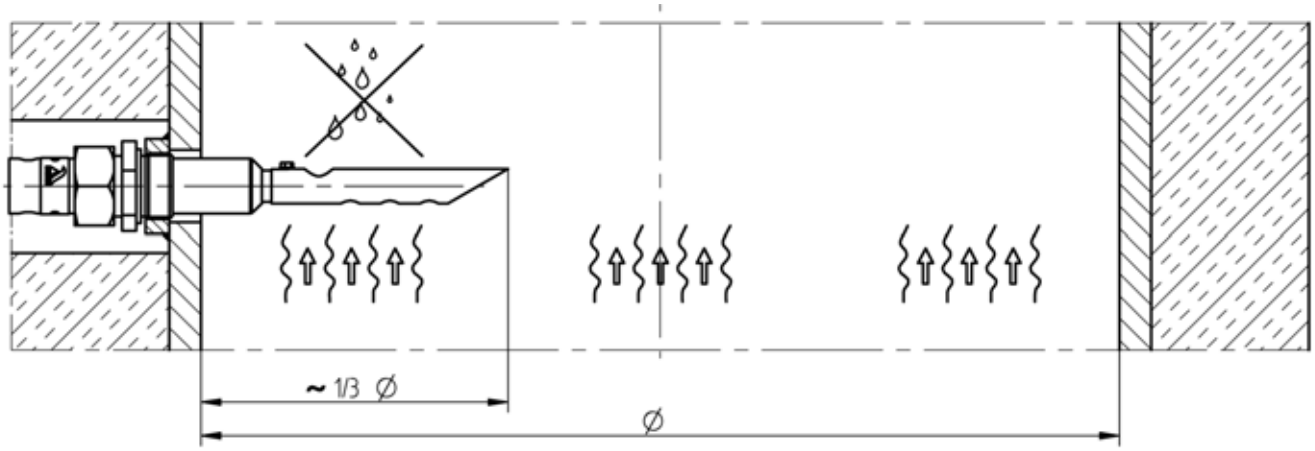


Fig. 7-2 Correct probe installation with GED in flue gas duct

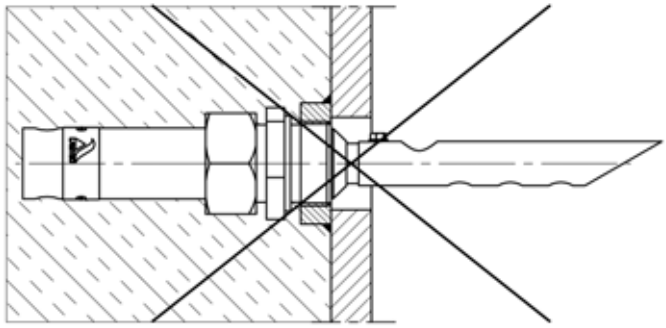


Fig. 7-3 Incorrect probe installation

5. Put the system out of operation and install the probe.
   If it is not possible to put the application out of operation the probe may be installed and the GED can be aligned not before the offset calibration is done.

NOTICE

If it is not possible to switch off the system, the probe can be installed only after a successful offset calibration and the GED has been aligned.

NOTICE

To ensure that there is enough air circulation, the probe must be freely insulated from its environment in a radius of 5 cm (1.97" in).

⚠ CAUTION!

Hot probe!

The probe may be hot during mounting/demounting! Risk of burns!

- ▶ Wear appropriate protective clothing.
- ▶ Be careful.
- ▶ Do not place the hot probe on flammable material.

Mounting position:

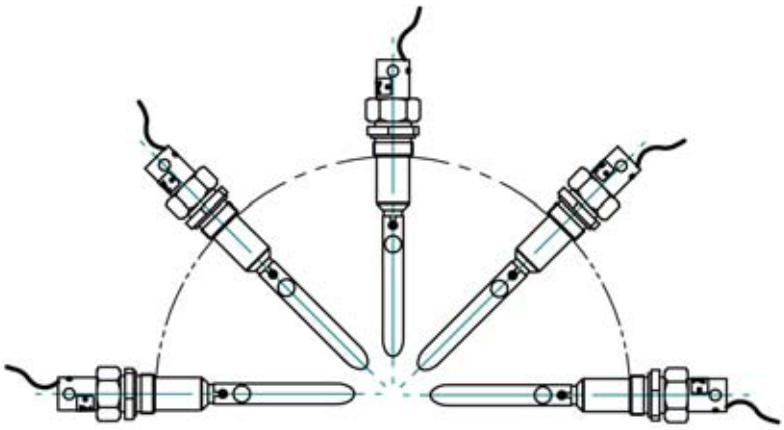


Fig. 7-4 Mounting position any, from horizontal to vertical

NOTICE

Outdoor mounting:

The measurement site should be protected on site against direct contact with rainwater, through a sufficient large roof.

7.2.3 Mounting of the Lambda Probe LS2-HT (High Temperature)

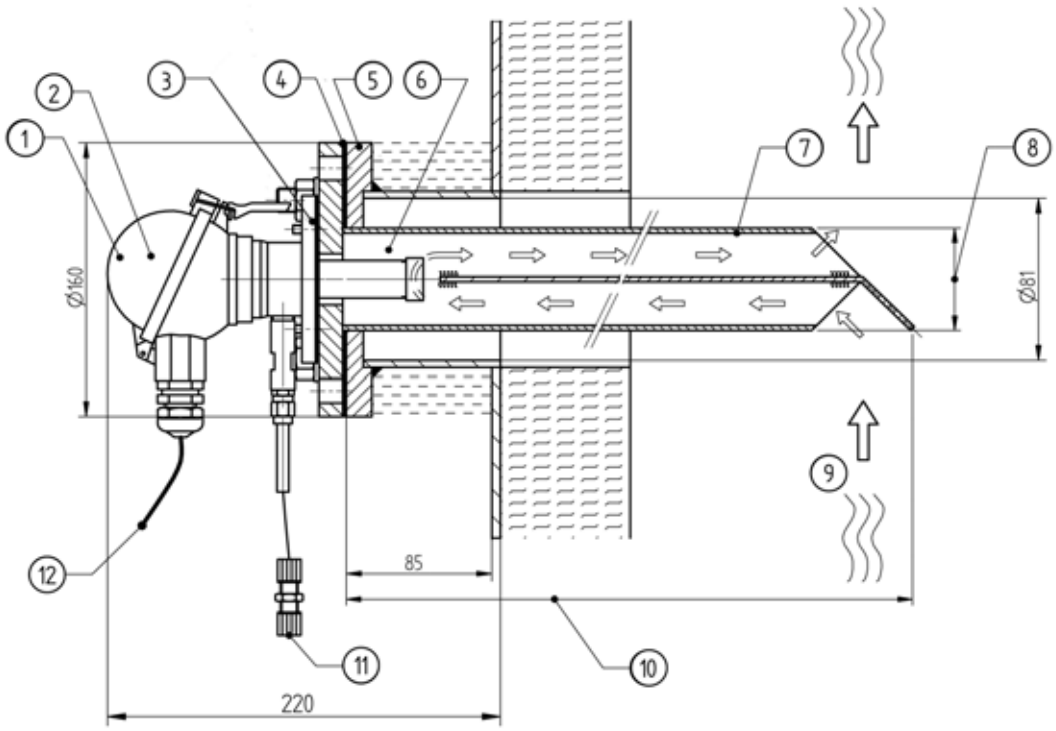


Fig. 7-5 Dimensional drawing Lambda Probe LS2-HT with flue gas bypass tube

1 Lambda Probe LS2-HT type 650R1515

2 Connection head max. 100 °C/212 °F

3 Flange seal Novaphit type 656P0263

4 Flange seal graphite type 655P4211

5 Counter flange with tube socket KTL coated type 655R0179 or
Counter flange with tube socket stainless steel 1.4571 type

6 Flue gas temperature at the probe head max. 450 °C/842 °F

7 Flue gas bypass tube

8 Diameter/diagonal maximum. 70 mm/2.76 "in

9 Gas velocity:
1 ... 16 m/s
(from 16 m/s: increasing measurement inaccuracy)
(from 30 m/s: maximum length 1.000 mm/39.370" in)

10 Length: 500 ... 2.000 mm/19.68 ... 78.74" in)

11 Hose connection 4/6 mm (0.16" in/0.24" in) for calibration gas

12 Connecting cable with plug, length 2 m/6.6 ft.

NOTICE

Outdoor mounting:

The measurement site should be protected on site against direct contact with rainwater, through a sufficient large roof.

NOTICE

The connecting cable of the probe has a length of 2 m (6.5 ft). The LT3 or the PCB must be installed in the vicinity of the probe.

⚠ WARNING!

Escape of hot, explosive, and harmful gases!

Hot, explosive, and harmful gases can escape during work on the flue gas channel.

▶ Take suitable protective measures to protect you and your environment from escaping gases.

NOTICE

When making the apertures, any parts falling into the channel may cause damage.

▶ Secure parts to be separated with wires!

Mounting steps

1. Drill or burn out a hole of diameter 89 mm (3.5 "in) from the flue gas channel.
2. Firmly weld the counter-flange close to the measuring point (threaded bolt horizontal) if the direction of flow of the flue gas is vertical or horizontal.
3. Insertion of the flange seal (3 mm/0.12 "in graphite type 655P4211)
4. Install and tighten the flue gas bypass tube whilst paying attention to the direction of flow of the flue gas!

NOTICE

Apply mounting paste 650R1090 to the thread. This prevents seizing and guarantees a problem-free installation and removal of the probe.

5. Then insert the included probe seal (Novaphit type 656P0263).
6. Seal the PIF aperture with a blank plug if necessary.

NOTICE

Install the probe just before commissioning. In a built-in state, the probe has to be always heated.

This prevents moisture from settling on the measuring cell, which, among other things, can cause measuring errors and could destroy the probe.

NOTICE

During the installation of the probe and later operation, ensure that the probe does not come into contact with oils, greases, or boiler cleaning agents.
Poisoned and/or dirty probes can be detected by an air voltage of -20 ... -30 mV.

7. After commissioning push the probe in the flue gas bypass tube and fasten the probe (output of the probe cable downwards, see figure *4.2.3 Technical Data LS2-HT Lambda Probe*).

NOTICE

During mounting, the six screws between the flue gas bypass tube and the Probe must be tightened one after the other crosswise. In the process, the tightening torque may be only slowly increased to the target tightening torque of a maximum of 6 Nm/screw.

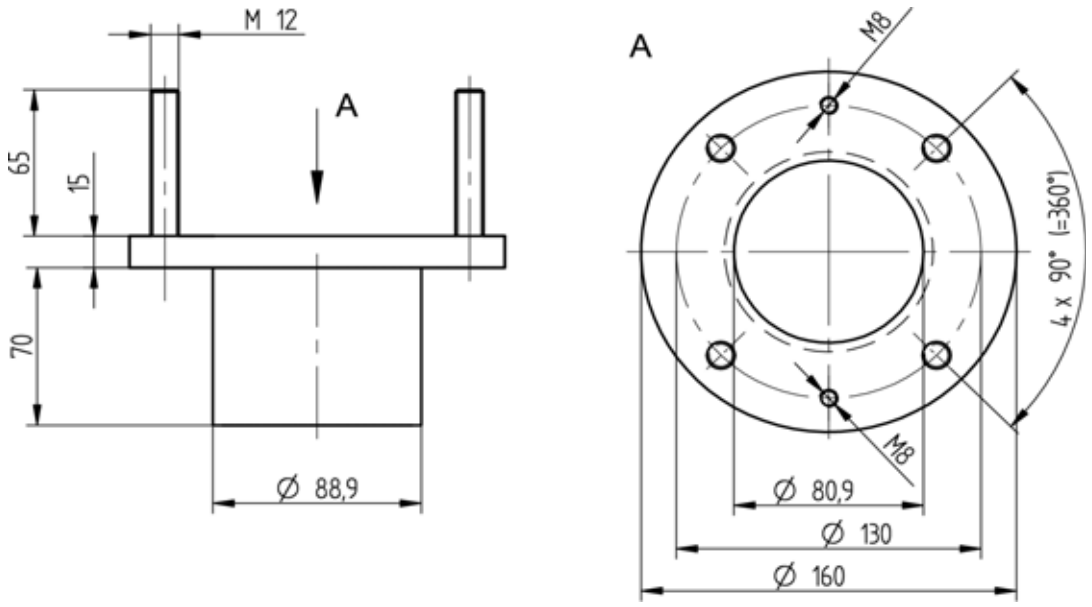


Fig. 7-6 Installation position if the direction of flow of the flue gas is vertical or horizontal

NOTICE

To ensure that there is enough air circulation, the probe must be freely insulated from its environment in a radius of 5 cm (1.97" in).

⚠ CAUTION!

Hot probe!

The probe may be hot during mounting/demounting! Risk of burns!

- ▶ Wear appropriate protective clothing.
- ▶ Be careful.
- ▶ Do not place the hot probe on flammable material.

NOTICE

If the measuring gas temperature of the probe exceeds 300 °C (572 °F), the HT probe must be reset.

- ▶ Use an intermediate flange. The intermediate flange must not be insulated.

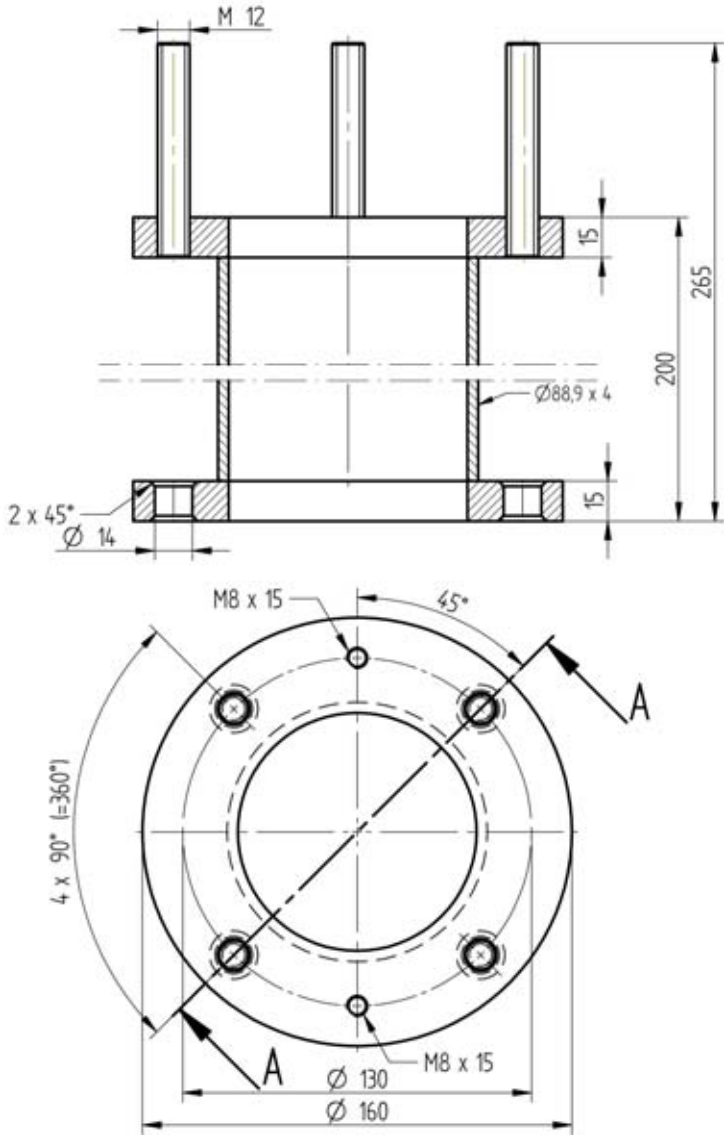


Fig. 7-7 Intermediate flange (in mm)

⚠ CAUTION!

If the permissible temperatures on the probe head of a maximum of 300 °C (572 °F) or on the connecting head of a maximum of 100 °C (212 °F) are not observed, the probe must be installed further back.

7.2.4 Mounting of the LT3 Electronic Evaluation Unit

Mount the LT3 Lambda Transmitter at a suitable position with the electrical connections and probe connection facing downward.
Provide a suitable space for wall mounting.
Ensure the bearing capacity of the wall and the easy accessibility to the measuring system.

Permissible ambient temperature range:

Operation:	-20 °C up to +60 °C (-4 °F up to 140 °F)
Transport and storage:	-20 °C up to +70 °C (-4 °F up to 158 °F)

NOTICE

Cold electronics – good electronics!

Always observe this slogan when establishing the mounting location for the LT3 Lambda Transmitter.

7.2.5 LT3 Electrical Connection

7.2.5.1 LT3 LS2 without Probe Connection Box (PCB)

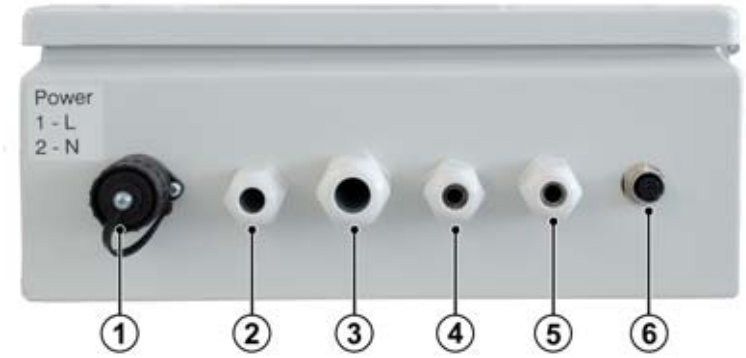


Fig. 7-8 Electrical connections LT3

1 Power supply.

2 M16 screwed cable gland for probe signals

3 M20 screwed cable gland for probe heating

4 Cable bushing, ∅ 5 mm minimum, ∅ 10 mm maximum, for connecting the LAMTEC SYSTEM BUS.

5 Cable bushing, ∅ 5 mm minimum, ∅ 10 mm maximum, for connecting the analogue and digital outputs (LSB modules).

6 External LSB connection to a 5-pole round plug for connection a PC with the LSB Remote Software installed to a programming unit by a USB/CAN module.

NOTICE

For direct connection to LT3 (without extension, without SAK) we recommend to cut off the probe plug of LS2.

When using an extension or SAK, the enclosed mating connector of the probe must be mounted to LT3.

For connection diagram see chapter *7.3 Connection Diagram*Wiring and *4.2.1 Technical Data Lambda Probe LS2 without Housing*.

Recommendation for line lengths and line cross-sections of the LAMTEC SYSTEM BUS:

- 0 - 40 m (0 ... 131.23 ft) 2 x 2 x 0.34 mm^2 (2 x 2 x AWG 21), cabled in pairs with screening, impedance 120 Ω
- 40 - 300 m (131.23 ft ... 984.25 ft) 2 x 2 x 0.5 mm^2 (2 x 2 x AWG 20), cabled in pairs with screening, impedance 120 Ω
- 300 - 500 m (984.25 ft ... 1640.42 ft) 2 x 2 x 0.75 mm^2 (2 x 2 x AWG 18), cabled in pairs with screening, impedance 120 Ω

Example cable type for fixed installation:

- LAPP cable 2170267 (LAMTEC article no.: 05L05 2 x 2 x 0.5).
- HELU cable 800685.

