

Lambda Transmitter LT2 Lambda Probe LS2



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1 General Information

1.1 Validity of these Instructions

Content of this Operating Manual

This Operating Manual describes the Lambda Transmitter LT2 with all components necessary for O₂ measurement, such as the Lambda Probe LS2, the probe installation fitting, etc.

Accessories and special applications

Information on accessories and special applications is provided in the booklets supplied with the particular systems. This information can be obtained from the manufacturers, at the Wall-dorf address.

This Operating Manual explains the functioning, mounting, installation, maintenance and operation of the Lambda Transmitter LT2. Other booklets, such as Product Information for example, provide further information but must never be used as a substitute for this Operating Manual.



CAUTION!

Always read the Operating Manual before starting work!
Please adhere strictly to all warnings/safety instructions!

For particular tasks, for example electrical installation, specialised knowledge is required. These tasks may only be carried out by suitably qualified personnel. See chapter 2.1.3 *Permissible Users*.

Validity

Our products undergo constant redevelopment. However, we make every effort to ensure that the Operating Manual is accurate and relevant to individual applications.

All previous editions are rendered obsolete on publication of an updated and corrected new edition.

On the last page you will find the current version number of this Operating Manual and the corresponding order number.

2 Safety

2.1 For Your Safety

2.1.1 Explanation of the Symbols in the Safety Notes

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.

2.1.2 Proper Use - Conditions of Use

Application

The LT2 Lambda Transmitter is an O₂ measuring instrument for the continuous measurement of O₂ concentration in non-combustible gases in the super-stoichiometric domain, in conjunction with the LS2 Lambda Probe.

Suitable for gas measurements with a small proportion of combustible components (< 10,000 ppm), for example in flue gases of combustions systems.

Admissible fuels:

- Non-interacting gaseous hydrocarbons
- Light oil
- Coal
- Biomass (wood)

NOTICE

Direct measurements in combustion gases are not possible.

If the system is to be used in some other way, and if the instrument's functionality in this application cannot be unambiguously assessed, the manufacturer should be contacted in advance.

Prerequisites

It is assumed that facility planning, assembly, installation, commissioning, maintenance and service works are carried out by sufficiently trained personnel, and these works are supervised by qualified specialists.

Correct handling

Special attention must be paid to the following:

- The application must conform to the technical data and the specifications regarding authorised use, assembly, connection, environmental and operational conditions (derived from the job documentation, the instrument's user information, rating plates etc), and to the documentation supplied.
- The local regulations and facility-specific and technical hazards must be noted and followed.
- All steps necessary to protect the equipment, e.g. during transport, storage, maintenance and inspection, should be carried out.

2.1.3 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 LT2, 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

2.1.4 Safety Equipment/Safety Measures

Hazards from electrical equipment

The LT2 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 LT2 is used in conjunction with control and monitoring technology, the operator must ensure that any breakdown or failure of the LT2 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 LT2 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.
-



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 LT2 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 LT2 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.
-

2.1.5 Important Notes on Shutdown/Return to Service

The Lambda Transmitter and the Lambda Probe form a high quality electronic system. Treat them with care at all times, including during shut-down, transport and storage.

Shut-down

NOTICE

Do not switch the Lambda Transmitter off as long as the Lambda Probe is mounted; including when the relevant facility has been shut down. Residual gases cause corrosion and may damage system parts.

- ▶ Do not store the instruments outdoors without protection!
Always store in a dry place, if possible in the original packaging.
- ▶ When dismantling, protect cable ends and plugs against corrosion and dirt. Corroded plugs may cause malfunction.
- ▶ If possible, transport in the original packaging.



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

Return to service

According to chapter 7 *Commissioning/Decommissioning*.

2.1.6 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.

3 Overview

3.1 System Overview

The LT2 Lambda Transmitter is an all-purpose O₂ measuring device based on microprocessor for direct measurement of the O₂ concentration under super-stoichiometric range ($\lambda > 1$) used together with LS2 Lambda Probe.