7.2.5.2 Probe Connection via PCB

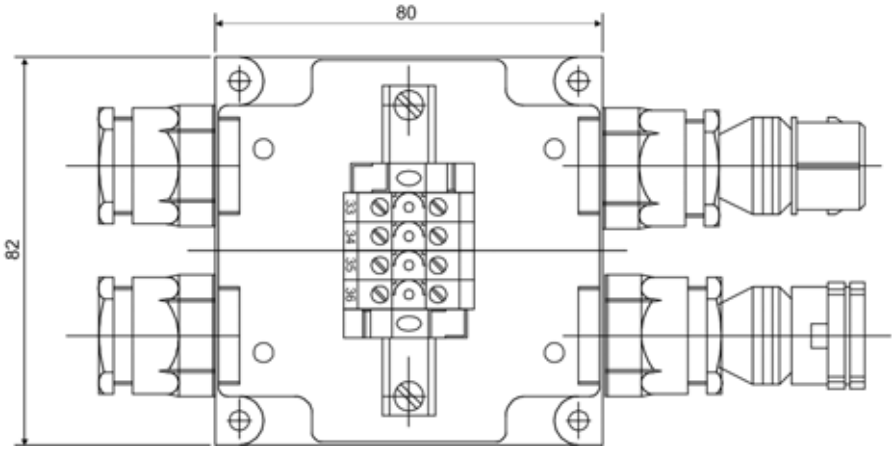


Fig. 7-9 PCB dimensions: Hight 55 mm, Protection class: IP66

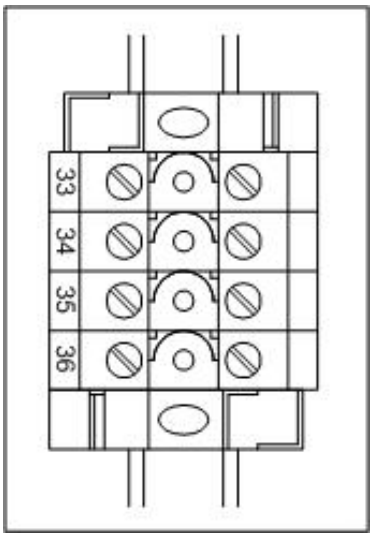


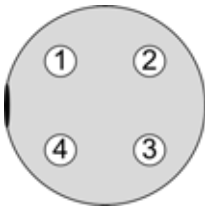
Fig. 7-10 Terminals PCB

Terminal 33 (PCB)	O_2 probe signal (-)	→	Terminal 10 (LT3) grey
Terminal 34 (PCB)	O_2 probe signal (+)	→	Terminal 11 (LT3) black
Terminal 35/36 (PCB)	Probe heating	→	Terminal 13/14 (LT3) white

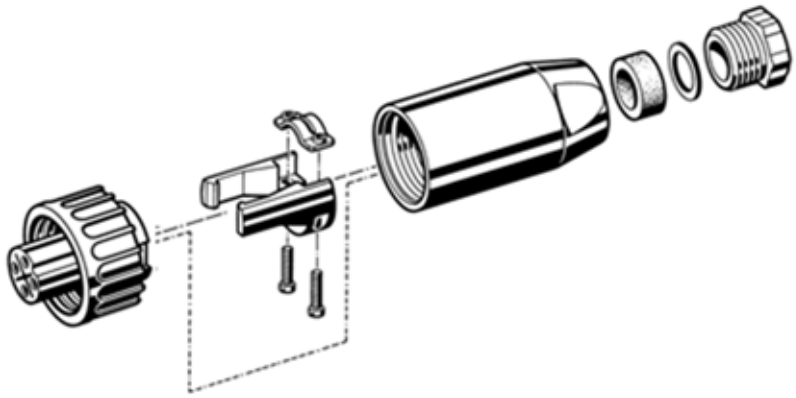
Necessary cable cross section between Probe connection box (PCB) and LT3.

Probe heater	other connection cables
up to 10 m (49.2 ft) ≥ 1.5 mm^2/15 AWG (shielded)	≥ 0.75 mm^2/20 AWG (shielded)

7.2.5.3 Power Supply

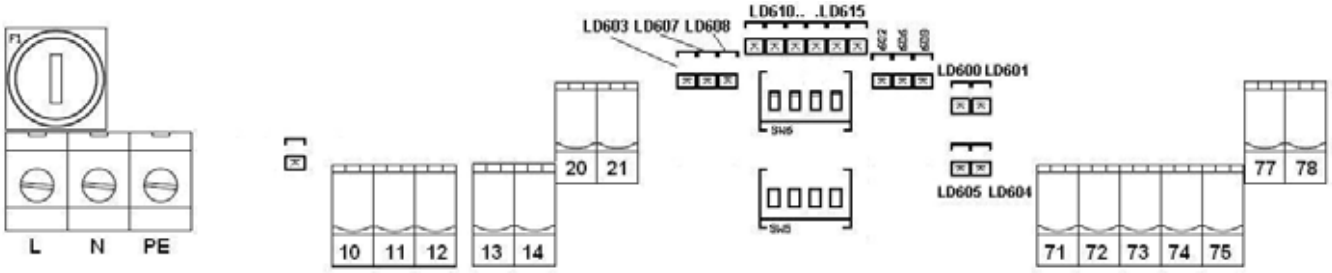


1: L
2: N
3:
4: PE



Power supply for wall mounting housing with matching connector

7.2.5.4 Assignment of Internal Terminals



L/N/PE	Supply voltage	230 VAC / 69 W		
10	O_2 probe signal (-)	grey		
11	O_2 probe signal (+)	black		
13/14	Probe heater	white		
71	CAN GND	LAMTEC SYSTEM BUS		
72/74	CAN-H	LAMTEC SYSTEM BUS	→	M12 installation bushing pin 4
73/75	CAN-L	LAMTEC SYSTEM BUS	→	M12 installation bushing pin 5
77	0 V	24 VDC - output	→	M12 installation bushing pin 3
78	+24 V	24 VDC - output	→	M12 installation bushing pin 2

7.2.5.5 Fuses

F1	Mains fuse 4 A fast-acting 5x20 IEC 60127-2/2 Littlefuse217

7.2.5.6 LEDs

LD604	LAMTEC SYSTEM BUS Flashing = no connection Constant lighting = connection established
LD603	OPERATION Flashing = heating phase of probe Constant lighting = ready for operation
LD607	MAINTENANCE MODE Activation/deactivation via control unit or software button
LD608	FAULT Flashing = fault is present OFF = no fault is present
LD610 ... LD615	NO FUNCTION

7.2.5.7 Termination Resistor LSB

NOTICE

The terminal resistance defines the beginning and end of the LAMTEC SYSTEM BUS. The terminal resistance on the first and last bus nodes absolutely must be activated.

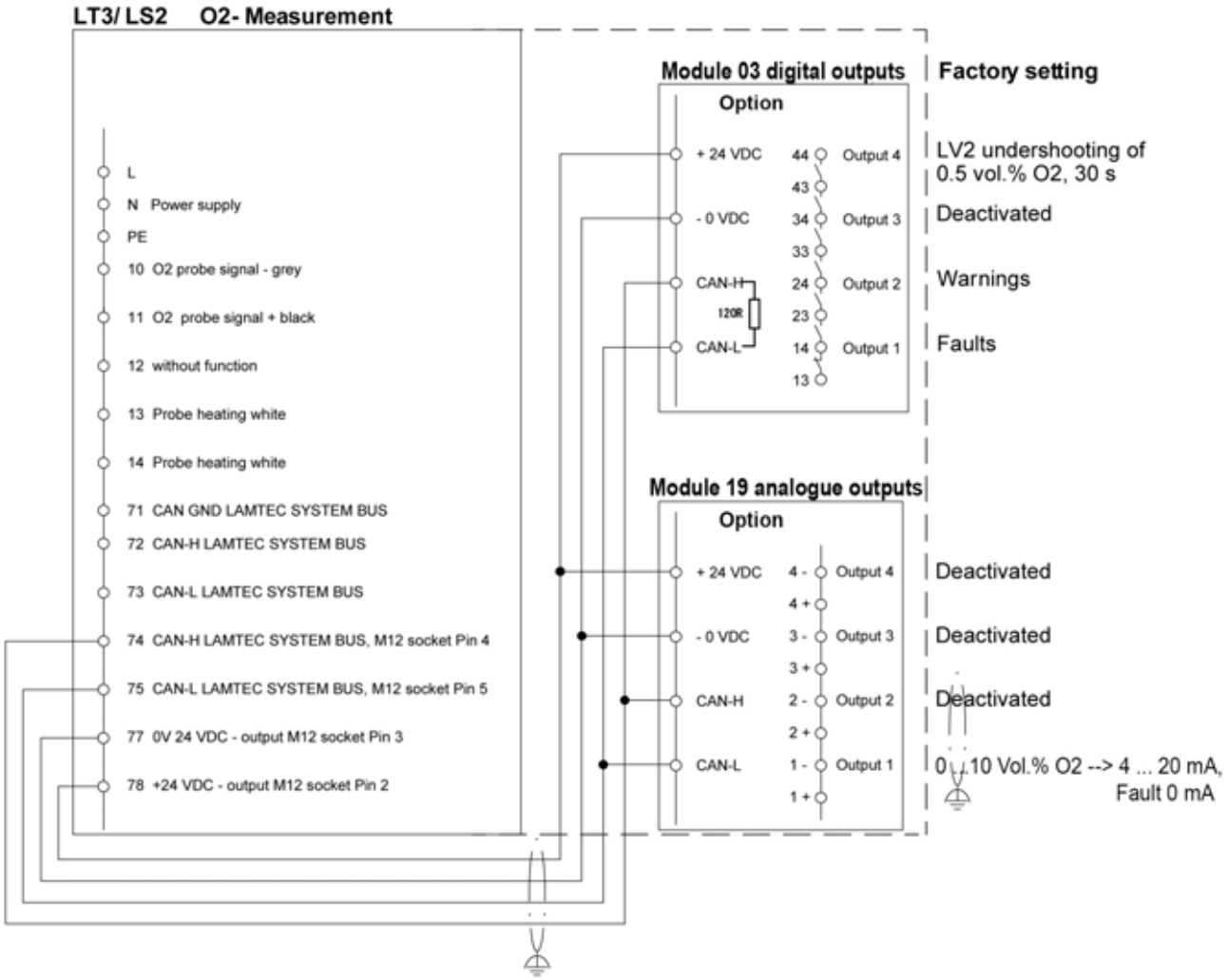
Assignment of the plug-in jumper BR602:

Terminal resistance not active	→	Plug-in jumper in position 1-2	
Terminal resistance active	→	Plug-in jumper in position 2-3	

Also see chapters *7.2.5 LT3 Electrical Connection* and *4.3 LSB Terminal Resistance*.

Only accessible after opening the housing !

7.3 Connection Diagram



7.4 Measurement Start-up

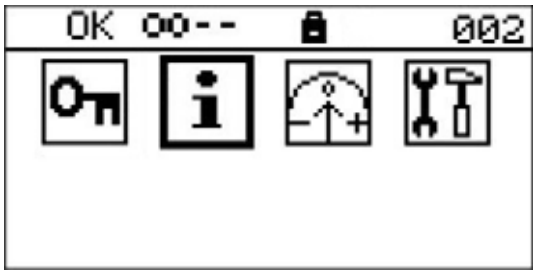
NOTICE

If it is not possible to switch off the system, the probe can be installed only after a successful offset calibration and the GED has been aligned.

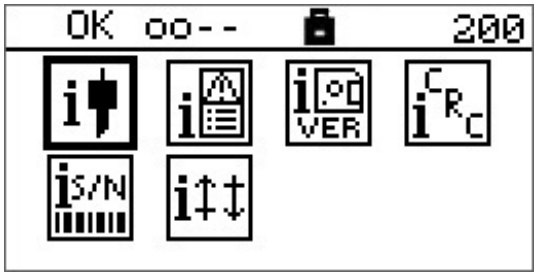
Commissioning the probe

1. Mount the probe
2. Connect the probe electrically.
3. Switch on the voltage.
4. Enter the password for access level 2 (Service); see Chapter *6.4.1 Main Menu - Password Entry*.
5. Activate maintenance mode; see Chapter *7.4.3 Activate/deactivate Maintenance Mode*.
6. Heat up the probe (10 minutes cold start and 30 minutes faultless measurement operation)
7. Cold start is displayed.
8. The device automatically changes over to measurement operation
9. The probe voltage stabilised to (-20 ... + 10mV).
10. The internal resistance stabilised to 15 ... 25 Ω.
11. Calibrate the probe; see Chapter *7.5 Calibrating the Probe*.

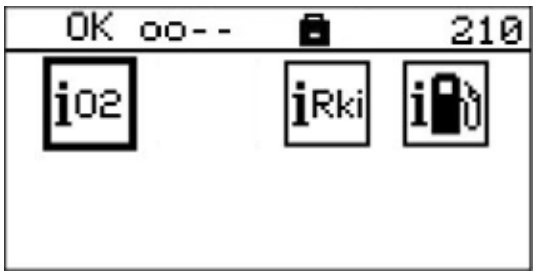
7.4.1 Reading the Measured Values



In the main menu, select the INFORMATION menu .

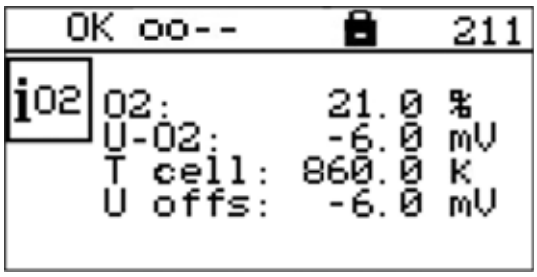


In the INFORMATION menu, select measured values and probe data with .

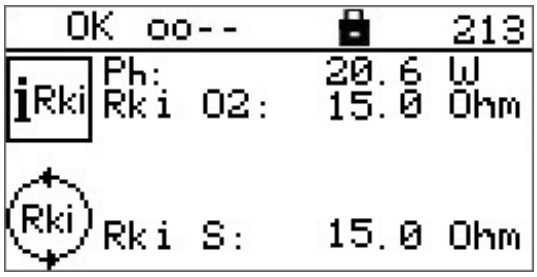


In MEASURED VALUES and PROBE DATA, select:

- Display of the O_2 measured values,
- Display of the R_{ki} internal probe resistances
- Display of the current fuel selection

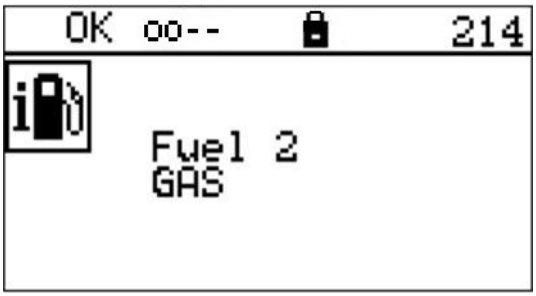


The O_2 probe voltage U-O_2 stabilises to values between +10 ... -20 mV.



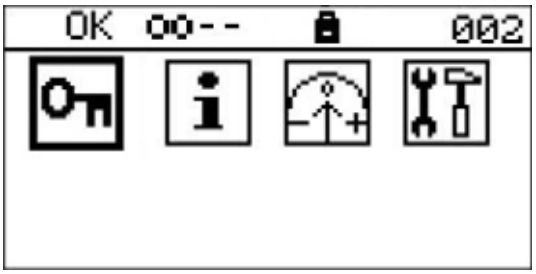
Die R_{ki} internal probe resistance lies between 15 ... 25 Ω.

- Display of whether the internal probe resistance regulation is active!
- **P_h** Display of the current heating capacity
- **R_{ki} S** Display of the setpoint value for the internal resistance regulation.

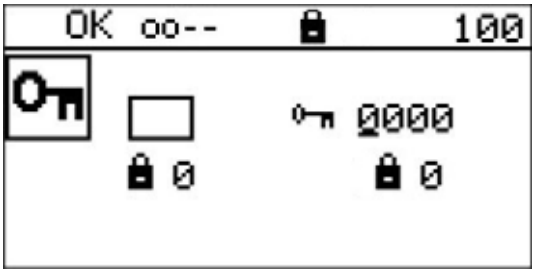


Currently selected fuel

7.4.2 Enter the Password for the Access Level



In the main PASSWORD ENTRY menu, select



Enter password via and ENTER .

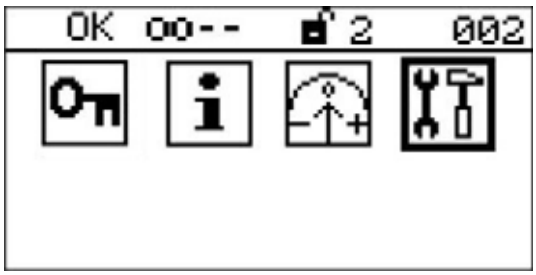
Access level 1:	Customer Level
Factory setting:	0000 – access to customer functions only
	Customers can change the password for access level 1. For details ask the burner manufacturer/supplier
Access level 2:	Service level Password: customer specific Access to customer and service functions

7.4.3 Activate/deactivate Maintenance Mode

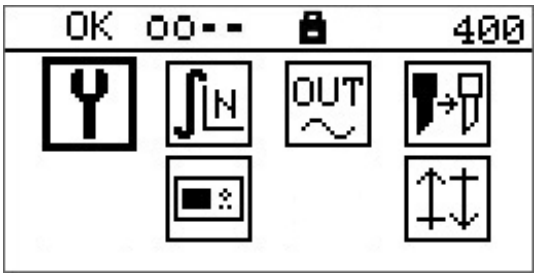
In maintenance mode, the majority of test routines are disabled. The measured values are displayed as not valid.

It is advantageous to activate the maintenance mode during probe calibration. Fixed substitute values can be set as an output during active maintenance mode.

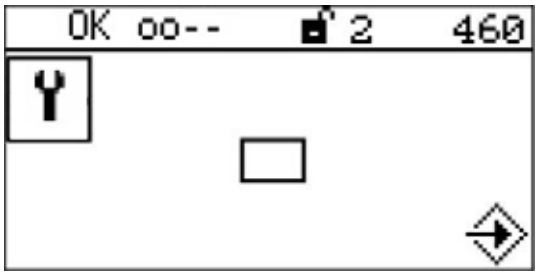
A specific access level is not required for this.



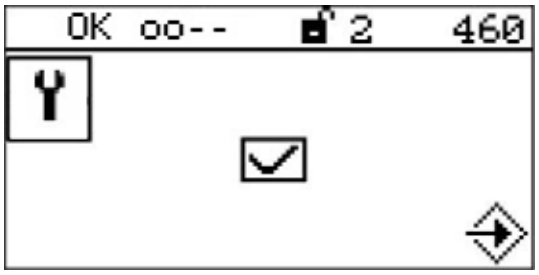
In the main menu, select .



In the MAINTENANCE MODE select .



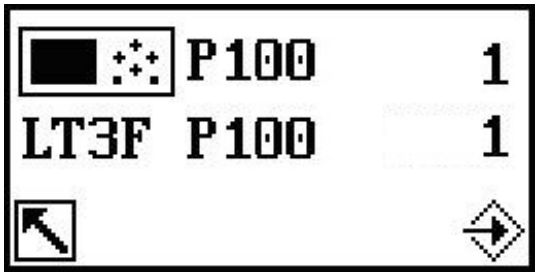
Menu 460 ACTIVATE/DEACTIVATE MAINTENANCE MODE opens.



Use the keys and ENTER to activate/deactivate the MAINTENANCE mode.

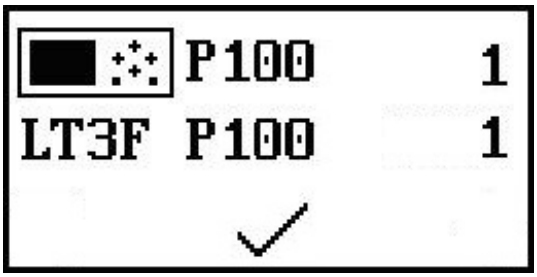
Activate maintenance mode

Deactivate maintenance mode

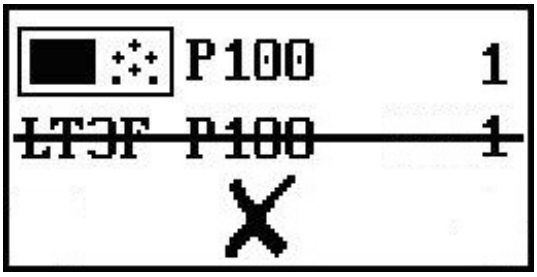


If both parameters (UI-LT and LT3) are the same confirm with ENTER .

Respect the time limit of 8 s



Wait until the display shows the transmission's end.
Return to the SETTINGS menu with the key ↖.



If the procedure is cancelled or in case of timeout this display is shown. BACK ↖ to the SETTINGS menu.

- The status line shows this symbol .

7.4.4 Response of the Internal Resistance Regulation

The internal ceramic resistance between the reference and O_2 electrodes (R_{ki} O_2) is a function of the sensor temperature, which is constantly regulated for a perfect function of the probe.

NOTICE

The optimum operating point of the LS2 lies at a point R_{ki} O_2 about 15 Ω.

This value must be reached before the first offset calibration or after a probe replacement is triggered.

If the measured R_{ki} O_2 deviates too strongly from the optimum setpoint value R_{ki} S = 15 Ω. (see menu 213) the installation situation of the probe must be changed for optimum operation:

R_{ki} O_2 > 15 Ω.

- The probe does not become hot enough:
  - The probe was installed in a cold spot and is thus cooled.
    Determine a new installation site.
  - If necessary check whether a R_{ki} O_2 of 15 Ω. is reached when it is disassembled.
    If a too high R_{ki} O_2 is assumed by the internal resistance regulation, the probe functions outside of its optimum operating point.

R_{ki} O_2 < 15 Ω.

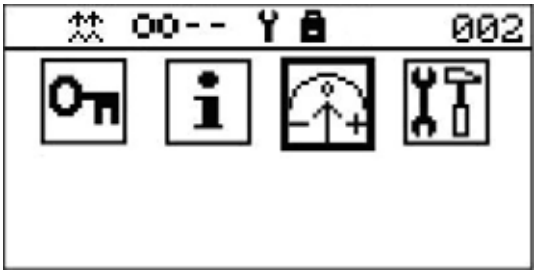
- The internal resistance regulation automatically sets the R_{ki} setpoint value to 15 Ω:
  - After 30 minutes in fault-free measurement operation and subsequent offset calibration
  - After 120 minutes in fault-free measurement operation without an offset calibration

7.4.5 Premature Cold Start Termination

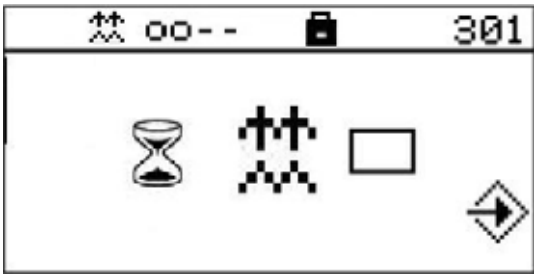
Occasionally, it might be necessary to terminate the COLD START prematurely, e.g., after a short-term power failure, but not before a minimum waiting period of 120 seconds has expired.

NOTICE

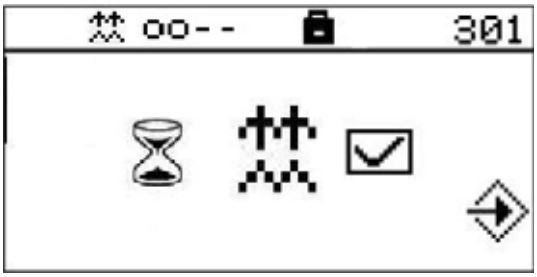
A premature cold start termination leads directly into measurement operation without an additional prompt. If the probe does not reach its optimum operating point, falsified measured values and, possibly, faults and warnings are the result.



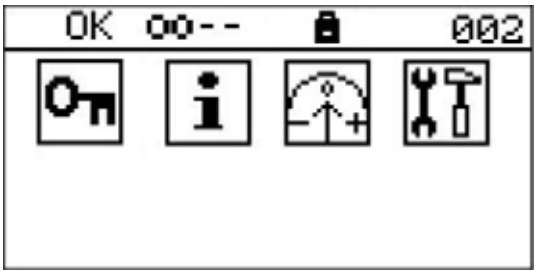
In the main menu, select for the calibration of the probe.



Interrupt the cold start prematurely.



By selecting with the cursor key and ENTER the cold start is terminated prematurely.



The system returns to the main menu automatically.

7.5 Calibrating the Probe

Maintenance mode has to be activated before running a calibration process, see chapter *7.4.3 Activate/deactivate Maintenance Mode*. This deactivates probe failures and avoids fault conditions. After finishing the calibration process successfully, maintenance mode must be deactivated.

A correct and regular probe calibration increases measuring precision.

The probes can be calibrated by either

- reference measurement or
- test gas

For calibration using a reference measurement, an flue gas analyser is required. The probes can then be calibrated when installed / whilst combustion is taking place.

For the test gas calibration, the LS2-HT is be provided with a test gas connection, see chapter *7.2.3 Mounting of the Lambda Probe LS2-HT (High Temperature)*. It can then be calibrated when installed / whilst combustion is taking place.

A testing device is available for the test gas calibration of the of the standard probe (LS2 type 650R1000), s. chapter *8.1 Probe Testing and Calibration*).

Disassemble the probe for calibration.

The following calibration processes must be performed after commissioning and/or replacement of the probe:

1 Required: Offset calibration, see chapter *8.1.1 Checking/Calibrating the Air Voltage (Offset)*
– Adapts the O_2 measured value to the operating conditions around a typical operating point. The ambient atmosphere must consist in 21 Vol.% O_2.

2 Recommended O_2 calibration, see chapter *8.1.2 Checking/Calibrating the O_2 Electrode*
– Adapts the O_2 measured value to the operating conditions around a typical working point.

7.5.1 Offset Calibration perform to 21 % O_2

Before offset calibration, check whether R_{ki} O_2 value is equivalent to 15 Ω (see menu 211 and 213 in chapter *7.4.1 Reading the Measured Values*).
Otherwise, proceed as described in chapter *7.4.4 Response of the Internal Resistance Regulation*.

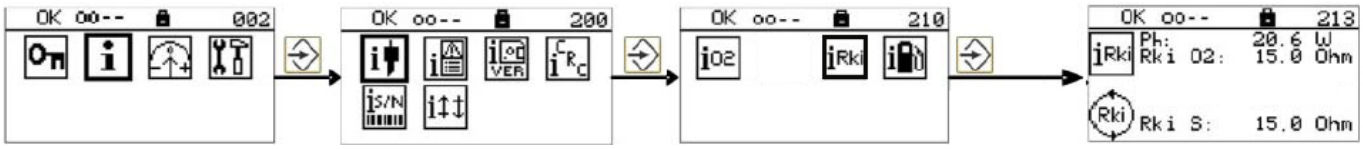


Fig. 7-11 R_{ki} Display

Also check the probe voltage U-O_2. It must be in the range of +10 ... -20 mV.

To perform an offset calibration, the probe must be located in the ambient air and should run for at least 30 minutes in a fault-free measuring mode.

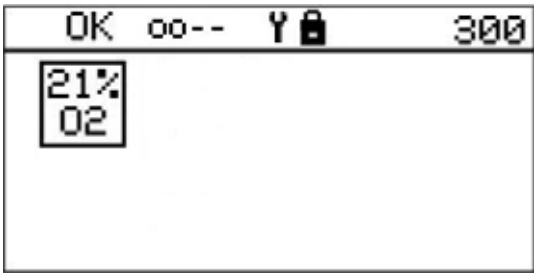
No access level is required!

NOTICE

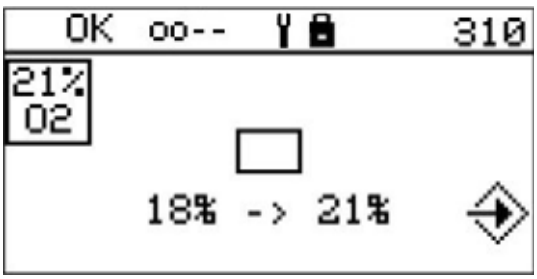
When using a LS2-HT (type 656R2015), the offset calibration can also be performed in an installed state whilst combustion is running. For this purpose, air (dry and oil-free air, instrument air or ambient air) must be fed at connection with a volume of 40 ... 60 l/h for the duration of the calibration (see the high-temperature probe with flue gas bypass tube figure in chapter *7.2.3 Mounting of the Lambda Probe LS2-HT (High Temperature)*).

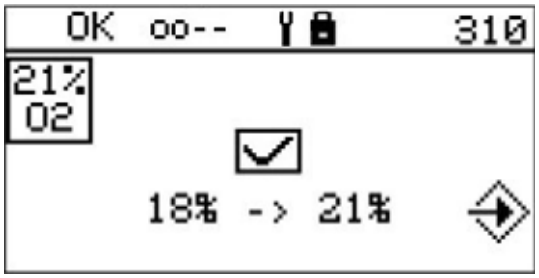
Activate **MAINTENANCE** MODE!

select the probe for Calibration in the main menu .



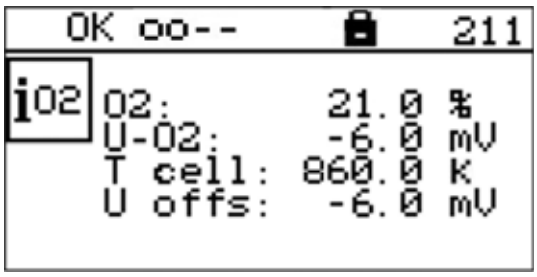
Select for the offset calibration.



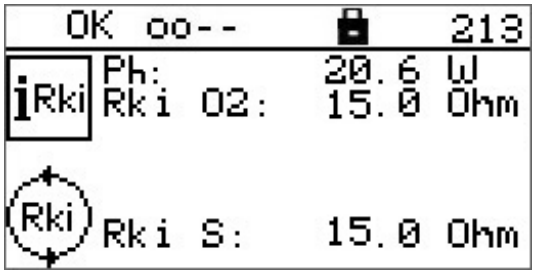


Using the keys and ENTER triggers the offset calibration

Confirm the setting with ENTER within 10 s, otherwise the value is rejected.



The U-O_2 value stabilises to values between +10 ... -20 mV.



The R_{ki} internal probe resistance value is 15 Ω.

Rki Display of whether the internal probe resistance regulation is active!

P_h Display of the current heating capacity

R_{ki} S Display of the setpoint value for the control of the internal resistance.

- Once triggered the offset calibration proceeds automatically.
- After a successful calibration, the O_2 value is 21 Vol.% O_2.
- **Deactivate WARTUNGSMODUS,** see chapter *7.4.3 Activate/deactivate Maintenance Mode*.

7.5.2 O_2 Calibrating in the Operating Point with Reference Measurement

- Activate **Maintenance mode.**

NOTICE

At least access level 1 required!

NOTICE

A correct calibration of the O_2 electrode with reference measurement works in the CO_e content flue gas as well. (from software version V0.106)

The calibration can be performed by reference measurement using an external measuring device or by using test gas at a known O_2 concentration (LS2default design only).

For LS2-HT a hose connection for calibration gas through which the test gas (40 ... 60 l/h) can be input is available (see chapter *7.2.3 Mounting of the Lambda Probe LS2-HT (High Temperature)*).

A special test gas adapter is not required for this type.

Recommended test gas: 3 Vol.% O_2 in N_2.

NOTICE

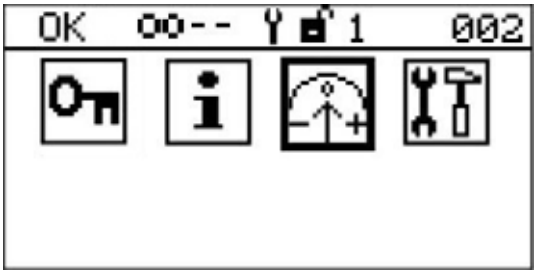
When performing a reference measurement using an external measuring device, check if the measuring device is measuring wet or dry. In the case of devices with an upstream measuring gas cooler, it always concerns a dry measurement. This also applies to devices which remove the moisture by means of a chemical substance. The LS2 measures wet. The difference between a wet to dry measurement is evident from the graphic in chapter *14.4 Wet/Dry Measurement Deviations, Conversion Table*.

NOTICE

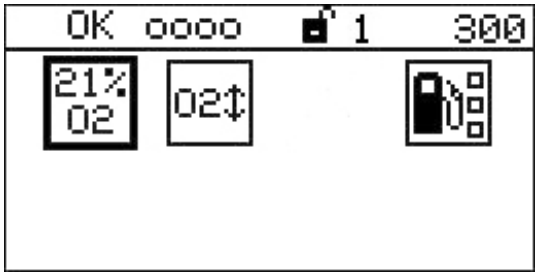
Calibration or testing with reference air is possible only with O_2 values smaller than 15 Vol.% and larger than 1 Vol. %.

NOTICE

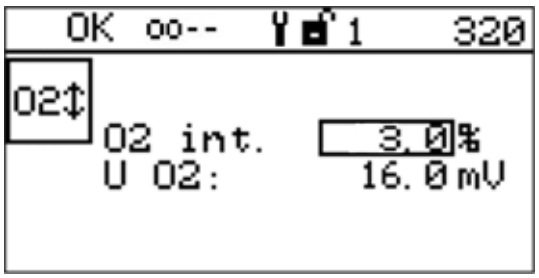
Do not perform an O_2 calibration with calibration gases ≥ 15 % O_2. Otherwise the calibration values are rejected and the warnings WH003/0 and WH004/0 are indicated.



Select  in the main menu to run the calibration.



Select O2↕ for O_2 calibration.

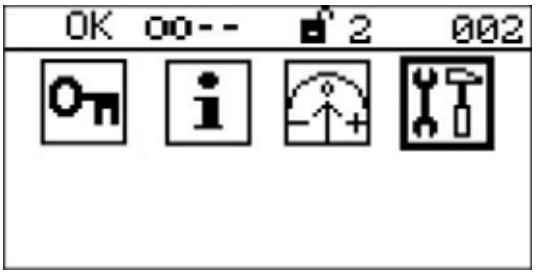


Adjust and calibrate the O_2 values with ⇨, ◇, ◆, ⇨.
Confirm the calibration within 5 s with ⇨.
Otherwise the calibration will be rejected.

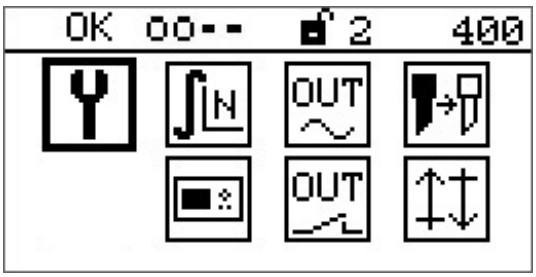
- **Deactivate MAINTENANCE mode.**

7.6 Settings

Adjusting the settings depends on the current access level. Access level 2 (service level) allows to adjust all settings.



Select in the MAIN MENU for the settings.



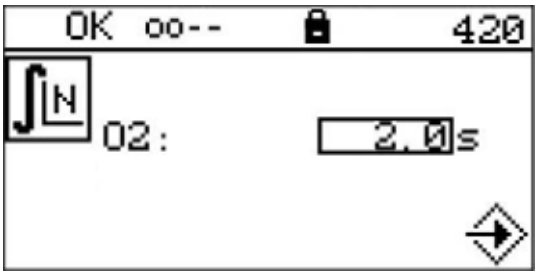
SETTINGS allows the following:

- Maintenance mode (level 0) see chapter *7.6.1 Maintenance Mode*
- Filter time for the measured values (level 0)
- Analogue outputs (level 1) see chapter *11.1.3 Conversion of the Output Range via the User Interface*
- Probe replacement (level 1)
- Display (level 0)
- Limit values (level 1)
- Digital outputs (level 2)

7.6.1 Maintenance Mode

In SETTINGS, select (see Chapter *7.4.3 Activate/deactivate Maintenance Mode*.)

7.6.2 Filter Time



Filter time of the measurement values:

No access level required.

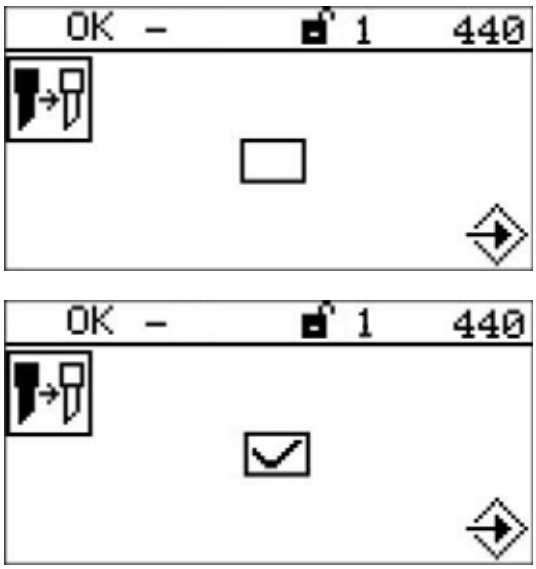
The filter time is the duration within which the measured values are averaged.

Factory setting:
O_2 measured value 2 s

7.6.3 Analogue Outputs

In SETTINGS, select for analogue outputs (see Chapter *11.1.3 Conversion of the Output Range via the User Interface*).

7.6.4 Replacing a Probe

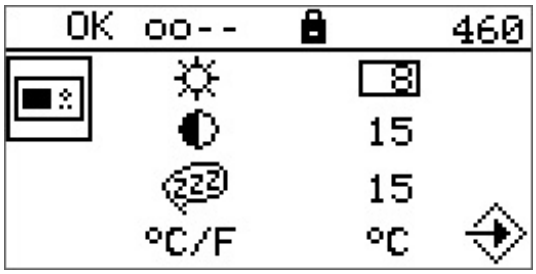


Probe replacement:

A minimum of access level 1 is required for triggering.

(See Chapter *8.2 Replacing a Probe*.)

7.6.5 Display



Display (no access level is required):

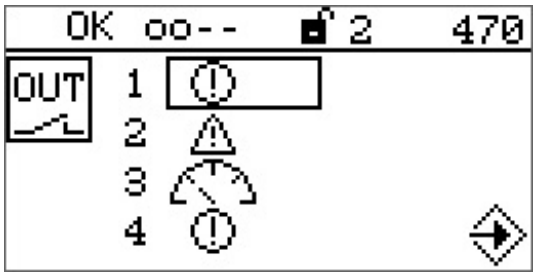
Brightness

Contrast

Time in seconds until the background lighting is shut OFF

Switch from °C to °F and vice versa

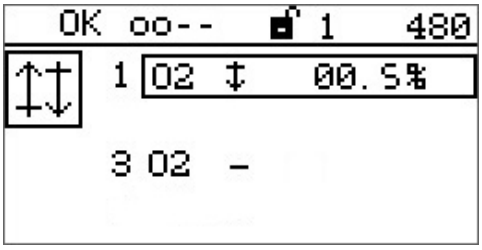
7.6.6 Digital Outputs



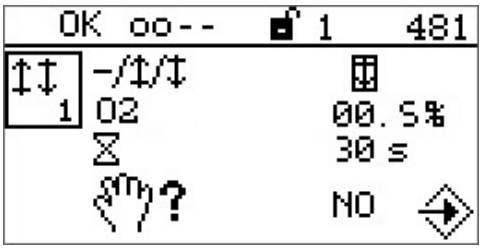
Digital outputs:
(See Chapter *11.2.2 Factory Setting of the Digital Outputs*.)
Can only be set in access level 2!