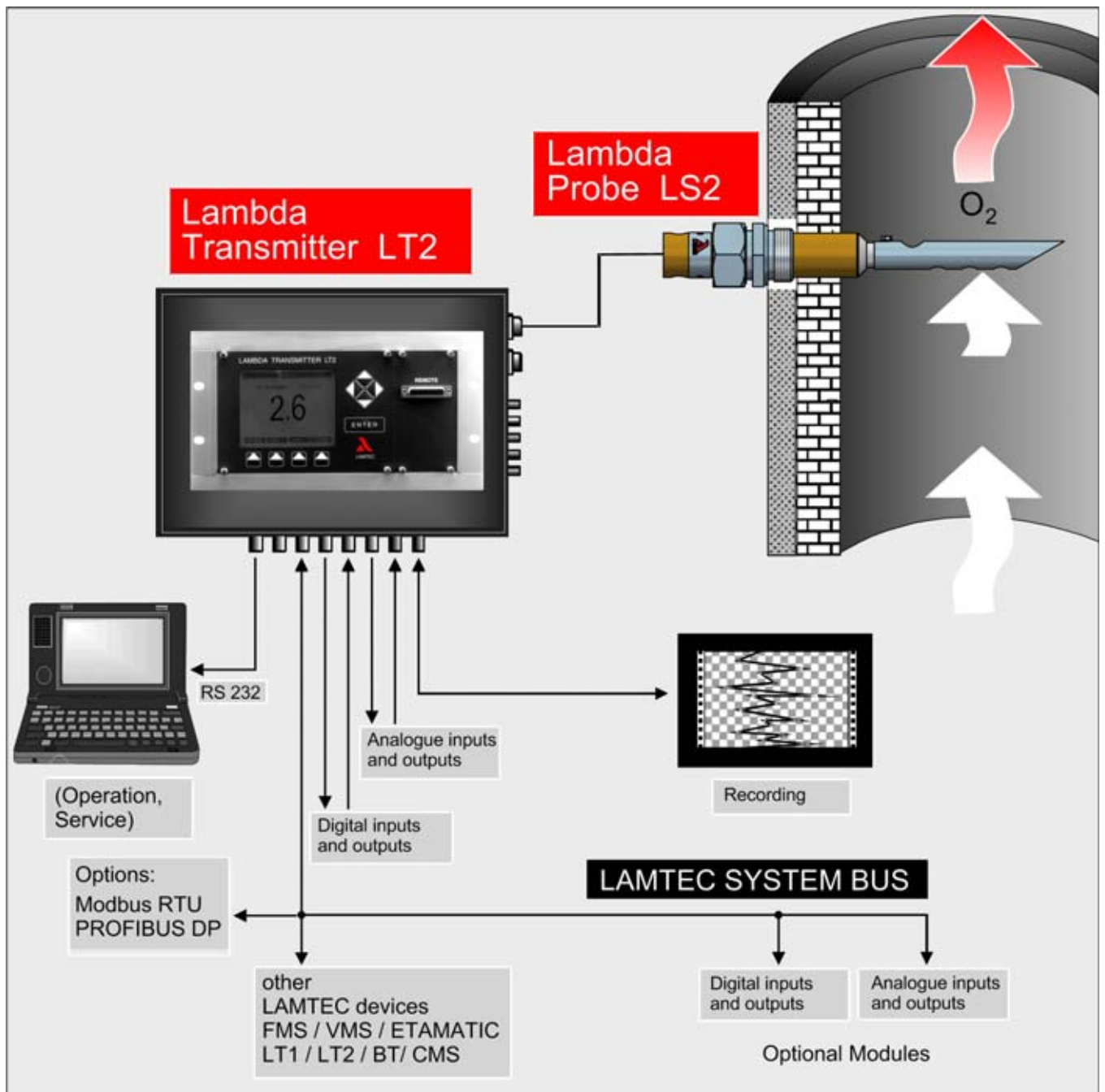


Fig. 3-1 System overview LT2 Lambda Transmitter

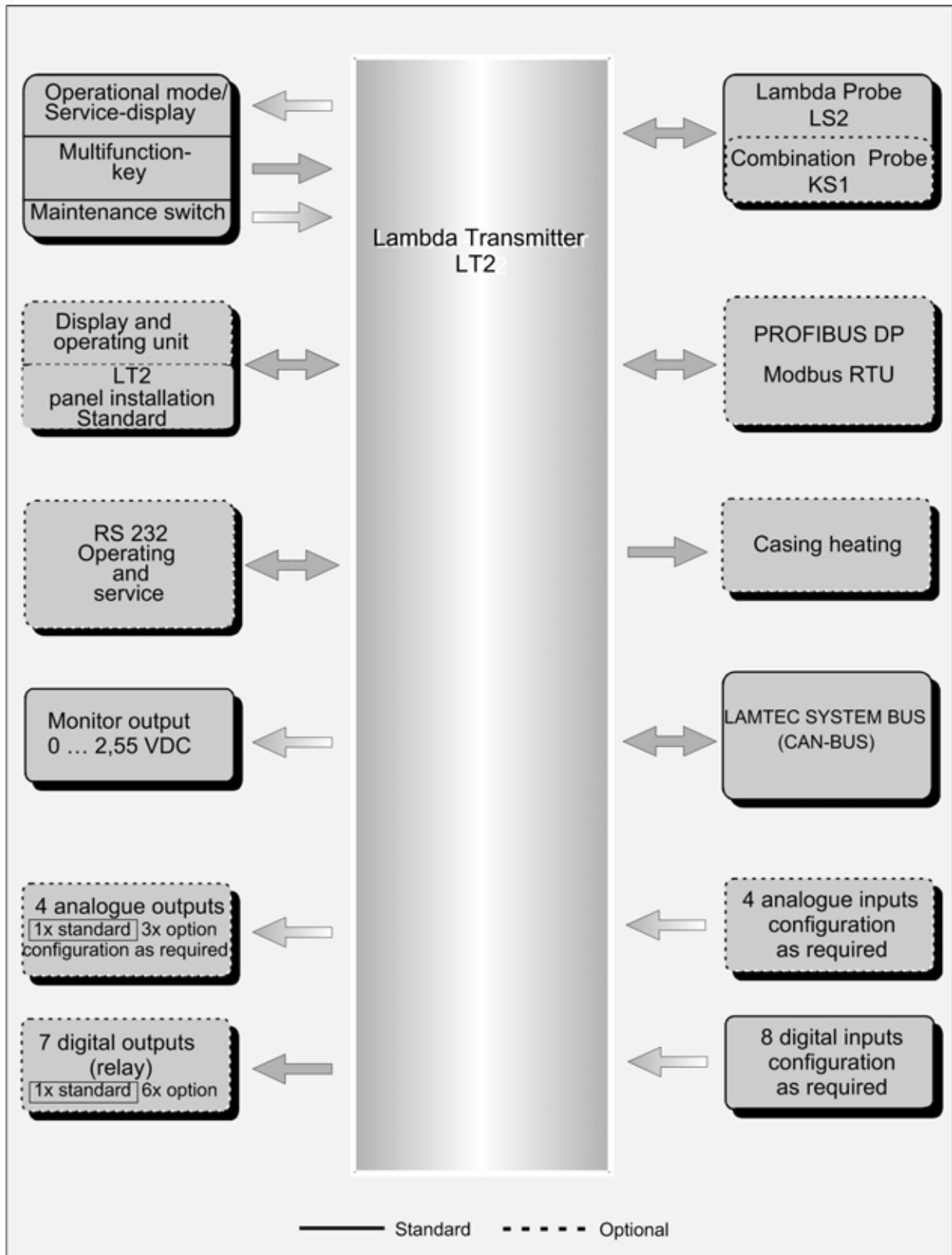


Fig. 3-2 System overview - LT2 Lambda Transmitter input/output modules

3 Overview

3.2 Brief Description

3.2.1 LS2/LS2-HT Lambda Probe

Universal O₂ measuring instrument, based on the Lambda Probe LS2 (zirconium dioxide voltage probe), for the direct continuous measurement and monitoring of oil (EL) and gas combustion systems in the super-stoichiometric domain ($\lambda > 1$) without special gas purification.



Fig. 3-3 Lambda Probe LS2

- 1 Lambda Probe LS2 in housing type 650R1000
Standard cable length 2 m/6.562 ft, Teflon, with connecting plug
alternative:
For use at large distances (no illustration) probe connection box (PCB)
type 6565R1025
see chapter 5.2 LS2/LS2-HT Lambda Probe.
- 2 Probe installation fitting (PIF) type 655R1010
- 3 Measuring gas extraction device (GED ECO) type 655R1001 ... 1004
(150 ... 1000 mm/5.90 ... 39.37" in)

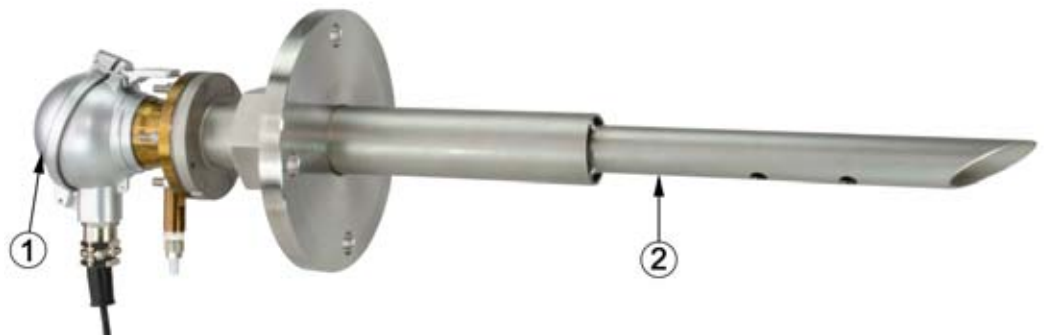


Fig. 3-4 Lambda Probe LS2 in HT-design

- 1 Lambda Probe LS2 in high-temperature housing type 650R1515.
Standard cable length 2 m/6.562 ft, Teflon, with connecting plug
- 2 GED FLEX

3.2.2 LT2 Lambda Transmitter

Two basic types are available:

- Wall mounting housing made of sheet steel, front lockable door, impact-resistant window
- Wall mounting housing made of sheet steel, front lockable door, without impact-resistant window



Lambda Transmitter LT2 in wall mounting housing IP65

- Sheet steel H400 x W300 x D150 mm/(HxWxD) 15.75x11.81x5.91" in.
- Type 657R102
- Display and operation unit as option

4 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_{O_2} 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.

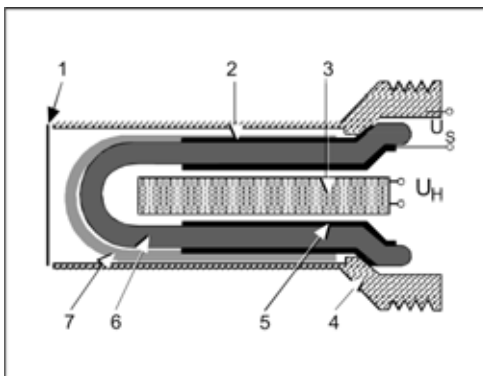


Fig. 4-1 Schematic construction of the ZrO_2 oxygen probe

- 1 Gas intake
- 2 Working electrode
- 3 Probe heating
- 4 Housing

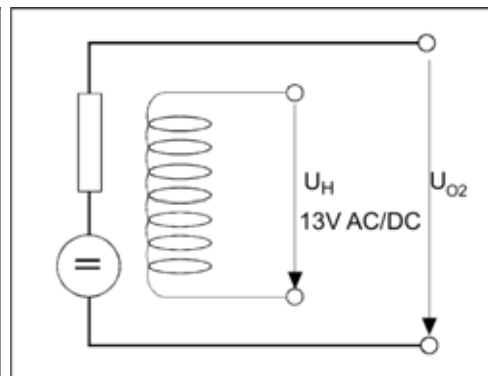


Fig. 4-2 The voltage probes equivalent electric circuit diagram

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

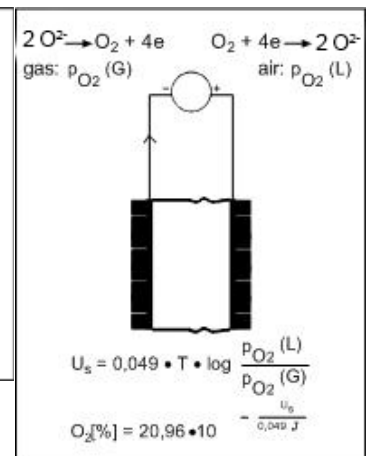


Fig. 4-3 The voltage probes working principle

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.

4 Theoretical Background

NOTICE

For simple handling and maintenance-free operation the LT2 LS2 O₂ measurement is designed for calibration in ambient air.

The accuracy of the calibration without test gas is about $\pm 10\%$ of the measuring value, not better than $\pm 0.3\text{ Vol.}\%$ (see chapter 9.3.1 *Checking/Calibrating with Test Gas*).