Only displayed if a digital output module exists and is parametrised.

7.6.7 Limit Values



Limit values
Click to proceed.

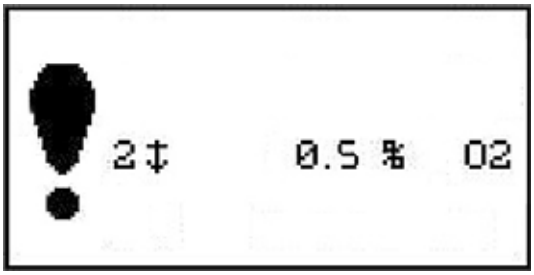


Use the keys , , , to change the limit values.

-/‡/‡	– Limit value = OFF ‡ Monitoring exceeding ‡ Monitoring undershooting
02	Setting of the limit value
⧖	Adjusting the trigger time of the limit value
	NO - Limit value is resets automatically YES - Manual acknowledgment of limit value is required (see chapter *6.4.2 Main Menu - Information*)

If a limit value is undershot/exceeded, this is indicated in the status line by a down/up arrow (see chapter *6.3 Status Line*).

In addition, the following message appears on the display:



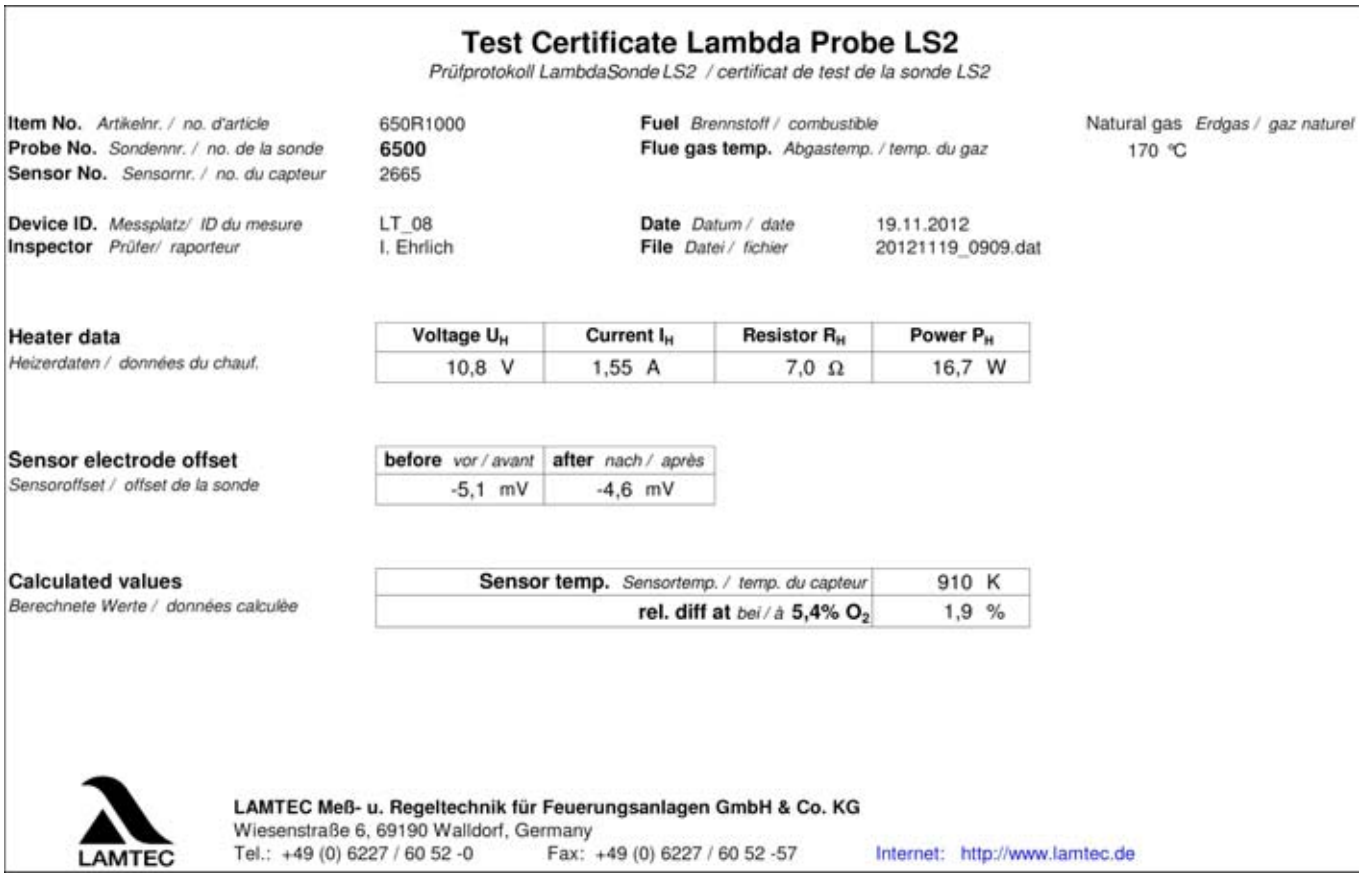
Press to return to the main menu

Limit value 2:

- Factory setting: Undershooting of 0,5 % O_2, 30 s

The value which is exceeded starts blinking in the main menu 001. Click to switch back from the main menu to the indication of the limit value. The display shows the hand symbol if the limit value needs to be quitted manually. Click ENTER to switch to the menu for acknowledge the limit value.

7.7 Test Certificate



Test Certificate Lambda Probe LS2

Prüfprotokoll LambdaSonde LS2 / certificat de test de la sonde LS2

Item No. *Artikelnr. / no. d'article*	650R1000	**Fuel** *Brennstoff / combustible*	Natural gas *Erdgas / gaz naturel*
Probe No. *Sondennr. / no. de la sonde*	**6500**	**Flue gas temp.** *Abgastemp. / temp. du gaz*	170 °C
Sensor No. *Sensornr. / no. du capteur*	2665		
Device ID. *Messplatz/ ID du mesure*	LT_08	**Date** *Datum / date*	19.11.2012
Inspector *Prüfer/ raporteur*	I. Ehrlich	**File** *Datei / fichier*	20121119_0909.dat

Heater data *Heizerdaten / données du chauf.*

Voltage U_H	Current I_H	Resistor R_H	Power P_H
10,8 V	1,55 A	7,0 Ω	16,7 W

Sensor electrode offset *Sensoroffset / offset de la sonde*

before *vor / avant*	**after** *nach / après*
-5,1 mV	-4,6 mV

Calculated values *Berechnete Werte / données calculée*

Sensor temp. *Sensortemp. / temp. du capteur*	910 K
rel. diff at *bei / à* **5,4% O_2**	1,9 %

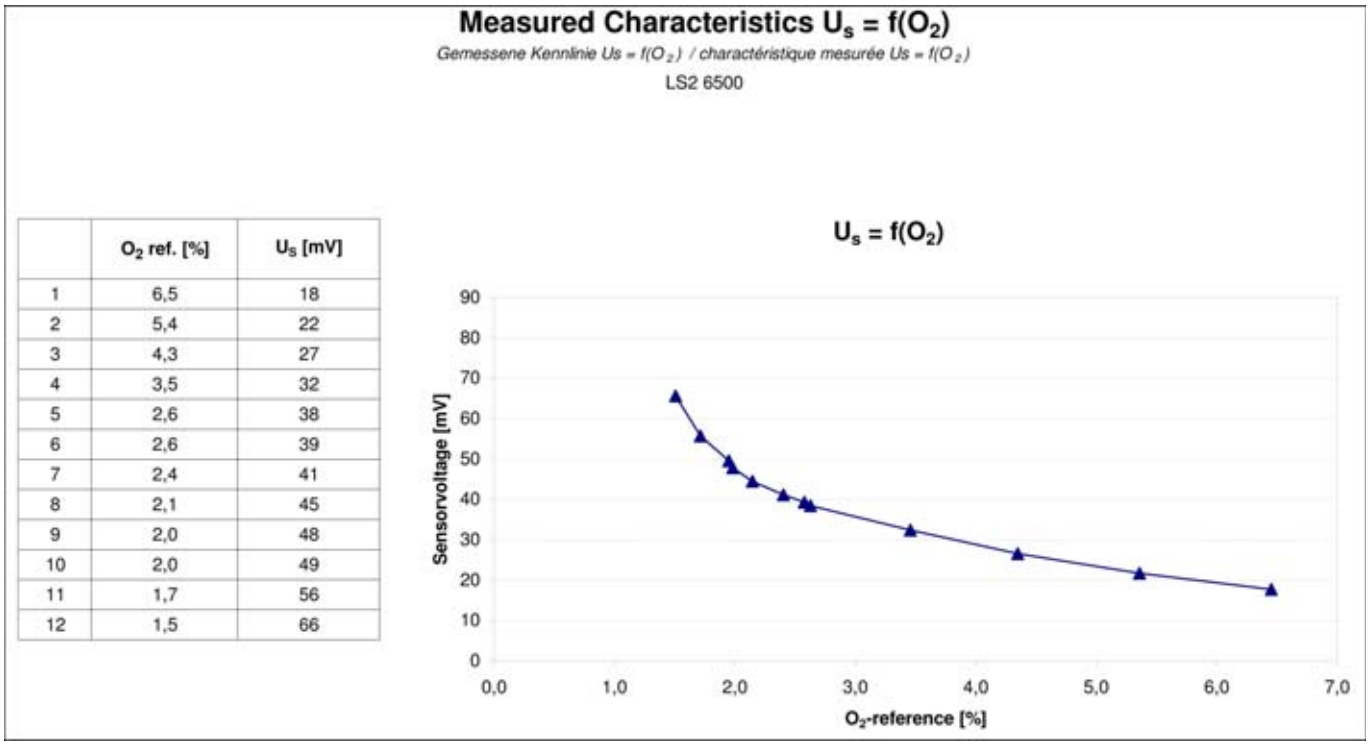
LAMTEC

LAMTEC Meß- u. Regeltechnik für Feuerungsanlagen GmbH & Co. KG
Wiesenstraße 6, 69190 Walldorf, Germany
Tel.: +49 (0) 6227 / 60 52 -0 Fax: +49 (0) 6227 / 60 52 -57 Internet: http://www.lamtec.de

Fig. 7-12 Test certificate LS2 (gas burner) page 1

NOTICE

If no reference measurement device is available, enter the value from field 'Calculated Values' in LT3 LS2 (O_2 measurement) P 220 (= 910 in this example).
This can be done with the LSB Remote Software.



	O_2 ref. [%]	U_s [mV]
1	6,5	18
2	5,4	22
3	4,3	27
4	3,5	32
5	2,6	38
6	2,6	39
7	2,4	41
8	2,1	45
9	2,0	48
10	2,0	49
11	1,7	56
12	1,5	66

Fig. 7-13 Test certificate LS2 (gas burner) page 2

7.8 Probe Certificate

Each probe has a probe certificate enclosed. This probe certificate shall be filled during commissioning. In the case of complaint or repair, you must add the probe certificate to the probe.

NOTICE

Without the probe certificate no goodwill solution.

Sondenpass
Probe certificate / Certificat de la sonde

Lambda-Sonde LS2

LAMTEC

LAMTEC Mess- u. Regeltechnik
für Feuerungsanlagen GmbH & Co.KG

Impexstr. 5, D-69190 Walldorf/Baden
Tel.-Nr.: 06227/6052-0
Fax-Nr.: 06227/6052-57
E-mail: info@lamtec.de

Sonden-Nr. *Probe no: / No. de la sonde:*

Artikel-Nr: *Article no: / No. d'article:*

Kunde *Customer / Client:*
Kunden-Nr. *Customer no. / Code client:*
Auftrags-Nr. *Order no. / No. de commande:*

Sondenpass bei Inbetriebnahme ausfüllen und im Falle einer Reparatur der Sonde beilegen.
Keine Kulanz ohne ausgefüllten Sondenpass!
Please return probe with certificate. No warranty claim without certificate.
Joindre le certificat de la sonde rempli au cas de renvoi. Sans certificat rempli, pas de réparation amiable.

Anlage
Installation
Adresse
Address / Adresse
Datum der Inbetriebnahme
Startup date / Mise en service, le
Brennstoff
Fuel / Combustible

Bitte vor Rücksendung ausfüllen *Fill in please before return / Remplir avant retour:*

Betriebsstunden
Operating hours / Heures de marche
Bemerkungen
Remarks / Remarques

8 Maintenance

As a result of extensive self-diagnosis, the measuring system is essentially maintenance-free. Maintenance is restricted to the calibration and the cleaning of dust or other deposits; as well as the cyclic replacement of the ZrO_2 measuring element.

8.1 Probe Testing and Calibration

The checking / calibration has to be built (advantageously installed) in at normal operating temperature and carried out under operating conditions.

Recommended time spans (cycles):

- 6 hours after commissioning
- 12 months for natural gas combustion systems

8.1.1 Checking/Calibrating the Air Voltage (Offset)

1. Shut down the system.

   If the system cannot be shut down the probe must be removed from the system. Respect the safety hints and warnings!
2. Pre-purge until there is no more flue gas at the measuring point (about 1 minute).
3. Finish pre-purge.
4. Perform the offset calibration of the O_2 (U-O2) electrode
   see chapter *7.5.1 Offset Calibration perform to 21 % O_2*.

8.1.2 Checking/Calibrating the O_2 Electrode

See Chapter *8.1.4 Checking/Calibrating with Reference Measurement*.

8.1.3 Checking/Calibrating with Test Gas

For the standard design of the LS2 Lambda Probe, a special testing device is required (type 650R1015).

⚠ WARNING!

Danger of burns!

If the probe is operated when removed, there is a danger of burns on the probe housing.

- ▶ Never lay the probe on flammable material and heat it up.
- ▶ Wear protective gloves

Description of the Testing Device

General Information:

The probe signals are pressure-dependent so they must be tested in a pressure-free environment. The testing device takes this into consideration and guarantees the best results in specific ranges. In exceptional cases, the pressure of the testing device must be adjusted to the pressure of the measuring point through an additional device.

Description:

The testing device is a device for the task of testing gases via the test gas connection ON (No. 4 in *Fig. 8-1 Testing device laying on the table*) onto the probes LS2 in the standard housing. The probe can be tested or calibrated by means of test gas function.

The testing device can used lying on the table or plugged into the flue gas channel (*Fig. 8-1 Testing device laying on the table* and *Fig. 8-2 Testing device plugged into flue gas channel*. For gas-tight fixing at the flue gas channel, the probe screw joints (clamping ring/screw cap) can be attached to the plug in nozzle for flue gas channel.

8 Maintenance

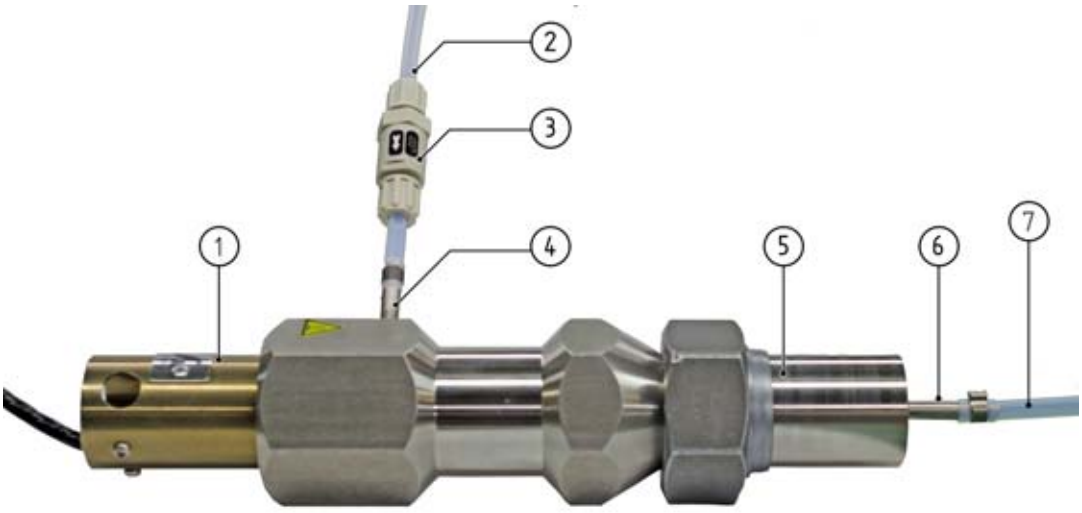


Fig. 8-1 Testing device laying on the table

1 Probe LS2, KS1, KS1D in Standard housing
2 Hose
3 Particle filter
4 Test gas connection ON
5 Plug in nozzle for flue gas channel
6 Test gas outlet
7 Hose

Fig. 8-2 Testing device plugged into flue gas channel

Test probe

1. Install probe:
   Push probe into the testing device until stop.
2. Heat up probe:
   A cold probe has to be heated up for at least 45 minutes in the installed condition. Should an already heated up probe be installed in the testing device, then wait for 15 minutes.

⚠ CAUTION!

The testing device with plugged in heated probe would get hot.

Risk of burning!

3. Test gas function:
   The test gas connection would be connected to the pressure reducer or the compressed air supply of the test gas bottle using hose or hose clamp (D_i=4; D_a=6 mm (0.236" in)). The corresponding test gas is to be given up with 2 ± 1 bar (pressure behind the bottle pressure reducer). After 2 minutes, the probe calibration and testing can take place.

NOTICE

For test gas usage of 2 bar, test gas pressure lies at 1.6 l/min and increases at 0.6 l/min per bar increase in pressure.

Table 4:Test gas matrix for testing or calibrating the respective probe

Functional check/calibration with test gas	Probe LS2
1 → Offset	A
2 → O_2	B

Table 5:Test gas composition

Test gas	Composition	
	O_2 [Vol.%]	N_2 [Vol.%]
A	21	Rest
B	3	Rest

Recommendation:
To check the O_2 electrode, use a test gas with 3 vol. % O_2 in N_2.

8.1.4 Checking/Calibrating with Reference Measurement

- The system must be in operation (ideally at the desired operating point).
- Perform the calibration as described in Chapters *8.1.2 Checking/Calibrating the O_2 Electrode* and *8.1.2 Checking/Calibrating the O_2 Electrode*.

8.1.5 Consumables

Lambda Probe → Average lifetime

– natural gas and light fuel oil: 3 ... 5 years

– with heavy fuel oil, coal and biogas: 1 ... 3 years

8.2 Replacing a Probe

⚠ WARNING!

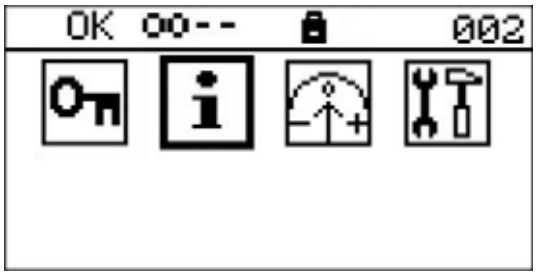
Danger of burns!

If the probe is operated when removed, there is a danger of burns on the probe housing.

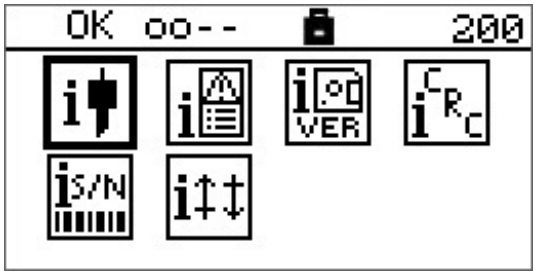
- ▶ Never lay the probe on flammable material and heat it up.
- ▶ Wear protective gloves

A probe must be replaced if:

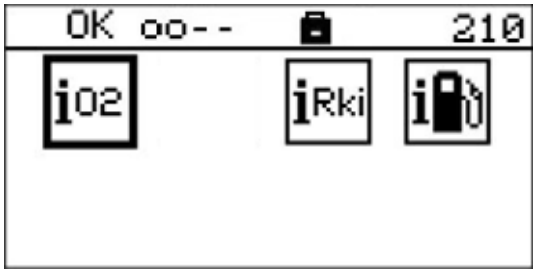
- The probe's internal resistance R_{ki}-O_2 can no longer be adjusted to values of 15 Ω (+/-5 Ω). Refer to the probe data in menu 213.
- The probe voltage U-O_2 in air reaches values of more than +20 mV or less than -30 mV. Refer to the probe data in menus 211 and 212.



Select i to switch to the Information menu.



Select i to switch to the measurement values and the probe data.

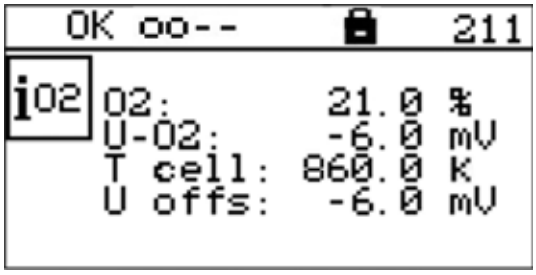


Display only:

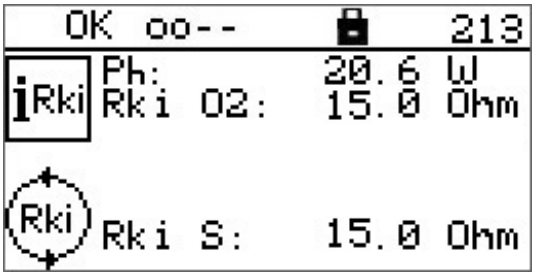
iO2 O_2 measurement values (menu 211)

iRki R_{ki} - the probe's internal resistance (menu 213)

present fuel selection



O_2 measurement values

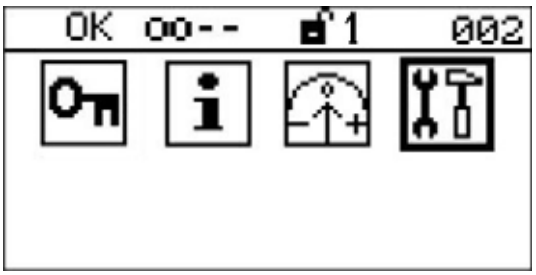


R_{ki} - the probe's internal resistance

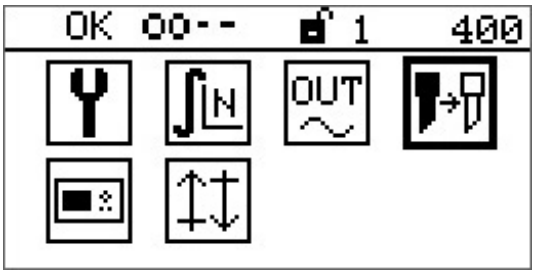
NOTICE

After replacing the probe the probe replacement process must be triggered immediately after switching on the system!

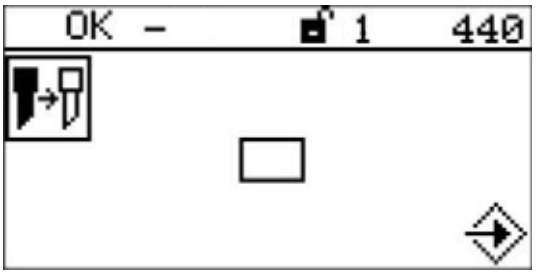
- Release level 1 or higher is required

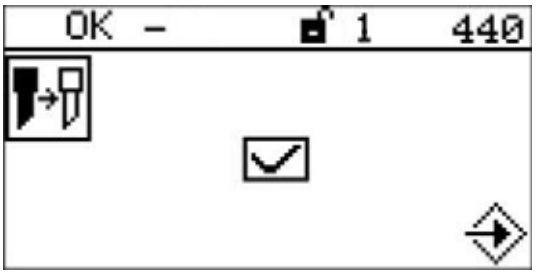


Select to switch to the settings menu.



Select to switch to the probe replacement process.





The selection with the cursor key and ENTER triggers the probe replacement process.

.

After the probe replacement process is successfully triggered the heating capacity R_{ki} is set to the default values and can be learnt by the system again.

Subsequently put the probe into operation in the same way as during initial start-up, see chapter *7 Commissioning*.

8.3 Sensor Replacement LS2-HT

⚠ WARNING!

Danger of burns!

If the probe is operated when removed, there is a danger of burns on the probe housing.

▶ Never lay the probe on flammable material and heat it up.

▶ Wear protective gloves

To replace the sensor in the LS2-HT probe a replacement kit is available.
The replacement kit includes:

- LS2-HT probe
- Seal for probe
- Filter disc
- Seal Novaphit

Sensor replacement LS2-HT (replacement)

✓ Disconnect the probe and check the connection
Check temperature of probe/sensor and if necessary cool down

🛠 Insulation slot screwdriver size 0,4 x 8 x 100 mm (0.0158x0.315x3.937" in)

🛠 Torque wrench 3,5 Nm with attachment for Allan key

🛠 Open-end wrench 24 mm (0.945" in)

🛠 Allan key 3 mm (0.118" in)

1. Loose the connection cable in the probe head *Fig. 8-3 Probe head*.
2. Loose Allan key and remove them → remove probe head *Fig. 8-4 Sensor without probe head*
3. Remove sensor and seal *Fig. 8-5 Mounting/dismounting the sensor* and *Fig. 8-6 Dismounted sensor with seal*.
4. Unscrew filter cap and remove filter *Fig. 8-7 Sensor holder with filter cap and filter*.
5. Replace filter, screw on filter cap.
6. Insert sensor with seal.
7. Put on the probe head and fasten with screws (tightening torque 3.5 Nm)

NOTICE

Please note the tightening torque 3.5 Nm!

8. Reconnect connecting cable, see Terminal socket LS2-HT up to 6/2015

NOTICE

Note the connection diagram and markings on terminal socket!

9. Close probe head.

The probe with a new sensor is ready to use.

8 Maintenance

Fig. 8-3 Probe head

Fig. 8-4 Sensor without probe head

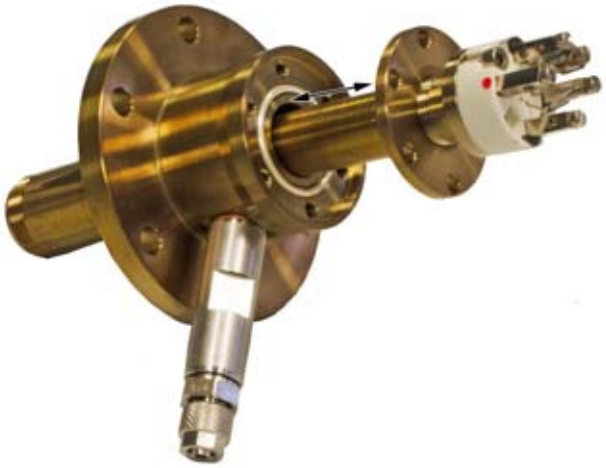
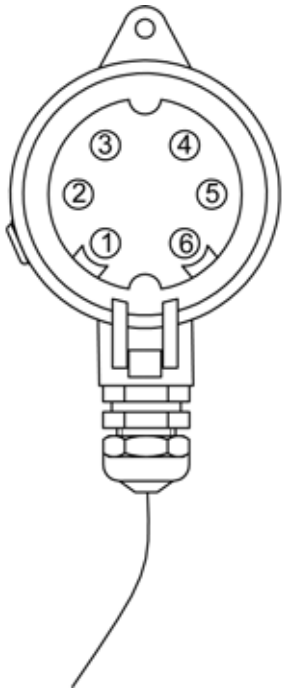


Fig. 8-5 Mounting/dismounting the sensor

Fig. 8-6 Dismounted sensor with seal

Fig. 8-7 Sensor holder with filter cap and filter



1	(+) Probe signal (black)
2	without configuration
3	Probe heating (white)
4	Probe heating (white)
5	not equipped
6	(-) Signal (grey)

Fig. 8-8 Terminal socket LS2-HT from 6/ 2015

9 Correcting Faults

9.1 Faults and Warnings

Faults and warnings are indicated by displaying the according fault and warning codes. Additionally faults are displayed by the red blinking of the “Enter’ button.

With the BACK ↖ you reach the main window 001. If the fault/warning is still active it will be displayed by a blinking symbol ⚠ in the status line of the screen. With the arrow key ◑ you can reach the fault/warning code from the main screen. A fault/warning is displayed until the according value reaches a normal state. Faults and warnings can be indicated by an optional digital output module.

F	Fault
W	Warning
H	Main processor
001	Fault number
/1	Fault probe/probe voltage trigger 1

NOTICE

For internal or not assignable faults download a dataset using the LSB Remote Software and sent it to LAMTEC for fault diagnostics.

9 Correcting Faults

9.1.1 Faults

Fault no.	Fault text
002 (HP) 102 (ÜP)	**Probe heating fault**
/1	The heater is short-circuited or has a high resistance; tolerance time of 10 s
	Help: - Check the wiring. LT3 Term. 13 and 14 → disconnect the probe - probe heating at LT3 or in SAK and measure the heater resistance between wire pos. 13 and 14 on the probe side. Resistance approx. 9 ... 10 Ω in heated state. - If not OK, exchange the probe and restart. - If OK, the fault presumably lies on the main board of LT3. If the lines of the probe heating and probe signal are mixed up during connection (possible in the case of the SAK wiring), the mother board is destroyed. Disconnect the probe and measure the heating voltage: approx. 11V
/2	Heating power more than 15 s outside of the permitted range (8W … 25 W)
	Help: Installation site too hot: the heating capacity cannot be further reduced (current actual value of R_i < 15 Ω) to reached the setpoint value of the internal resistance R_{ki} of 15 Ω or Installation site too cold: the heating capacity cannot be further increased (current actual value of R_i > 15 Ω) to reached the setpoint value of the internal resistance R_{ki} of 15 Ω. Check the value of the internal resistance R_{ki} in the display. - Trigger the probe exchange and restart the probe so that the R_{ki} of 15 Ω can be learnt again. - Check the system temperature at the installation site. - Check the probe when removed if pertinent. - Exchange → the worn probe if pertinent. - As a follow-up fault, 002/3 Heater R_i outside of 5 ... 15 Ω might be displayed.

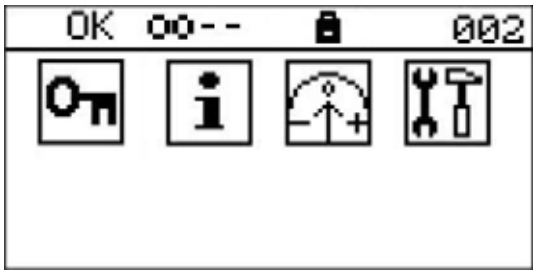
/3	Heater R_i outside of 5 ... 15 Ω Internal resistance of heater outside of the interval 5 Ω ... 15 Ω **Help:** Installation site too hot: the heating capacity cannot be further reduced (current actual value of R_i < 15 Ω) to reached the setpoint value of the internal resistance R_{ki} of 15 Ω. Check the value of the internal resistance R_{ki} in the display. - Trigger the probe exchange and restart the probe so that the R_{ki} of 15 Ω can be learnt again. - Check the system temperature at the installation site. - Check the probe when removed if pertinent. - Exchange → the worn probe if pertinent. As a follow-up fault, 002/2 Heating capacity outside of permissible interval (8 W ... 25 W) for longer than 15 s might be displayed.
/4	OFF current too high
/5	Heating control circuit open Heater controller at limit stop for longer than 30 seconds. **Help:** Check wiring between probe and LT3 (check probe signals terminals 10/11)
/6	Temperature of the O_2 sensor too high (R_{ki}-O_2 too low) For longer than 10 seconds, R_{ki}-O_2 is under 10 Ω Heater R_i outside of 5 Ω ... 15 Ω Internal resistance of heater outside of the interval 5 Ω ... 15 Ω
003 (HP) 103 (ÜP)	**Internal fault of analogue signal processing** Device defective - Contact the manufacturer. Specify the trigger for diagnostic purposes.
004 (HP) 104 (ÜP)	**Internal resistance of ceramics of the O_2 electrode**
/1	R_{ki} O_2 too high. Internal resistance of ceramics of O_2 for LT3-F over 50 Ω, tolerance time of 30 s.
/2	R_{ki} O_2 too low. Internal resistance of ceramics of O_2 under 10 Ω, tolerance time of 30 s.
	Help: If R_{ki}-O_2 for LT3-F over 50 Ω then - Probe too cold. - Internal resistance regulation not active or incorrect setpoint value. - The probe is stuck in a cold spot and the heating capacity does not suffice. Look for a new installation position. - Flow speed too high. - Heating defective and probe cold. - Sensor breakage. - Check wiring between probe and LT3 (signal terminals 10/11/12) If R_{ki}-O_2 under 10 Ω, probe is too hot, internal resistance regulation is not active, or incorrect setpoint value. The optimum operating point (setpoint value) lies at 15 Ω.

007 (HP) 107 (ÜP)	**Probe insulation** Exhaust gas temperature at probe head > 300 °C. Probe too hot. Possible wiring errors when using a SAK – Check wiring, see chapter *7.2.5.2 Probe Connection via PCB*
	Help: Remove the probe. For LS2 Standard: Extend the connection piece of the probe installation fitting and GED if necessary. Extension must not be insulated. For LS2-HT: Use intermediate flange. The intermediate flange must not be insulated.
008 (HP) 108 (ÜP)	**Intern fault: measured value comparison HP/UP** Device defective; contact the manufacturer and specify the trigger for diagnostic purposes. Possible wiring errors when using a SAK – Check wiring, see chapter *7.2.5.2 Probe Connection via PCB*
014 (HP) 114 (ÜP)	**Write the data record**
015 (HP) 115 (ÜP)	**Parameter/EEPROM fault** After a software update, the default parameters were not read in, trigger P105. Device defective. Contact the manufacturer and specify the trigger for diagnostic purposes.
016 (HP) 116 (HP)	**Internal fault/self tests** Device defective. Contact the manufacturer and specify the trigger for diagnostic purposes.

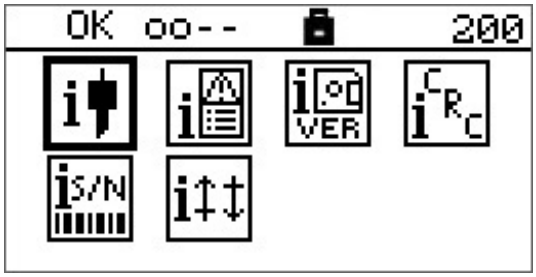
9.1.2 Warnings

Warning no.	Warning text
001 (HP) 101 (ÜP)	**O_2 offset voltage in the air too large or too small**
/1 - 29999	Trigger value of the O_2 offset voltage in the air (x0.1 mV)
003 (HP) 103 (ÜP)	**O_2 temperature too large or too small, was not assumed** invalid calibration (p. ex. with calibration gas >14,9 Vol % O_2). The new O_2 temperature is not accepted. The O_2 measurement remains/will be improper.
/1 - 29999	Trigger value of the O_2 temperature (x0.1 K)
010 (HP) 110 (ÜP)	**For LT3-F: Internal resistance of ceramics of the O_2 electrode over 45 Ω** **For LT3: Internal resistance of ceramics of the O_2 electrode over 80 Ω**
/0 - 65535	Trigger value of current internal resistance (x0.1 Ω), tolerance time of 3 seconds.
016 (HP) 116 (ÜP)	**Internal warning**
/1	Serial number, customer ID or service password reset. Contact the manufacturer.  Display if customer ID in LT3 and UI do not correspond.

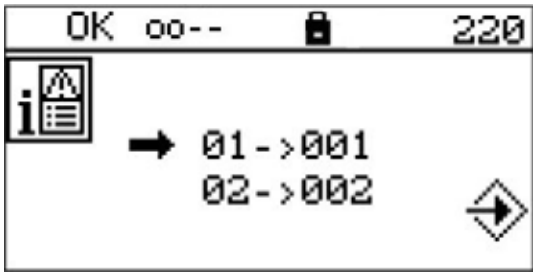
9.1.3 Call of the Fault History



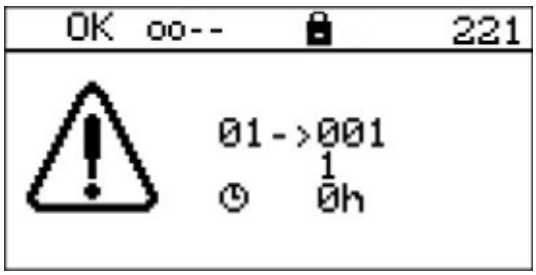
In the MAIN MENU, select for information.



In INFORMATION, select for the fault history.



Fault history



01 Number of the entry

001 Fault number of the main processor
If the fault number is displayed as "101" (+100), there is a fault in the monitoring processor.

1 Trigger 1

0h Occurs in case of ... Operating hours

For fault numbers, see Chapter *9.1.1 Faults*.

10 Decommissioning

10.1 Protection Against Emissions from Gas Carrying Channels

Recommendation in case of breaks in operation:

- With longer breaks in operation, in excess of 3 months, switch off the measuring system.
- Removal prevents damage to the probe.
- In the case of briefer breaks in operation, it is recommended that you continue to allow the measuring system to run.

The LS2 Lambda Probe is fitted directly to the gas-carrying channel via the probe installation fitting (PIF). If the LS2 Lambda Probe or the probe installation fitting (PIF) are dismantled, depending on the plant but particularly in the case of overpressure, aggressive and / or hot gas can seep out of the channel and pose a serious health hazard to an unprotected operator if suitable safety measures have not be taken previously.

⚠ WARNING!

Risk of burning due to hot gases!

In the case of overpressure and temperatures in excess of 200 °C/392 °F in the gas channel, gases could escape when dismantling the LS2 Lambda Probe or the probe installation fitting (PIF).

- ▶ Before opening, shut down the system.
- ▶ Wear suitable protective clothing and a protective mask.
- ▶ Fix respective warning information in close proximity to the mounting site.
- ▶ Immediately seal the opening again.

The LT3 Lambda Transmitter and the LS2 Lambda Probe are a high-quality, electronic measuring system. It therefore requires careful handling in all situations - decommissioning, transport and storage.

NOTICE

Do not switch off the LT3 Lambda Transmitter as long as the LS2 Lambda Probe is mounted. Not even if the associated plant has been brought to a standstill. Residual gases will cause corrosion and could damage system components.

- ▶ Do not store the device outside without any protection!
- ▶ When uninstalling, protect the ends of cables and the connectors from corrosion and soiling. Corroded connectors can cause malfunctions.
- ▶ Always store in a dry location and, if possible, keep in the original packaging.
- ▶ If possible, always transport in the original packaging.

NOTICE

The LS2 Lambda Probe is capable of being stored in a dismantled state.
This also applies if a LS2 Lambda Probe has already been in operation once.