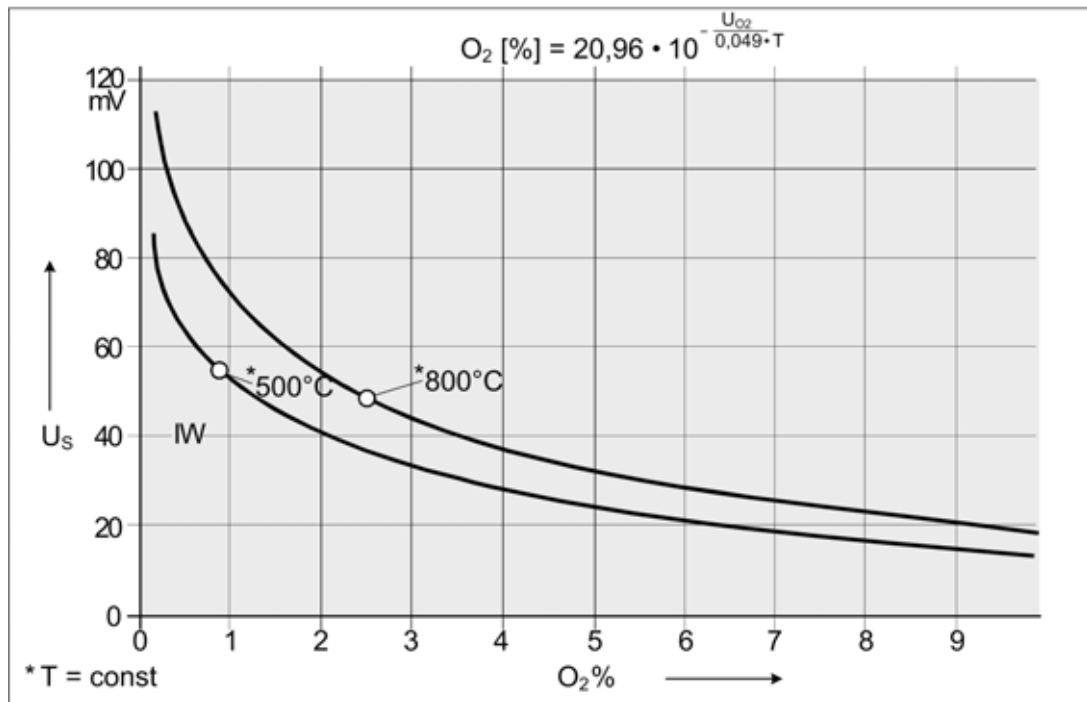


Fig. 4-4 Measurement and calibration diagram of the oxygen probe - the effect of temperature on the probes characteristic curve.

NOTICE

For higher specified measurement accuracy it's possible to calibrate with reference measurement or test gas.

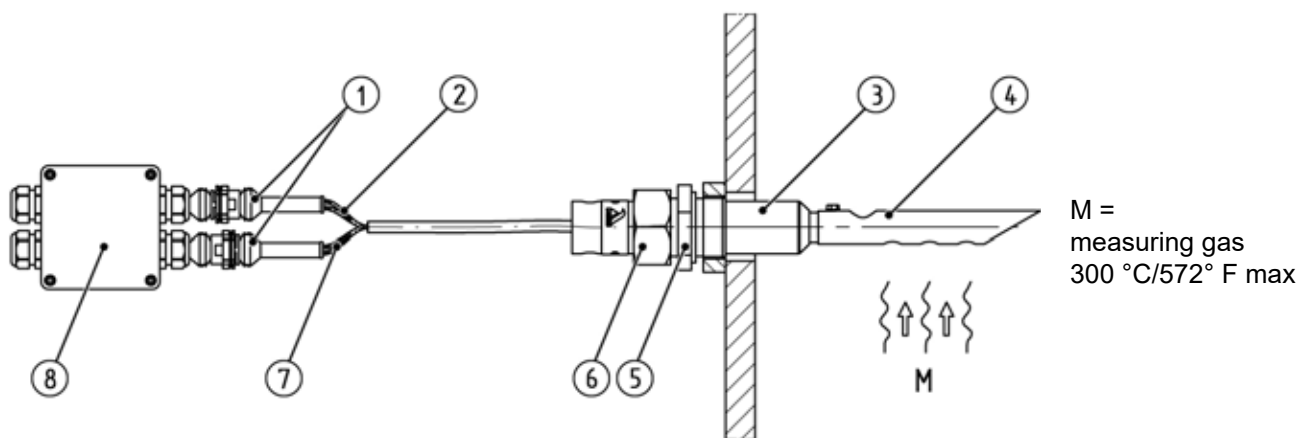
The specified accuracy with reference measurement or test-gas lies at $\pm 5\%$ of measurement value, not better than $\pm 0.3\text{ Vol.}\%$.

5 Technical Description

5.1 System Overview - Necessary Components

The O₂ measurement system is available in various versions. It consists of the following components:

- LS2/LS2-HT Lambda Probe
- Gas extraction device GED ECO/GED FLEX
- Probe installation fitting (PIF)/counter flange
- Probe connection box (PCB)
- LT2 Lambda Transmitter in IP65 wall-mounted housing



- 1 Plug
- 2 Probe signal
- 3 LS2 Lambda Probe, type 650R1000
- 4 Gas extraction device (GED ECO)
- 5 Half-collar G11/4", type 655R1012
- 6 Probe installation fitting (PIF), type 655R1010
- 7 Probe heater
- 8 Probe connection box (PCB), type 655R1025 (optional)



Fig. 5-1 LT2 Lambda Transmitter in wall-mounted housing type 657R102-..., sheet steel, 400x300x150 mm (hwxwd)/15.75x11.81x5.91" in., with display and operating unit

5 Technical Description

5.1.1 Advantages of the Measurement Principle

- No gas treatment needed, measurement directly in the humid flue gas
- Setting time at 90 %-value (T_{90}) < 20 s
- Measuring gas temperature depending on the design up to 300 °C (572 °F)/up to 1200 °C (2192 °F)
- Low heating power 15 ... 25 W
depending on the state of aging of the zirconium dioxide sensor
- Universal applicable
- Easy application
- Low-maintenance

5 Technical Description

5.2 LS2/LS2-HT Lambda Probe

The LS2 Lambda Probe is the transducer. It is located directly in the exhaust gas stream. The gas to be measured is fed to the probe via the gas extraction device (GED)/GED FLEX. Measurement takes place directly in the probe. The LS2 probe is connected to the probe connection box (PCB) or LT2 via a 4 strand cable with two plugs.