11 Options

11.1 Analogue Outputs via LSB Module Current, alternative Voltage, LSB address 19

11.1.1 Functional Description

- Current module: 4 analogue outputs 0/4 ... 20 mA
- Voltage module: 4 analogue outputs 0/2 ... 10 VDC
- Possible to quickly wire several modules by means of strapping plugs

The LSB modules are universally applicable output modules, which are controlled via the LSB SYSTEM BUS. In the process, the module is triggered by an adjustable address (1 - 99). The statuses of the outputs are transferred in the data bytes. If an analogue output module with the same address exists in the system, the voltage / current measured there is shown on the respective output.

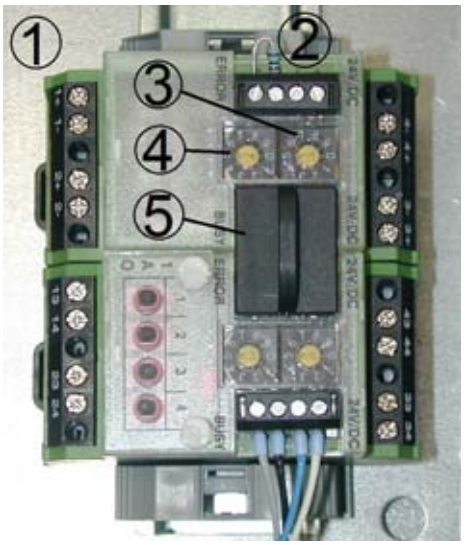
NOTICE

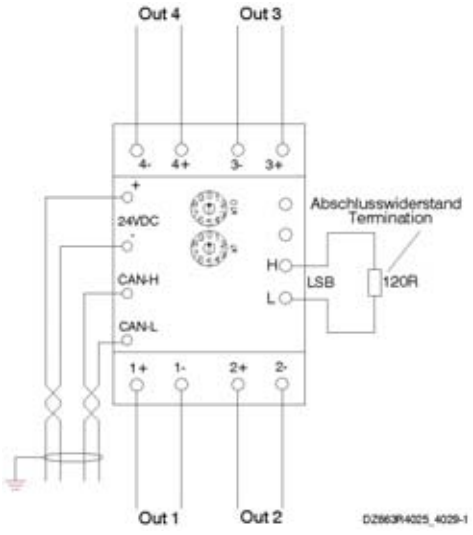
All outgoing lines from the LSB module must be shielded. The shields must be applied to the PE rail as short as possible.

NOTICE

The termination resistor (120 Ω) **must** be installed and activated on the first and the last BUS device (see Chapter *4.3 LSB Terminal Resistance*).

Avoid stub line!





1	Analogue output module
2	LSB terminal resistance, 120 Ω
3	Rotary switch for setting the tens LSB address
4	Rotary switch for setting the ones LSB address
5	Jumper plug

Terminal assignment:

1+ / 1-	Analogue output 1
2+ / 2-	Analogue output 2
3+ / 3-	Analogue output 3
4+ / 4-	Analogue output 4
24 VDC	Voltage supply for LT3 Terminals 77-/78+
CAN H/L	LAMTEC SYSTEM BUS for LT3 Terminals 74 H/75 L (see Chapter *7.2.5.4 Assignment of Internal Terminals*)

11.1.2 Factory Setting of Analogue Outputs via LSB Module

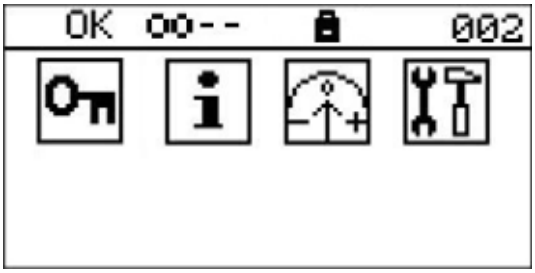
The module is activated at the factory. In case of a later installation or exchange, the LSB address 19 must be set on the module using only 2 rotary switches.

Analogue output 1 (O_2 measurement value)

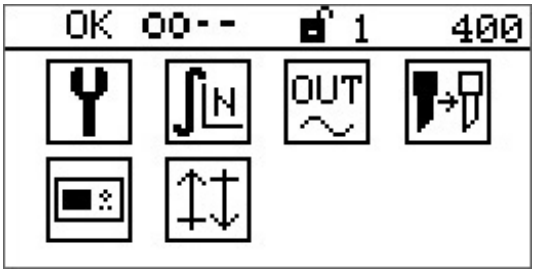
- Setting range → 0 … 25 % O_2 adjustable
- Factory setting: 0 … 10 Vol.% O_2 → 4 … 20 mA, fault 0 mA

11.1.3 Conversion of the Output Range via the User Interface

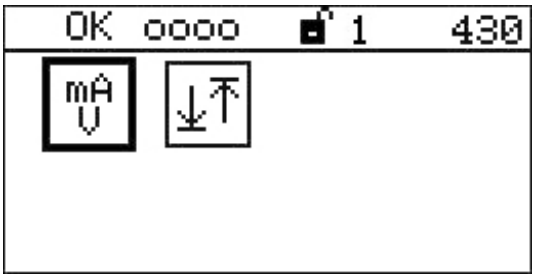
Access level 1 or higher required.



Select in the main menu to switch to the settings menu.

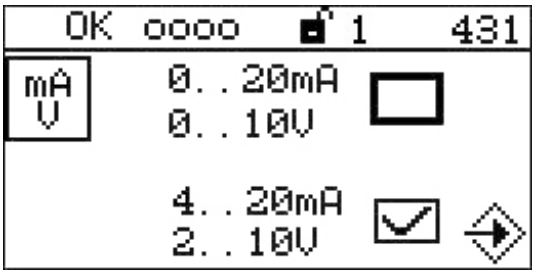


Select to switch to the analogue outputs.

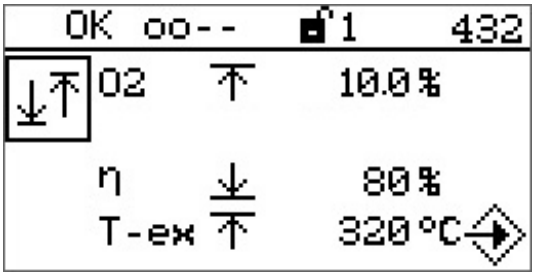


The analogue outputs menu provides the following setting options:

- Current range or voltage range
- Output range



Selection of current range or voltage range depending on the module.



Output range for:

O_2 = O_2 measurement value

η = Efficiency

T-ex = Output temperature

11.1.4 Technical Data for Analogue Output Module

Rated voltage	24 VDC
Current consumption	50 mA
Power consumption	1.2 W
Operating voltage range	0.8 ... 1.1 x nominal voltage (19.2 V ... 26.4 V)
Operating temperature range	-20 °C ... +60 °C/-4 °F ... 140 °F
Storage temperature range	-20 °C ... +70 °C/-4 °F ... 158 °F
Safety circuit	Reverse battery protection for the operating voltage
Functional display	Green LED for bus activity and supply voltage
Status display	Red LED for bus error message
Order number - voltage module	663R4025
Order number - current module	663R4029
Analogue outputs (voltage)	
Output current (10 VDC)	5 mA
Precision	1 %
Load	Max. 300 Ω/output
Output voltage	0 ... 10 VDC
Analogue outputs (current)	
Output current	0 ... 20 mA
Precision	1 %
Load	Max. 300 Ω/output
Housing	
Inlet cross section device terminals	2.5 mm^2/13 AWG
Connection cross section screwable push terminal (BUS, supply)	1.5 mm^2/15 AWG
Weight	95 g/0.21 lb
Housing dimensions (W x H x D) mm/ "in	35 x 68 x 60/1.38 x 2.8 x 2.36

11.2 Digital Outputs via LSB Module, LSB Address 03 and 51

11.2.1 Functional Description

- 4 relay outputs 250 VAC, 6 A.
- Possible to quickly wire several modules by means of jumper plugs.
- The relay outputs are activated manually using switches.

LSB modules are universally applicable output modules for DIN rail mounting. They are actuated via the LSB. The module is addressed via a settable address (1 ... 99). The data bytes transmit whether data is required or commands are to be executed.

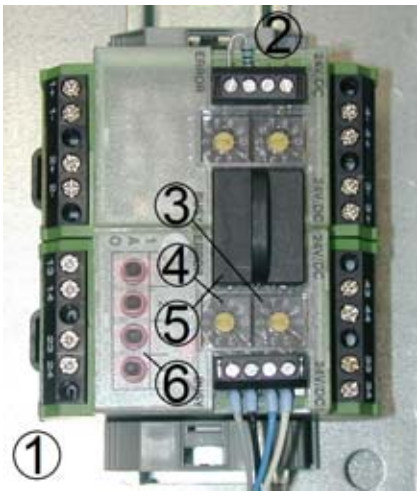
NOTICE

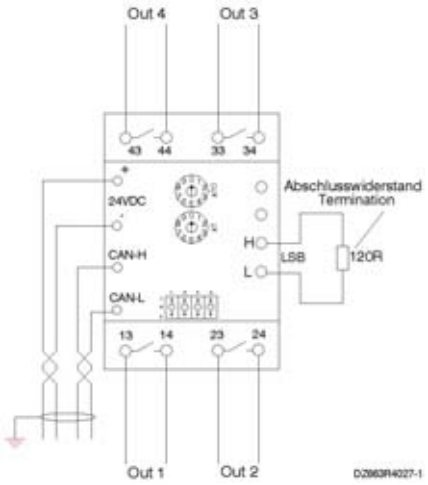
All outgoing lines from the LSB module must be shielded. The shields must be applied to the PE rail as short as possible.

NOTICE

The termination resistor (120 Ω) **must** be installed and activated on the first and the last BUS device (see Chapter *4.3 LSB Terminal Resistance*).

Avoid stub line!





		Terminal assignment:	
1	Digital output module		
2	LSB terminal resistance 120 Ω	**13/14**	Relay output 1
3	Rotary switch for setting the tens LSB address	**23/24**	Relay output 2
4	Rotary switch for setting the ones LSB address	**33/34**	Relay output 3
5	LSB Bus Connector Plug	**43/44**	Relay output 4
6	Manual activation	**24 VDC**	Voltage supply for LT3 Terminals 77-/78+
		CAN H/L	LAMTEC SYSTEM BUS for LT3 Terminals 74 H/75 L (see Chapter *7.2.5.4 Assignment of Internal Terminals*)

11.2.2 Factory Setting of the Digital Outputs

The LSB module for digital outputs 1 ... 4 is activated at the factory. In case of a later installation or exchange, the **LSB address 03** must be set on the module using only 2 rotary switches.

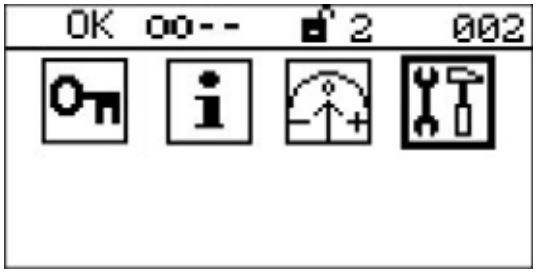
Digital output 1 Term. 13/14	Faults
Digital output 2 Term. 23/24	Warning
Digital output 4 Term. 43/44	Limit value 2 (undershooting of 0.5 vol. % O_2, 30 s)

The LSB module for digital outputs 5 ... 8 is activated at the factory. In case of a later installation or exchange, the **LSB address 51** must be set on the module using only 2 rotary switches.

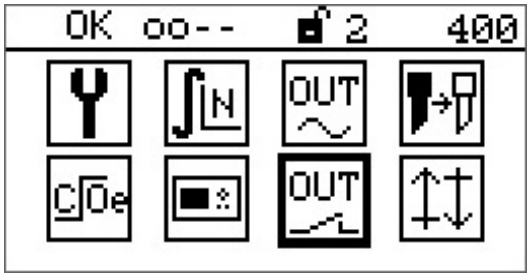
Digital output 5 Term. 13/14	Calibration
Digital output 6 Term. 23/24	Cold start
Digital output 7 Term. 33/34	Measure
Digital output 8 Term. 43/44	Maintenance

11.2.3 Settings

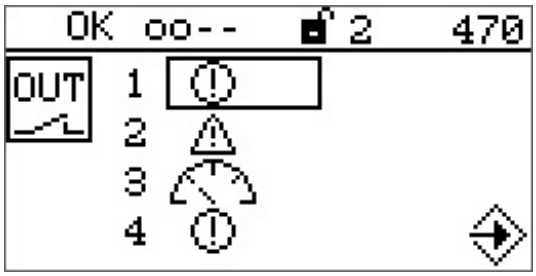
Only in access level 2 (Service)



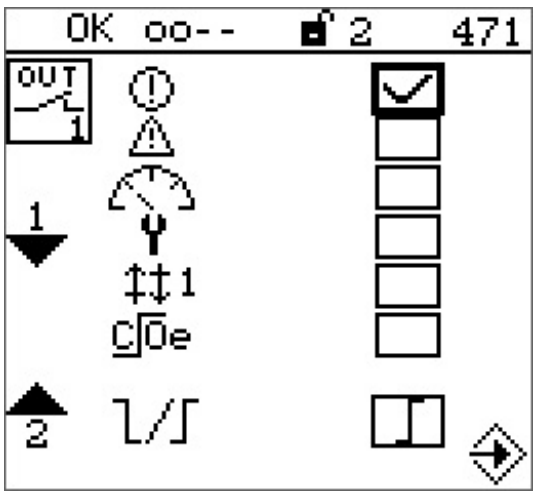
In the MAIN MENU, select to make settings.



In SETTINGS select for digital outputs.



In DIGITAL OUTPUTS select 1, 2, 3, or 4 to allocate the desired trigger to the respective digital output.



- Warning
- fault
- Calibration
- Maintenance
- Limit value
  - Limit value 1, digital output 1 only
  - Limit value 2, digital output 2 only
  - Limit value 3, digital output 3 only
  - Limit value 4, digital output 4 only
- CO edge signal
- Operating current (relay switches when the trigger is active)
- Closed-circuit current (relay switches when the trigger is not active)

11.2.4 Diagnosis of the Digital Outputs

4 LEDs above the switches indicate the switching state of the digital outputs.

NOTICE

Manual activation of the relay outputs:
Position 1 → output contact always closed
Position A → output contact switches via LSB
Position 0 → output contact always open

11.2.5 Technical Data for Digital Output Module

Rated voltage	24 VDC
Current consumption	100 mA
Power consumption	2.4 W
Operating voltage range	0.8 ... 1.1 x nominal voltage (19.2 V ... 26.4 V)
Operating temperature range	-20 °C ... +60 °C/-4 °F ... 140 °F
Storage temperature range	-20 °C ... +70 °C/-4 °F ... 158 °F
Safety circuit	Reverse battery protection for the operating voltage
Functional display	Green LED for bus activity and supply voltage
Status display	Red LED for bus error message
Precision	1 %
Response time (receive to send)	15 ms
Recovery time	550 ms
Order number	663R4027
Digital outputs	
Output contact	4 contacts, normally open
Contact material	Ag/NI
Switching voltage	max. 250 V
Inrush / breaking current max.	12 A/4 s at 10% power on time
Continuous current	6 A/relay however max. 12 A/module
Fuse protection for contacts	6 A
Mechanical life cycle	1 x 10^7 switch play
Electrical life cycle	1 x 10^5 switch play
Permissible switching rate	360/h at nominal load
Insulation in accordance with VDE 0110	C
Rated voltage	250 V
Overvoltage category	II
Degree of pollution	2
Test voltage coil / contact	4000 VAC 50 Hz 1 min
Test voltage contact / contact	1000 VAC 50 Hz 1 min
Housing	
Type of protection (EN 60529)	Housing IP50 terminals IP20
Inlet cross section device terminals	2.5 mm^2/13 AWG
Connection cross section screwable push terminal (BUS, supply)	1.5 mm^2/15 AWG
Weight	95 g/0.21 lb
Housing dimensions (W x H x D) mm/ " in	35 x 68 x 60/1.38 x 2.8 x 2.36

11 Options

11.3 Digital Inputs via the LSB Module, LSB Address 11 and 55

11.3.1 Functional Description

- 4 floating digital inputs per module
- 8 digital inputs possible (2 modules)
- The digital inputs are activated manually using switches.

LSB modules are universally applicable output modules for DIN rail mounting. They are actuated via the LSB. The module is addressed via a settable address (1 ... 99). The data bytes convey whether data is required or commands are to be executed.

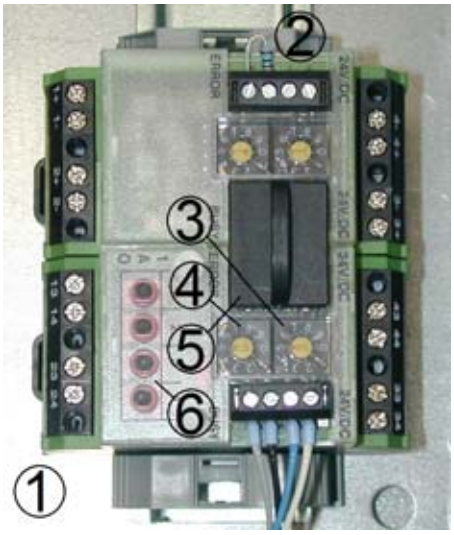
NOTICE

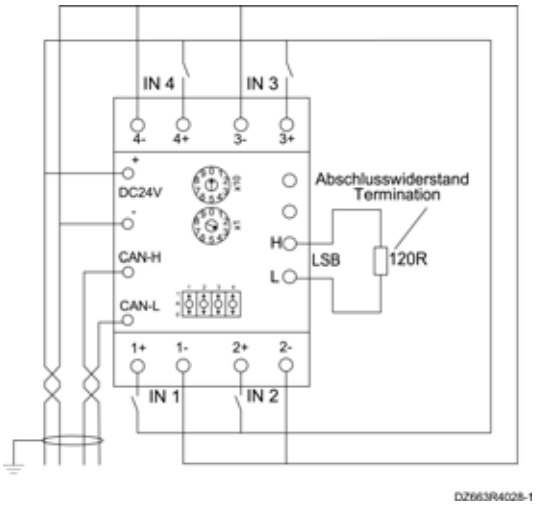
All outgoing lines from the LSB module must be shielded. The shields must be applied to the PE rail as short as possible.

NOTICE

The termination resistor (120 Ω) **must** be installed and activated on the first and the last BUS device (see Chapter *4.3 LSB Terminal Resistance*).

Avoid stub line!





1	Digital input module Input 1 ... 4, address 11 Input 5 ... 8, address 55	Terminal assignment:	
2	LSB terminal resistance, 120 Ω	**1+/1-**	Digital input 1
3	Rotary switch for setting the tens LSB address	**2+/2-**	Digital input 2
4	Rotary switch for setting the ones LSB address	**3+/3-**	Digital input 3
5	Jumper plug	**4+/4-**	Digital input 4
6	Manual activation	**24 VDC**	Power supply for LT3 Terminals 77-/78+
		CAN H/L	LAMTEC SYSTEM BUS for LT3 Terminals 74 H/75 L

11.3.2 Factory Settings of the Digital Inputs

Digital input 1	Trigger OFFSET CALIBRATION
Digital input 2	RESET FAULT
Digital input 4	DEACTIVATION LIMIT VALUE 1 ... 4
Digital input 5	RESET LIMIT VALUE 1 ... 4
Digital input 8	DEACTIVATION CALIBRATION

NOTICE

Manual activation of the relay outputs:
Position 1 → input always activated
Position A → input switches via external contact with 24 VDC
Position 0 → input always deactivated

11.3.3 Diagnosis of the Digital Inputs

4 LEDs above the switches indicate the switching state of the digital outputs.

11.3.4 Technical Data for Digital Input Module

Rated voltage	24 VDC
Power consumption	100 mA
Power consumption	2.4 W
Operating voltage area	0.8 ... 1.1 x nominal voltage (19.2 V ... 26.4 V)
Operating temperature range	-5 °C ... +60 °C/23 °F ... 140 °F
Storage temperature area	-20 °C ... +70 °C/-4 °F ... 158 °F
Safety circuit	Reverse battery protection for the operating voltage
Functional display	Green LED for bus activity and supply voltage
Status display	Red LED for bus error message
Precision	1 %
Response time (receive to send)	15 ms
Item number	663R4028
Digital inputs	
Input voltage	30 VDC
Input current (24 VDC control input)	6 mA
High signal recognition	> 7 VDC
Low signal recognition	< 3 VDC
Recovery time	550 ms
Housing	
Type of protection (EN 60529)	Housing IP50 terminals IP20
Inlet cross section device terminals	2.5 mm^2/13 AWG
Area of relative air humidity (IEC60721-3-3)	Ambient class 3k3
Connection cross section screwable push terminal (BUS, supply)	1.5 mm^2/15 AWG
Weight	95 g/0.21 lb
Housing dimensions (W x H x D) mm/"in	35 x 68 x 60/1.38 x 2.8 x 2.36)

11.4 Technical Data for HART Module

Setting of LSB address not necessary.

11.4.1 Functional Description

- Current module: 2 analogue outputs 0/4 ... 20 mA
- HART communication (SLAVE) via analogue output 1

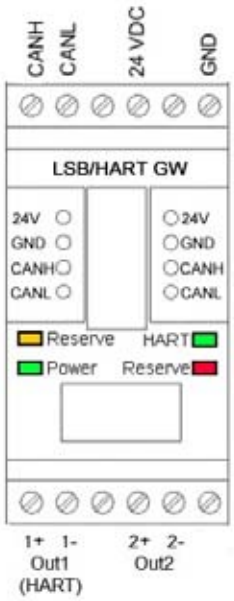
NOTICE

All outgoing lines from the HART module must be screened. The screens must be applied to the PE rail as short as possible.

NOTICE

The termination resistor (120 Ω) **must** be installed and activated on the first and the last BUS device (see Chapter *4.3 LSB Terminal Resistance*).

Avoid stub line!



Terminal assignment:

1+ / 1-	Analogue output 1 and HART communication (SLAVE)
2+ / 2-	Analogue output 2
24 VDC	Voltage supply for LT3 Terminals 77-/78+
CAN H/L	LAMTEC SYSTEM BUS for LT3 Terminals 74 H/75 L

11.4.2 HART Commands and DIP Switch Settings

See separate documentation.

11.4.3 Technical Data

Rated voltage	24 VDC
Current consumption	8 mA
Power consumption	2 W
Operating voltage range	19.2 ... 26.4 VDC
Operating temperature range	-20 °C ... +60 °C/ -4 °F … +140 °F
Storage temperature range	-20 °C ... +70 °C/ -4 °F … +158 °F
Display	LED for CAN, HART, STATUS, ERROR
Order number	657R5930
Analogue outputs (current)	
Output current	4 ... 20 mA
Precision	0.2 %
Load	max. 150 Ω
HART	
Signal	Output via analogue output 1 (O_2)
Load	230 ... 1,100 Ω
Measurement range O_2 loop	Adjustable by DIP switches in the following ranges: - 0 ... 10 vol. % O_2 (factory setting) - 0 ... 21 vol. % O_2 - 0 ... 25 vol. % O_2 The DIP switches must be set to 0 if the customer specific range selection shall be set by HART.
Housing	
Inlet cross section device terminals	2.5 mm^2/13 AWG
Weight	95 g/0.21 lb
Housing dimensions (W x H x D) mm/"	35 x 68 x 60/1.38 x 2,68 x 2,36

11.5 Field Bus Module for PROFIBUS PBM100

The burner control system communicates via LAMTEC SYSTEM BUS (LSB) with its modules consistently. PROFIBUS module PBM100 integrates LAMTEC burner control system into field bus environment (PROFIBUS). PBM100 listens for different, measured process values on LSB, processes these signals and transfers them to field bus.

Setting of LSB address not necessary.

11.5.1 DIP Switch

Use DIP switches to configure settings of PBM100.

Functions of DIP switches

<table>
<tr><th colspan="3">DIP switches 1 - 7</th></tr>
<tr><td rowspan="2"> 
</td><td>1</td><td>Binary coded PROFIBUS DP address
Switch no. 1 = bit 6
Switch no. 7 = bit 0</td></tr>
<tr><td>0</td><td>Example:
<table><tr><th colspan="7">DIP-Switch</th><th>Address</th></tr><tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th></th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>27</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>109</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>127</td></tr></table></td></tr>
</table>

LSB family is set by DIP switch 8-9.

DIP switch 8	DIP switch 9	LSB family
0	0	1
0	1	2
1	0	3
1	1	4

DIP switch 10	
0	CAN terminal resistance inactive
1	CAN terminal resistance active

11.5.2 LEDs

PBM100 has 4 LEDs which are connected as described below:

LED	Colour	Description
PWR	green	**ON:** Module working in normal mode = fully initialised and without any fault.
CAN	green	**OFF:** No communication or CAN BUS error **Blinking with 2 Hz:** Errors (optional, if a CAN warning is detectable) **ON:** CAN is ready.
PB	green	**OFF:** no communication via PROFIBUS DP **ON:** communication without error via PROFIBUS DP
ERR	red	**OFF:** no errors **ON:** PBM100 Initialisation incomplete or not yet successfully completed or CAN message missing for more than 3 s.

11.5.3 Technical Data PBM100

PBM100	
Power supply	24 VDC +10/-15% via bus terminals
Current consumption	100 mA
Housing	PA6.6 UL94-V0 Cover: Polycarbonate, transparent
Installation	Support rail TH35 according to EN 60715
Dimensions (HxWxD)	72x51x70 mm (2.83"x2.01"x2.76" in)
Weight	105 g (0.23 lb)
Flammability	UL-94 V0 (panel: UL-94 V2)
Lengths of cable	Supply 24 VDC <10 m (32.81 ft) LSB: max. 100 m (328.08 ft) (screened) PROFIBUS DP: 100 m (328.08 ft) (screened)

Environmental conditions		
Operation:	Climatic condition	class 3K5 as per DIN EN 60721-3
	Mechanical condition	class 3M5 as per DIN EN 60721-3
	Temperature range	-20 ... +60 °C (-4 °F ... +140 °F) (condensation not permitted)
Transport:	Climatic condition	class 2K3 as per DIN EN 60721-3
	Mechanical condition	class 2M2 as per DIN EN 60721-3
	Temperature range	-20 ... +70 °C (-4 °F ... +158 °F) (condensation not permitted)
Storage:	Climatic condition	Class 1K3 as per DIN EN 60721-3
	Mechanical condition	Class 1M2 as per DIN EN 60721-3
	Temperature range	-20 ... +70 °C (-4 °F ... +158 °F) (condensation not permitted)
Protection class:	according to DIN EN60529	IP40 (housing) IP20 terminals

NOTICE

The limits of the technical data must be strictly adhered to.

11.5.4 PROFIBUS DP Communication

11.5.5 Communication Appendix

Bit encoding: Status of the digital outputs of the LSB module

Digital outputs	Active (bit encoding)
1	0x01
2	0x02
3	0x04
4	0x08

ID of the LSB modules: Set the address with the rotary switches

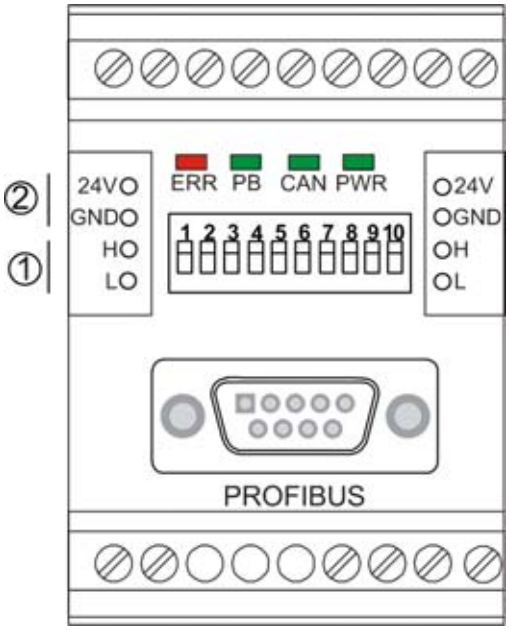
LSB module no.	LSB family				BT300 support before release 3.3
	1	2	3	4	
Digital module 1	3	2	1	0	✗
Digital module 2	7	6	5	4	✗
Digital module 3	11	10	9	8	✗
Digital module 4	15	14	13	12	✗
Digital module 5	19	18	17	16	✗
Digital module 6	23	22	21	20	✗
Digital module 7	27	26	25	24	✗
Digital module 8	31	30	29	28	✗
Digital module 9	35	34	33	32	✗
Digital module 10	39	38	37	36	✗
Digital module 11	43	42	41	40	✗
Digital module 12	47	46	45	44	✔
Digital module 13	51	50	49	48	✔
Digital module 14	55	54	53	52	✔
Digital module 15	59	58	57	56	✗
Digital module 16	63	62	61	60	✗

Bit encoding of LT3 device status

Active (bit encoding)	Explanation
0x0001	Measurement
0x0002	Heating up
0x0003	Calibration
0x0004 ... 0x0100	Not assigned, invalid
0x2000	Maintenance
0x4000	Warning
0x8000	Fault

11.5.6 External Connection

Terminals may not be connected!



1 CAN/LSB

2 DC power supply (safety extra low voltage)

Terminals may not be connected!

NOTICE

It is prohibited to use the terminals!

Recommendation for line lengths and line cross-sections of the LAMTEC SYSTEM BUS:

- 0 - 40 m (0 ... 131.23 ft) 2 x 2 x 0.34 mm^2 (2 x 2 x AWG 21), cabled in pairs with screening, impedance 120 Ω
- 40 - 300 m (131.23 ft ... 984.25 ft) 2 x 2 x 0.5 mm^2 (2 x 2 x AWG 20), cabled in pairs with screening, impedance 120 Ω
- 300 - 500 m (984.25 ft ... 1640.42 ft) 2 x 2 x 0.75 mm^2 (2 x 2 x AWG 18), cabled in pairs with screening, impedance 120 Ω

Example cable type for fixed installation:

- LAPP cable 2170267 (LAMTEC article no.: 05L05 2 x 2 x 0.5).
- HELU cable 800685.

Specification of the PB master input data

The following specifies the input data which the PBM transfers to the master:

Byte position*	Designation	Configuration
5, 6	O_2 actual value	O_2 display value, uint16 value in [ppm], for status, see CO_e
9, 10	O_2 sensor voltage raw	Electrode voltage 2, integer 16 value in [1mV]
13, 14	LT3 status	Device status bit-encoded
15, 16	Warning word 1	LT warnings bit-encoded, Bit [0 ... 15] for each warning 1 ... 16
17, 18	Warning word 2	LT warnings bit-encoded, Bit [16 ... 31] for each warning 17 ... 32
19, 20	Fault word 1	LT faults bit-encoded, Bit [0 ... 15] for each warning 1 ... 16
21, 22	Fault word 2	LT faults bit-encoded, Bit [16 ... 31] for each warning 17 ... 32

* Byte-counting starting at 1

Specification of the PROFIBUS master output data

The following describes the assignment of the output data received by the PBM from the PROFIBUS master.

NOTICE

If the PROFIBUS module is used with a BT300 with software version 3.3 or lower, only specially selected LSB digital modules can be used (see the LSB module ID table in Chapter *11.5.5 Communication Appendix*).

Byte position*	Designation/Configuration
1, 2	Fault/warning reset Execution when changing the byte 1, 2 to 0x55AA → 0xAA55 0xAA55 → 0x55AA
3	ID (number) of the digital module 1 ...16**
4	Bit encoding of the digital outputs to be set Bit [0 ... 3] → digital outputs 1 ... 4 (refer to the bit encoding status of the digital outputs of the LSB module table in Chapter *11.5.5 Communication Appendix*).

* Byte-counting starting at 1

** Enter the number of the digital module (1 ... 16), and set the address according to the number and LSB family using the rotary switch on the LSB module.

11.6 LSB Module for Calculating Combustion Efficiency

Setting of LSB address not necessary.

11.6.1 Functional Description

Properties:

- Two Pt100 temperature inputs to record the flue gas temperature and inlet temperature
- Two analogue outputs 0/4 ... 20 mA to emit the flue gas temperature and efficiency
- Power supply 24 VDC/50 mA (PELV)

NOTICE

All outgoing lines from the LSB module must be shielded. The shields must be applied to the PE rail as short as possible.

Description of function

The calculation takes place according to the following formula:

nF in % = $(1-q_A)*100\%$

q_A = flue gas loss

$q_A = (t_{air} - t_{ex}) * [(A_2/ (21 – O_2)) + B]$ with the oxygen content in the exhaust gas in Vol. % O_2 with the intake air temperature t_{air} and the flue gas temperature t_{ex} each in °C as well as with the fuel-specific factors

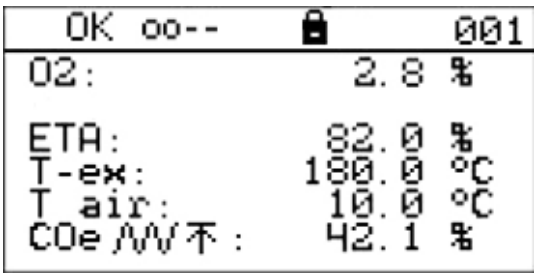
for oil: A_2 = 0.68; B = 0,007

for gas: A_2 = 0.66; B = 0,009

Function not effective until < 14.9 Vol. % O_2

It is assumed that the combustion takes place free of CO and soot

Display:



ETA efficiency 0 ... 100%

T-ex flue gas temperature
0 ... 400 °C/32°F ... 752 °F

T air inlet air temperature
0 ... 400 °C/32°F ... 752 °F

NOTICE

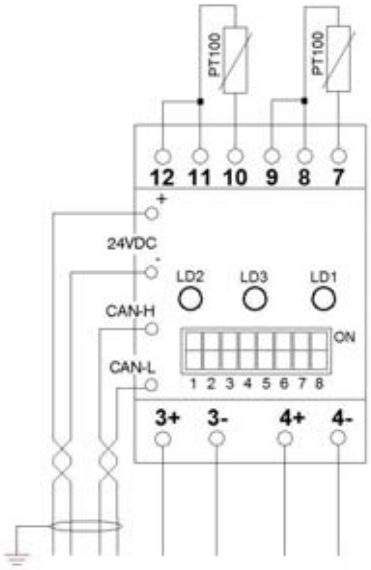
In case of overflow/underflow of the measuring range, the corresponding measured values flash.

NOTICE

The termination resistor (120 Ω) **must** be installed and activated on the first and the last BUS device (see Chapter *4.3 LSB Terminal Resistance*).

Avoid stub line!

The terminal resistance can be set via DIP switch 1.



Terminal assignment:

10 / 11 / 12 Pt100 temperature input for recording the flue gas temperature 0 ... 400 °C/ 32 °F ... 752 °F

7 / 8 / 9 Pt100 temperature input for recording the inlet temperature 0 ... 400 °C/ 32 °F ... 752 °F

3+ / 3- Analogue output 3 efficiency
Factory setting: 80 ... 100 % → 4 ... 20 mA

4+ / 4- Analogue output 4 (flue gas temperature)
Factory setting: 0 ... 400 °C/32 °F ... 752 °F → 4 ... 20 mA

DIP switch settings

DIP switch 1
LSB terminal resistance 120 Ω

ON active (terminal device)

DIP switch 1
LSB terminal resistance 120 Ω

OFF not active

DIP switches 2 and 3
LSB device family 1 (Standard)

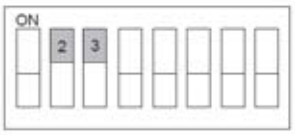
2 OFF → 3 OFF

DIP switches 2 and 3
LSB device family 3

2 ON → 3 OFF

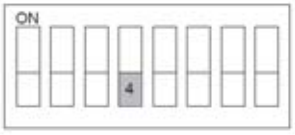
DIP switches 2 and 3
LSB device family 2

2 OFF → 3 ON



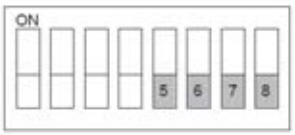
DIP switches 2 and 3
LSB device family 4

2 ON → 3 ON



DIP switch 4
Operating mode

OFF → normal mode ON
→ Do not use the programming mode



DIP switch 5 - 8

Not assigned

LED status

LED 1 red→ERROR

OFF	Normal mode
ON	Initialisation not yet performed or not successfully ended (e.g., because the module could not be initialised).
	No message has been received for at least 3 seconds.

LED 2 green→POWER

ON	Module completely initialised and without error.

LED 3 green→CAN

OFF	CAN controller in bus OFF. No communication possible.
FLASHING	The CAN controller has discovered temporary faults. After the problem is remedied, the LED continues too flash for a while.
ON	CAN is ready for operation.

11.6.2 Technical Data

11.6.2.1 LSB Module for Calculating Combustion Efficiency

Input data	
Rated voltage $_{UN}$	+24 VDC
Current consumption	50 mA
Power consumption	1.2 W
Operating voltage range	0.8 ... 1.1 x nominal voltage (19.2 V ... 26.4 V)
Operating temperature range	-5 °C ... +60 °C/23 °F ... 140 °F
Storage temperature range	-20 °C ... +70 °C/-4 °F ... 158 °F
Functional display	Green LED for bus activity and supply voltage
Status display	Red LED for bus error message
Order number	657R5940
Analogue outputs (current)	
Output current	4 ... 20 mA
Precision	1%
Load	max. 300 Ω
Analogue inputs (P100)	
Measuring range	0 ... 400 °C/32 °F ... 752 °F
Connecting method	3-wire
Housing	
Inlet cross section device terminals	2.5 mm^2/13 AWG
Connection cross section screwable push terminal (BUS, supply)	1.5 mm^2/15 AWG
Weight [kg/lb]	0.095/0.21
Dimensions (HxWxD) [mm]	35 x 68 x 60 mm/1.38 x 2.8 x 2.36

11.7 External Connection

NOTICE

With an external connection of the LSB modules, this must also be supplied with external voltage. The module can be stacked without clearance between each module. After stacking 15 modules, start again with the external supply voltage.

1. Fit the LSB module at the desired position.
   In the case of several modules, connect these with the help of the enclosed jumper plugs.
2. Connect the LSB module to the external voltage supply (24 VDC) and to LSB.
   Term. 72/74 → CAN-H
   Term. 73/75 → CAN-L
   Kl.71 → Connect CAN GND to the external power supply OV.
3. Set address at the module

LSB-Module with 4 analogue outputs, order no. 663R4025 or
663R4029 LSB-Module address 19

LSB-Module with 4 digital outputs, order no. 663R4027
LSB-Module address 03 for output 1 ... 4
LSB-Module address 51 for output 5 ... 8

LSB-Module with 4 digital inputs, order no. 663R4028
LSB-Module address 11 for input 1 … 4
LSB-Module address 55 for input 5 ... 8

HART-Module with 2 analogue outputs, order no. 657R5930 (not LT3-F)
Setting of the LSB-Module address not necessary

Efficiency-Module with 2 analogue in- and outputs, order no. 657R5940
Setting of the LSB-Module address not necessary

PROFIBUS DP-Module, order no. 657R5950 (not LT3-F)
Setting of the LSB-Module address not necessary

Recommendation for line lengths and line cross-sections of the LAMTEC SYSTEM BUS:

- 0 - 40 m (0 ... 131.23 ft) 2 x 2 x 0.34 mm^2 (2 x 2 x AWG 21), cabled in pairs with screening, impedance 120 Ω
- 40 - 300 m (131.23 ft ... 984.25 ft) 2 x 2 x 0.5 mm^2 (2 x 2 x AWG 20), cabled in pairs with screening, impedance 120 Ω
- 300 - 500 m (984.25 ft ... 1640.42 ft) 2 x 2 x 0.75 mm^2 (2 x 2 x AWG 18), cabled in pairs with screening, impedance 120 Ω

Example cable type for fixed installation:

- LAPP cable 2170267 (LAMTEC article no.: 05L05 2 x 2 x 0.5).
- HELU cable 800685.