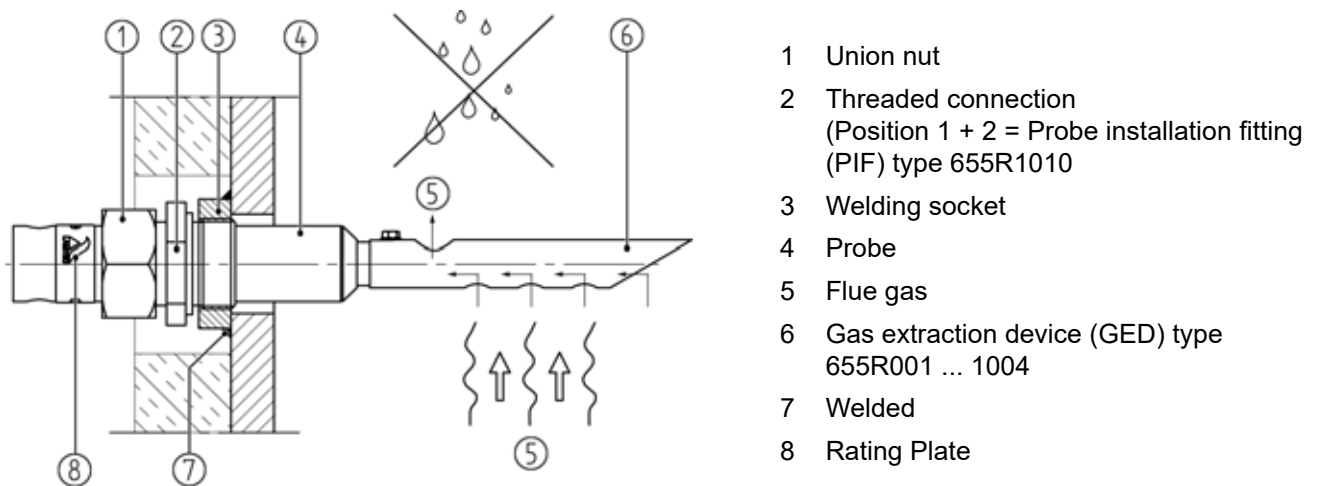


Fig. 5-2 Probe installation with GED

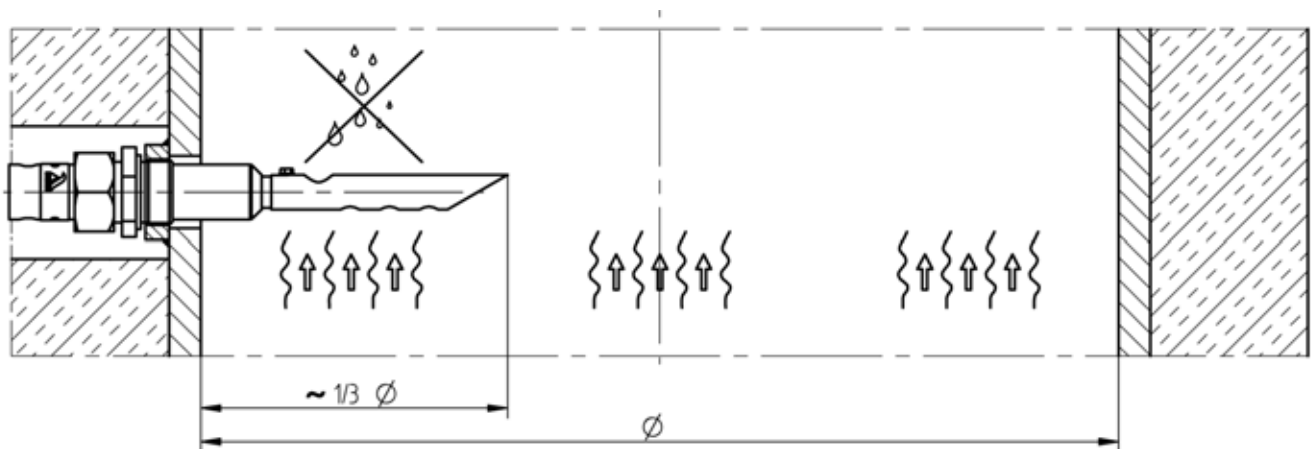


Fig. 5-3 Correct probe installation with GED in flue gas duct

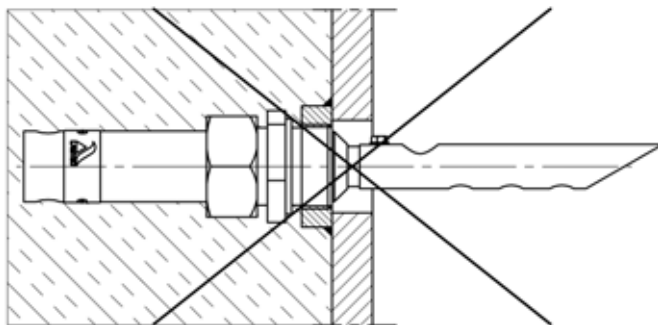


Fig. 5-4 Wrong probe installation

5 Technical Description

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).

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).

Wiring between SAK and LT2 Lambda Transmitter via conventional cable and terminals, see wiring diagram in chapter *11.5 Electric Connection LT2* until chapter *11.6 Analogue Inputs Terminals 11 to 26 - Connecting Variants*

Alternatively, direct connection LS2 LT2 without SAK is possible via a customised cable (2 m, 5 m, 10 m and 20 m), see wiring diagram chapter *11.4 Electric Connections Device Side*.

5.2.1 Gas Extraction Device (GED ECO)

The gas extraction device is available in four different lengths (150 mm (5.91" in), 300 mm (11.81" in), 450 mm (17.72" in), 1000 mm (39.37" in)).

NOTICE

Observe the flow direction during installation!

The GED ECO length should not exceed the required minimum.

Maximum possible length = 1 m (3.281 ft). Only recommended in low-vibration installation sites.

Important:

'Core flow measurement' which is required by some installations is often obsolete.

'Strands' are extremely rare in practice.

According to previous experience, strands occur:

- a At the collision of gases of different temperatures; mostly air leaks into the exhaust gas.
- b At gas velocities below 1 m/s (3.281 ft/s) (separation). When genuine 'strands' occur it is extremely difficult to find an extraction position suitable for all operating conditions within the gas extraction device's length.

NOTICE

Make the GED ECO as long as necessary. Avoid lengths > 450 mm (17.72" in) if possible.

5.3 LT2 Lambda Transmitter

5.3.1 LT2 Lambda Transmitter in Wall Mounting Case

5 Technical Description



The LT2 Lambda Transmitter is the data interpreting device for the LS2 Lambda Probe. It incorporates all the necessary components for the operation of the LS2 Lambda Probe and the evaluation of the measurement signal. Furthermore, it features additional analogue inputs and outputs, digital inputs and outputs for process status signals, status signals and limit value signals, as well as serial interfaces and a universal bus interface (optional extra) for connection with the customer's control systems.