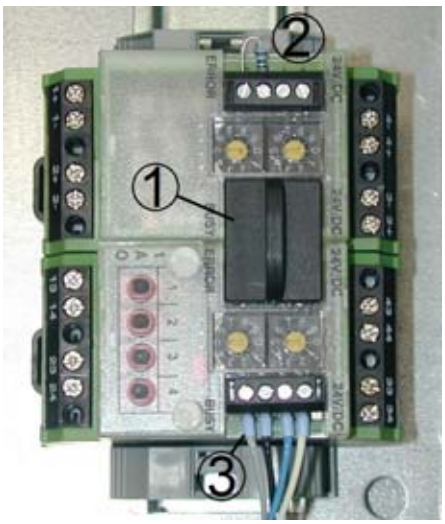
NOTICE

All outgoing lines from the LSB module must be shielded. The shields must be applied to the PE rail as short as possible.

NOTICE

The termination resistor (120 Ω) **must** be installed and activated on the first and the last BUS device (see Chapter *4.3 LSB Terminal Resistance*).

Avoid stub line!



1 LSB Bus Connector Plug
2 LSB terminal resistance 120 Ω
3 Connecting terminals for
- Power supply
- LAMTEC SYSTEM BUS

11.7.1 Commissioning of the Additional Modules

Checking the module

- Ensure that the CAN LOW and CAN HIGH, as well as the 24V voltage supply, are connected correctly.
- Make sure that a terminal resistance of 120 Ω is set at the free connecting point between CAN LOW and CAN HIGH (see Chapter *4.3 LSB Terminal Resistance*).
- Setting the address on the module (tens at the top, ones at the bottom)
  – LSB module with 4 analogue outputs: LSB address "19"
  – LSB module with 4 digital outputs: LSB address "03"
  – LSB module with 4 digital inputs: LSB address "11"
  – Modules for calculating the efficiency or field bus connection do not require an own LSB address
- With digital modules, the switches of the manual operating levels must be set to "A."

After switching on, you should see the following status

- Red LED off on the LSB module
- Green LED flashes on the LSB module

If not, consider the following problem solutions

- No LED on the LSB module lit
  – No 24V supply
- Green LED on the LSB module constantly lit, red LED flashes
  – LSB module without address
  – No or incorrect parameters activated
- Green and red LED on the LSB module constantly lit
  – Incorrect address set on the LSB module

NOTICE

If the LT3 is being used for O_2 control or the LT3-F for CO/O_2 control, it may happen, that the connected LSB-modules are not be controlled correctly. The LSB modules start to flash red and the output values are disturbed.

To avoid this, the ETAMATIC or when FMS/VMS then the connected communications processor board/field bus module requires a software update to the latest version.

Please check the version before commissioning.

Shown on the ETAMATIC:	Using PC software for remote control → view → version → **Software Version Communication Processor** Software-EPROM on processor board in ETAMATIC
Shown on the FMS/VMS: or	Check on the label **Software** printed on the outside of the housing of communications processor board / field bus module
Using PC software for remote control → view → version →	**Software Version Secondary Communication Processor** Software-EPROM in communications processor board/ field bus

Function up from software version for communication processor for LSB:

When ETAMATIC / ETAMATIC OEM:	B9w001, up from April 2015
When communication processor / PROFIBUS connection for FMS/VMS	A9xxx, up from November 2011
When MODBUS connection RTU for FMS/VMS:	M9xxx, up from April 2015
When MODBUS connection TCP for FMS/VMS:	E9xxx, up from June 2011

If you have any questions, please contact support@lamtec.de or phone +49 6227 605233.

12 Storage

12.1 Storage Conditions

NOTICE

- Do not store the device outside without any protection!
- When uninstalling, protect the ends of cables and the connectors from corrosion and soiling. Corroded connectors can cause malfunctions.
- Always store in a dry location and, if possible, keep in the original packaging.
- If possible, always transport in the original packaging.
- Transport and storage: -20 °C up to +70 °C/-4 °F up to 158 °F.

13 Disposal Notes

13.1 Environmental Protection, Waste Disposal

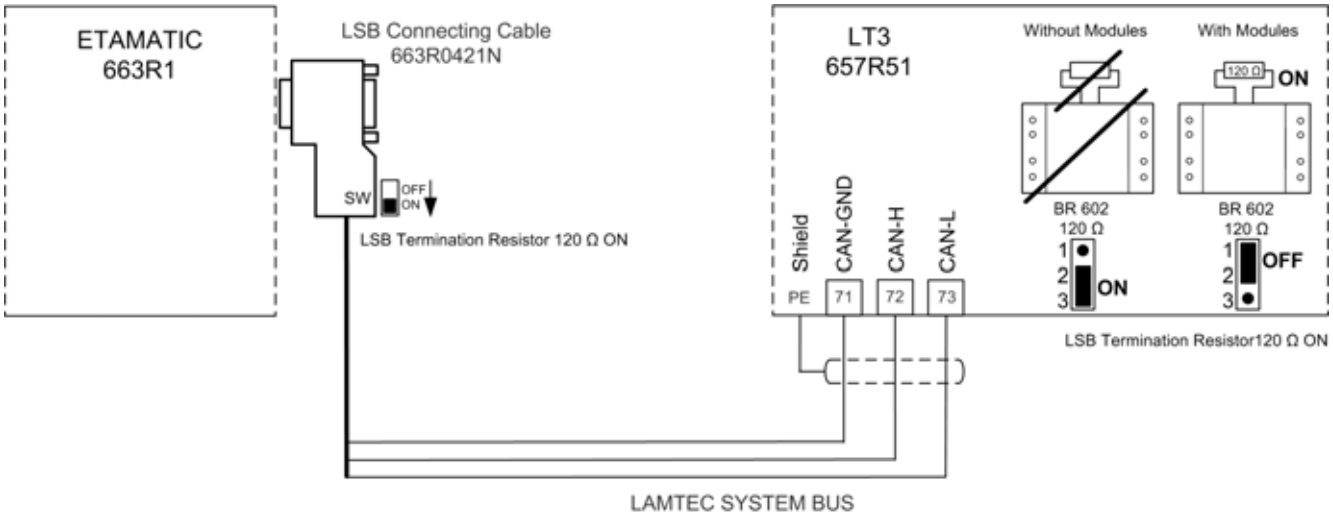
The design of Lambda Transmitter and LS2 is also based on environmental considerations. The modules can easily be separated and sorted into distinct types, and recycled accordingly.

The device contains electrical and electronic components and must not be disposed of as domestic waste. The local and currently valid legislation absolutely must be observed.

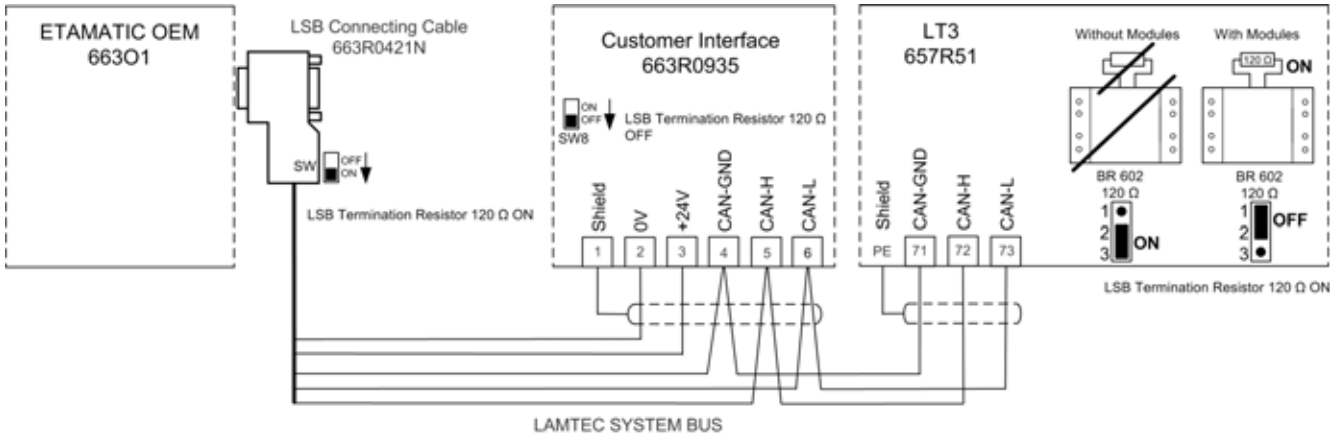
14 Appendix

14.1 Connection Burner Control System

14.1.1 Connection ETAMATIC to LT3 via LSB

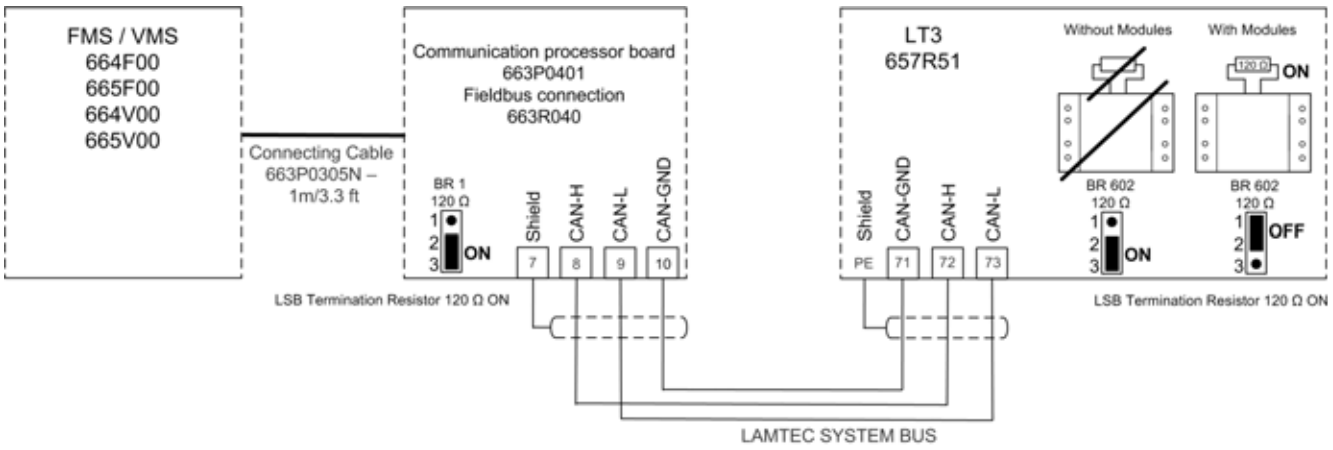


14.1.2 Connection ETAMATIC OEM to LT3 via LSB

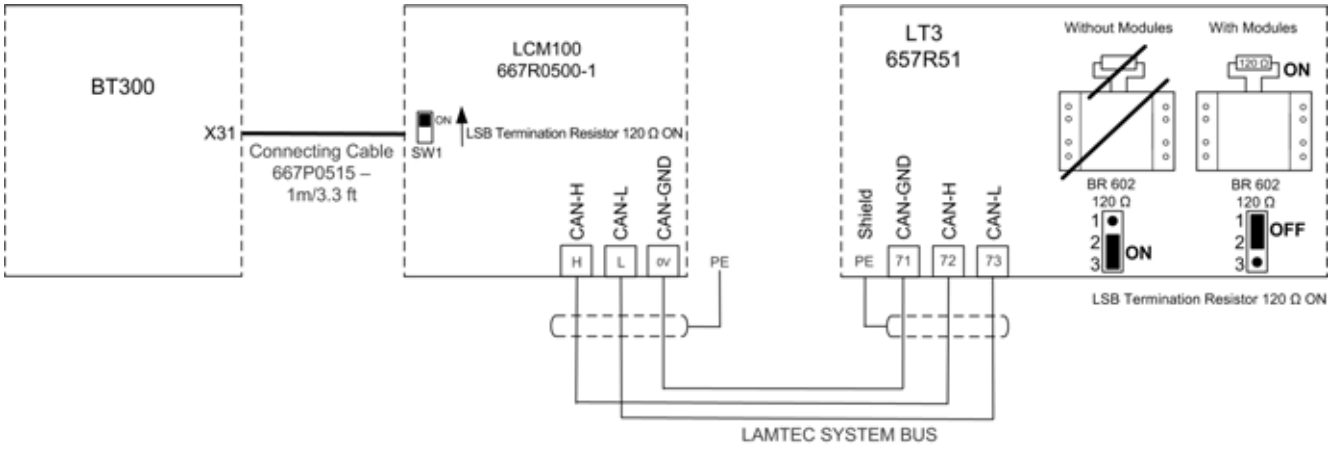


14 Appendix

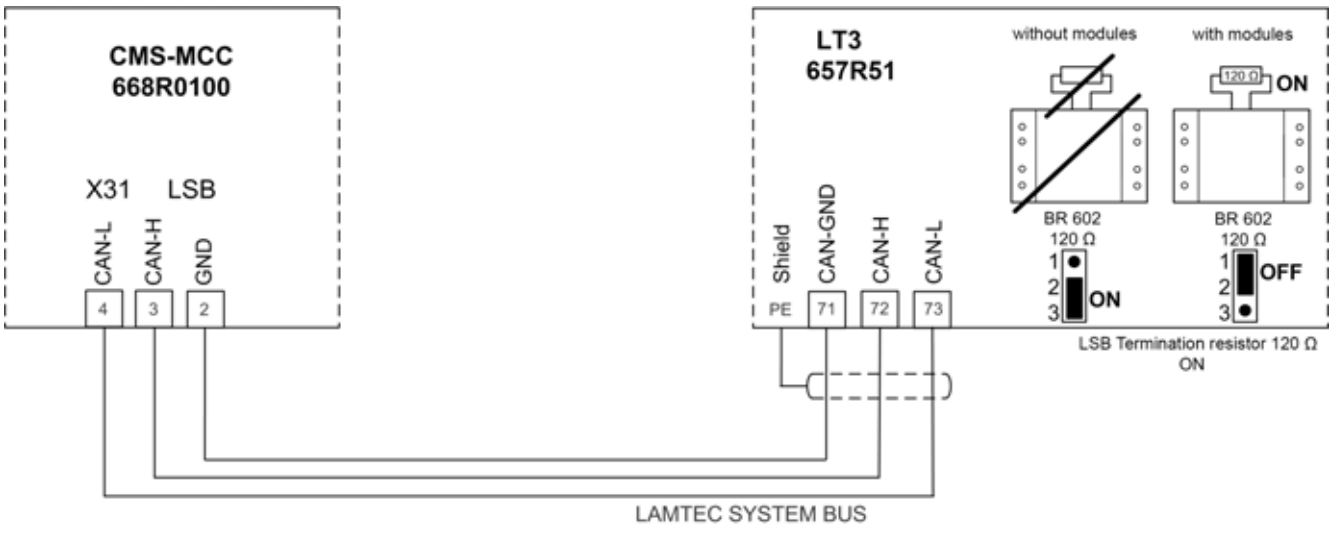
14.1.3 Connection FMS/VMS to LT3 via LSB



14.1.4 Connection BT300 to LT3 via LSB



14.1.5 Connection CMS to LT3 via LSB



14 Appendix

14.2 Spare Parts LT3

Description	Order No.
LT3 mainboard	657E5100
LT3 processor board main processor (specify the serial number of the LT3)	657R5012
LSB module with 4 analogue outputs, current	663R4029
LSB module with 4 analogue outputs, voltage	663R4025
LSB module with 4 digital outputs	663R4027
LSB module with 4 digital inputs, 24 VDC	663R4028
HART module	657R5930
Module for efficiency calculation	657R5940
Module for field bus connection, PROFIBUS	657R5950
Programming unit	663R0932 V3.0
User Interface UI-LT	657R5051

14.3 LS2 Spare Parts

Spare Parts	Type
Replacement kit for sensor for high temperatures consisting in: Sensor, gasket for connecting head, mesh and metal C-ring	650R1520 (1)
1 Mounting compound - Anti-seize-paste (5 pcs. per pack)	650R1090
1 Gasket between counter flange and flue gas bypass tube	655P4211
1 Sealing for counter flange DN65 PN6, 3 mm/0.12 "in, material: graphite	656P0263

(1) Recommendation: Keep the marked spare parts in stock.

Description / Type	Order-no.
High dust mounting flange for manual purging, material 1.4571	SO656R1010

14.4 Wet/Dry Measurement Deviations, Conversion Table

NOTICE

The LT3 carries out measurements directly in the humid flue gases (wet measurement). When extractive devices are used, flue gases are removed and prepared.
Dry measurements are normally used here, since the humidity has been extracted from the flue gas. As a result, O_2 measurement values vary (see diagrams below).

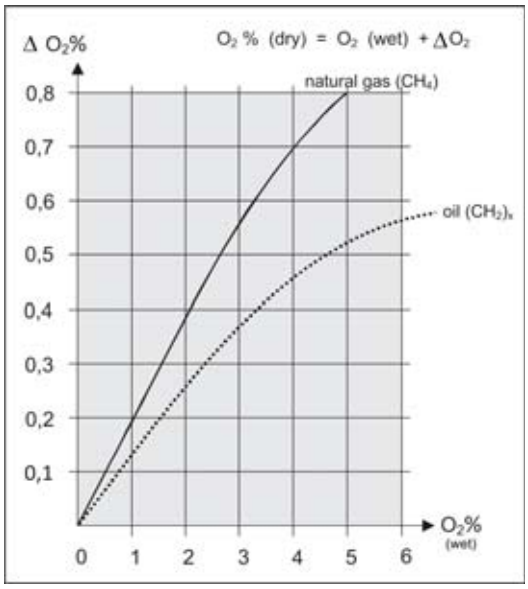


Fig. 14-1 Theoretical max. deviations of the O_2 concentration in wet and dry measurement.
Fuel: natural gas or oil

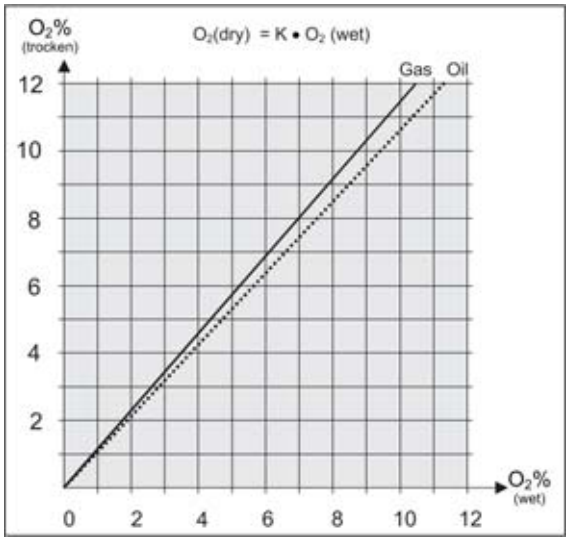


Fig. 14-2 Calibration plot for the concentration values of O_2 (dry) and O_2 (wet)

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	1.08	1,08
0-12 % O_2	1.15	1.10

The information in this publication is subject to technical changes.

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