5 Technical Description

5.3.2 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.

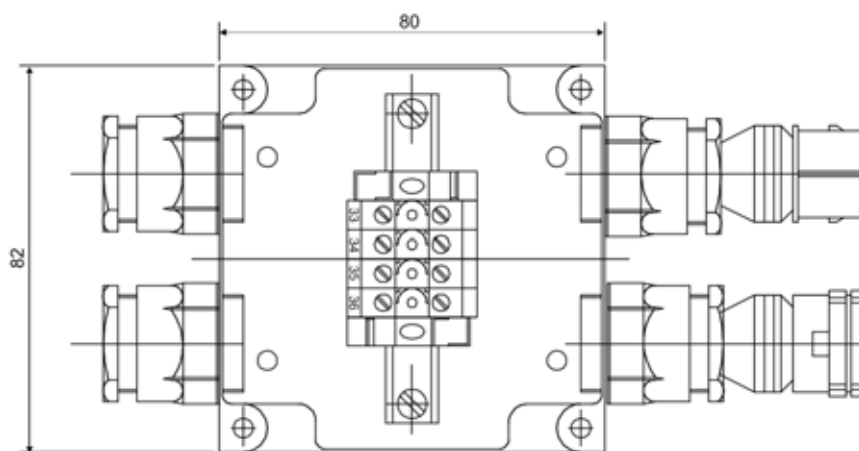


Fig. 5-5 PCB-Dimension diagram high: 55 mm (2.166" in) protection class: IP66

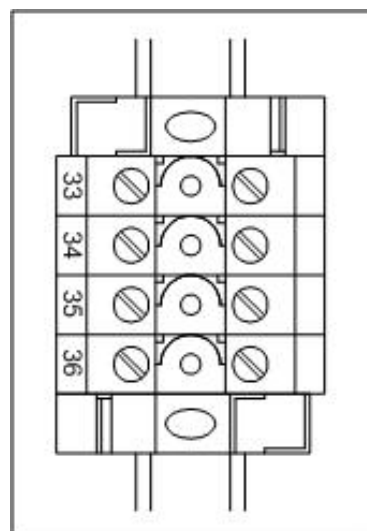


Fig. 5-6 PCB-Connection diagram

- 33 Probe signal -
- 34 Probe signal +
- 35 Probe heater
- 36 Probe heater

5 Technical Description

5.4 Cold-start Delay

Serves to suppress false measurements while the probe warms up to operating temperature. Cold-start delay is always activated after POWER OFF and probe replacement.

The cold-start delay can be aborted at any time

- via the multifunction key
- via the optional display and operating unit, see separate publication
- via Remote-Display-Software, see separate publication

During the cold-start delay, either

- a substitute value (factory setting), $O_2 \rightarrow 0 \text{ \% vol. (P361)}$
- set the type of the substitute value for O_2 in P362:

OFF: No output of the substitute value

ON: Output of the substitute value of the preceding parameter.

+Maintenance: (factory setting): Output of the substitute value of the preceding parameter, even in maintenance mode.

+Maint.freeze: Output of the substitute value of the preceding parameter in the case of cold start or error as hitherto. Additionally the preceding measurement value is frozen, as long as maintenance mode is active.

The substitute value during cold start/error takes priority over the freezing of the measurement value during maintenance.frozen

After a pre-heating period of 10 minutes the probe voltage stabilises to a value between 0 ... 20 mV and the AC inner resistance to a value below 100 Ω .

5.5 Digital Inputs

Parameter group 1170 to 1249

8 digital inputs to LT2 supply section electronics, 24 VDC, 6 mA either referenced to instrument potential or floating (see chapters *11.4 Electric Connections Device Side* to *11.6 Analogue Inputs Terminals 11 to 26 - Connecting Variants*), arbitrarily configured via (optional) display and operating unit and service and diagnostic software.

5.6 Analogue Outputs 0/4 ... 20 mA, 0/2 ... 10 V

Analogue output 1 - terminal 42 (-), 43 (+)

Output of the O_2 value 0 ... 10 % $\rightarrow$ 4 ... 20 mA, alternatively 0/2 ... 10 V

Modules 2, 3 and 4 option

Parameters 530/540/550/560 $\rightarrow$ setting of the function:

- OFF/diagnoses
- O_2 measurement value
- Configured measurement value 1 ... 6
- R_i – probe
- O_2 probe voltage
- CO_e
- U_{CO_e}

Parameters 531/541/551/561 $\rightarrow$ setting of the output value:

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

Parameters 532/542/552/562 $\rightarrow$ lower range limit, for example "0" for 0 % O_2

Parameters 533/543/553/563 $\rightarrow$ upper range limit, for example "100" for 10,0% O_2 or "210" for 21,0% O_2

Analogue outputs are realised by plug-in cards on the LT2 processor board (max. 4) – retrofit at any time

type 657R0050 non-floating,

type 657R0051 floating max. potential difference ± 20 V (available only for output 1 and 2)

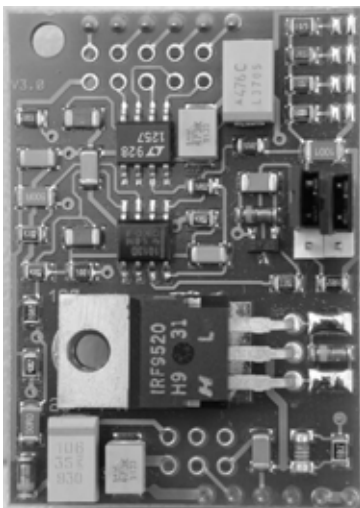


Fig. 5-7 Analogue output board

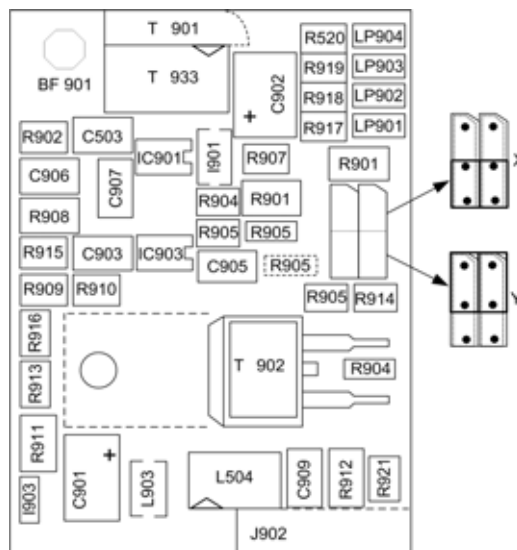


Fig. 5-8 X-jumper voltage output 0/2 ... 10 V
Y-jumper current output 0/4 ... 20 mA

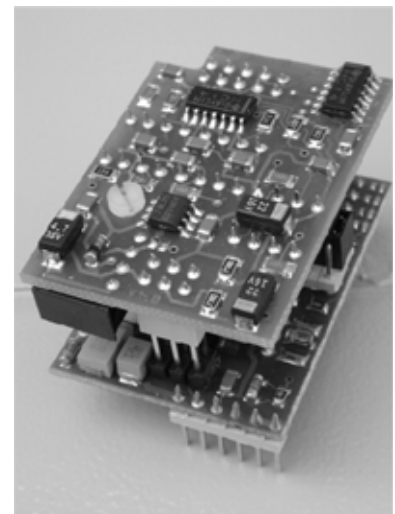


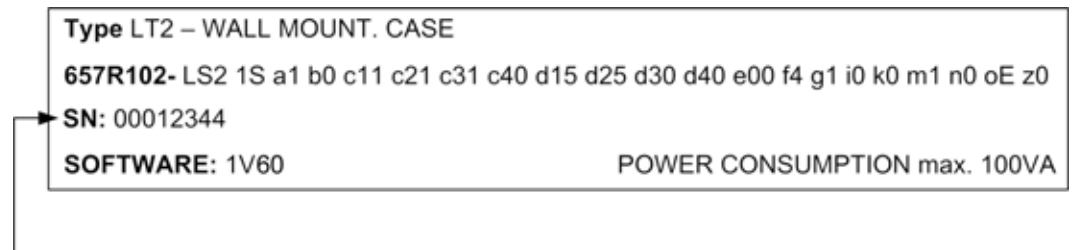
Fig. 5-9 Output card non-floating type 657R0051

The position of the jumpers define whether a current output or a voltage output is active. The parameters 531/541/551/561 define the current range (0 or 4 to 20 mA).

5 Technical Description

5.7 Device Configuration and Factory Setting

You can derive the device's variant from the variant number. You will find the variant number on the type plate. The variant number is constructed according to the following key:



Serial Number

Example: LT2 in variant No.:

LS2 1S a1 b0 c11 c21 c31 c40 d15 d25 d30 d40 e00 f4 g1 i0 k0 m1 n0 oE z0

LT2:	LS2	1S	a1	b0	c11	c21	c31	c40	d15	d25	d30	d40	e00	f4	g1	i0	k0	m1	n0	oE	z0
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

1: for probe

- KS1 → configured for CO probe KS1
- KS1D → configured for Combination Probe KS1D
- LS2 → configured for Lambda Probe LS2

2: Type

- 1S → standard type
- 2OEM → OEM type
- 3a → for probe with GED FLEX and purge unit
- 3K → for probe type 'K - semi automatic calibration'
- 3KR → for probe type 'KR - cyclic regeneration'
- 4KA → for probe type 'KA - semi automatic calibration and purge'
- 5KV → for probe type 'KV - full automatic calibration'
- 6KVA → for probe type 'KVA - full automatic calibration and purge'
- 6KVZ → for probe type 'KV-full automatic calibration and regeneration cyclic'
- 7EX1 → for probe type 'EX-area 1'
- 8EX2 → for probe type 'EX-area 2'
- 9E → for probe type 'HT - ejector extraction'

3: Display

- a0 → without
- a1 → with display and operating unit 657R0831/33
- a2 → with display and operating unit 657R0833RBT

4: Pressure sensor

- b1 → with absolute pressure and differential pressure
- b2 → with differential pressure sensor
- b3 → with pressure sensor for draught measurement

5: Analogue output 1

- c11 → analogue output 1 current 4 ... 20 mA 657R0050
- c12 → analogue output 1 current 0 ... 20 mA 657R0050
- c13 → analogue output 1 voltage 0 ... 10 V 657R0050
- c14 → analogue output 1 current 4 ... 20 mA floating 657R0054
- c15 → analogue output 1 current 4 ... 20 mA floating 657R0054REG
- c16 → analogue output 1 current 0 ... 20 mA floating 657R0054
- c17 → analogue output 1 voltage 0 ... 10 V floating 657R0054
- c18 → analogue output 1 ejector control 657R0050E
- c19 → analogue output 1 current 4 ... 20 mA electrically isolated 657R0053

6: Analogue output 2

- c21 → analogue output 2 current 4 ... 20 mA 657R0050
- c22 → analogue output 2 current 0 ... 20 mA 657R0050
- c23 → analogue output 2 voltage 0 ... 10 V 657R0050
- c24 → analogue output 2 current 4 ... 20 mA floating 657R0051
- c25 → analogue output 2 current 4 ... 20 mA floating 657R0051REG
- c26 → analogue output 2 current 0 ... 20 mA floating 657R0051
- c27 → analogue output 2 voltage 0 ... 10 V floating 657R0051
- c28 → analogue output 2 ejector control 657R0050E
- c29 → analogue output 2 current 4 ... 20 mA electrically isolated 657R0053

7: Analogue output 3

- c31 → analogue output 3 current 4 ... 20 mA 657R0050
- c32 → analogue output 3 current 0 ... 20 mA 657R0050
- c33 → analogue output 3 voltage 0 ... 10 V 657R0050
- c34 → analogue output 3 current 4 ... 20 mA floating 657R0051
- c35 → analogue output 3 current 4 ... 20 mA floating 657R0051REG
- c36 → analogue output 3 current 0 ... 20 mA floating 657R0051
- c37 → analogue output 3 voltage 0 ... 10 V floating 657R0051
- c38 → analogue output 3 ejector control 657R0050E
- c39 → analogue output 3 current 4 ... 20 mA electrically isolated 657R0053

8: Analogue output 4

- c41 → analogue output 4 current 4 ... 20 mA 657R0050
- c42 → analogue output 4 current 0 ... 20 mA 657R0050
- c43 → analogue output 4 voltage 0 ... 10 V 657R0050
- c44 → analogue output 4 current 4 ... 20 mA floating 657R0051
- c45 → analogue output 4 current 4 ... 20 mA floating 657R0051REG
- c46 → analogue output 4 current 0 ... 20 mA floating 657R0051
- c47 → analogue output 4 voltage 0 ... 10 V floating 657R0051
- c48 → analogue output 4 ejector control 657R0050E
- c49 → analogue output 4 current 4 ... 20 mA electrically isolated 657R0053

9: Analogue input 1

- d11 → analogue input 1 potentiometer 1...5 k Ω
- d12 → analogue input 1 current 0/4 ... 20 mA passive
- d13 → analogue input 1 voltage 0 ... 2900 mV (EX1)
- d14 → analogue input 1 pulse (RPM)
- d15 → analogue input 1 temperature Pt100 0 ... 320 °C (32 ... 608 °F)
- d16 → analogue input 1 temperature Pt100 0 ... 850 °C (32 ... 1562 °F)
- d17 → analogue input 1 current 0/4 ... 20 mA active (24 V supply)
- d18 → analogue input 1 differential pressure
- d19 → analogue input 1 voltage -100 ... 2000 mV (KS1D)

10: Analogue input 2

- d21 → analogue input 2 potentiometer 1 ... 5 k Ω
- d22 → analogue input 2 current 0/4 ... 20 mA passive
- d23 → analogue input 2 voltage 0 ... 2900 mV (EX1)
- d24 → analogue input 2 pulse (RPM)
- d25 → analogue input 2 temperature Pt100 0 ... 320 °C (32 ... 608 °F)
- d26 → analogue input 2 temperature Pt100 0 ... 850 °C (32 ... 1562 °F)
- d27 → analogue input 2 current 0/4 ... 20 mA active (24 V supply)
- d28 → analogue input 2 absolute pressure
- d29 → analogue input 2 voltage 0 ... 10 V

11: Analogue input 3

- d31 → analogue input 3 potentiometer 1 ... 5 k Ω
- d32 → analogue input 3 current 0/4 ... 20 mA passive
- d33 → analogue input 3 voltage 0 ... 2900 mV EX1
- d34 → analogue input 3 pulse (RPM)
- d35 → analogue input 3 temperature Pt100 0 ... 320 °C (32 ... 1562 °F)
- d36 → analogue input 3 temperature Pt100 0 ... 850 °C (32 ... 1562 °F)
- d37 → analogue input 3 current 0/4 ... 20 mA active (24 V supply)
- d38 → analogue input 3 differential pressure
- d39 → analogue input 3 voltage 0 ... 10 V

12: Analogue input 4

- d41 → analogue input 4 potentiometer 1 ... 5 k Ω
- d42 → analogue input 4 current 0/4 ... 20 mA passive
- d43 → analogue input 4 voltage 0 ... 2900 mV EX1
- d44 → analogue input 4 pulse (RPM)
- d45 → analogue input 4 temperature Pt100 0 ... 320 °C (32 ... 608 °F)
- d46 → analogue input 4 temperature Pt100 0 ... 850 °C (32 ... 1562 °F)
- d47 → analogue input 4 current 0/4 ... 20 mA active (24 V supply)
- d48 → analogue input 4 absolute pressure
- d49 → analogue input 4 voltage 0 ... 10 V

13: RM/LI/Controller/Firing Rate

- e30 → relay module 657R0857
- e31 → firing rate dep. limit values, firing rate def. LSB and relay module 657R0922
- e32 → firing rate dep. limit values, firing rate def. poti and relay module 657R0922/PO
- e33 → firing rate dep. limit values, firing rate def. current. and relay module 657R0922/ST
- e34 → O₂-controller (PID), firing rate def. LSB and relay module 657R1120
- e35 → O₂-controller PID, firing rate def. poti and relay module 657R1120/PO
- e36 → O₂-controller PID, firing rate def. current. and relay module 657R1120/ST
- e37 → speed dependent O₂ controller, firing rate def. LSB and relay module 657R1123
- e38 → speed depended O₂ controller, firing rate def. LSB and relay module 657R1123/PO
- e39 → speed dependent O₂ controller, firing rate def. current and relay module 657R1123/ST
- e40 → output of burner-firing rate at analogue output 657R1124

14: Efficiency calculation

- f1 → efficiency calculation (fixed ambient temperature) 657R0896
- f2 → efficiency calculation 657R0895
- f3 → temperature measurement 0 ... 320 °C/ 850 °C (32 °F ... 606 °F/1562 °F)
- f4 → efficiency calculation incl. 2x Pt100 sensors and analogue output 657R0917
- f5 → Efficiency calculation incl. 2x Pt100 sensors 699R0895
- f6 → Efficiency calculation incl. 1x Pt100 sensors 699R0896

15: Supply voltage

- g1 → supply voltage 230 VAC
- g2 → supply voltage 115 VAC

16: Reference air pump

- i1 → pump unit for reference air 230 VAC 657R1060
- i3 → pump unit for reference air 115 VAC 657R1060

17: Case heating

- k1 → housing heating 230 VAC/120 W 657R0367

18: CO monitoring/controlling

- m1 → CO controller master 657R0602
- m2 → CO controller slave 657R0602 & 663R1030
- m3 → CO monitoring master 657R0601
- m4 → CO monitoring slave 657R0601

19: Calculations

- n1 → CO₂ calculation 657R0910
- n2 → O₂ wet/dry conversion 657R0918

20: Language

- oD → language German/English
- oDF → language German/French
- oE → language English/German
- oEF → language English/French
- oFE → language French/English

21: Special configuration

- z8 → configuration by order

5 Technical Description

5.8 Options

5.8.1 Display and Operating Unit Type 657R0831

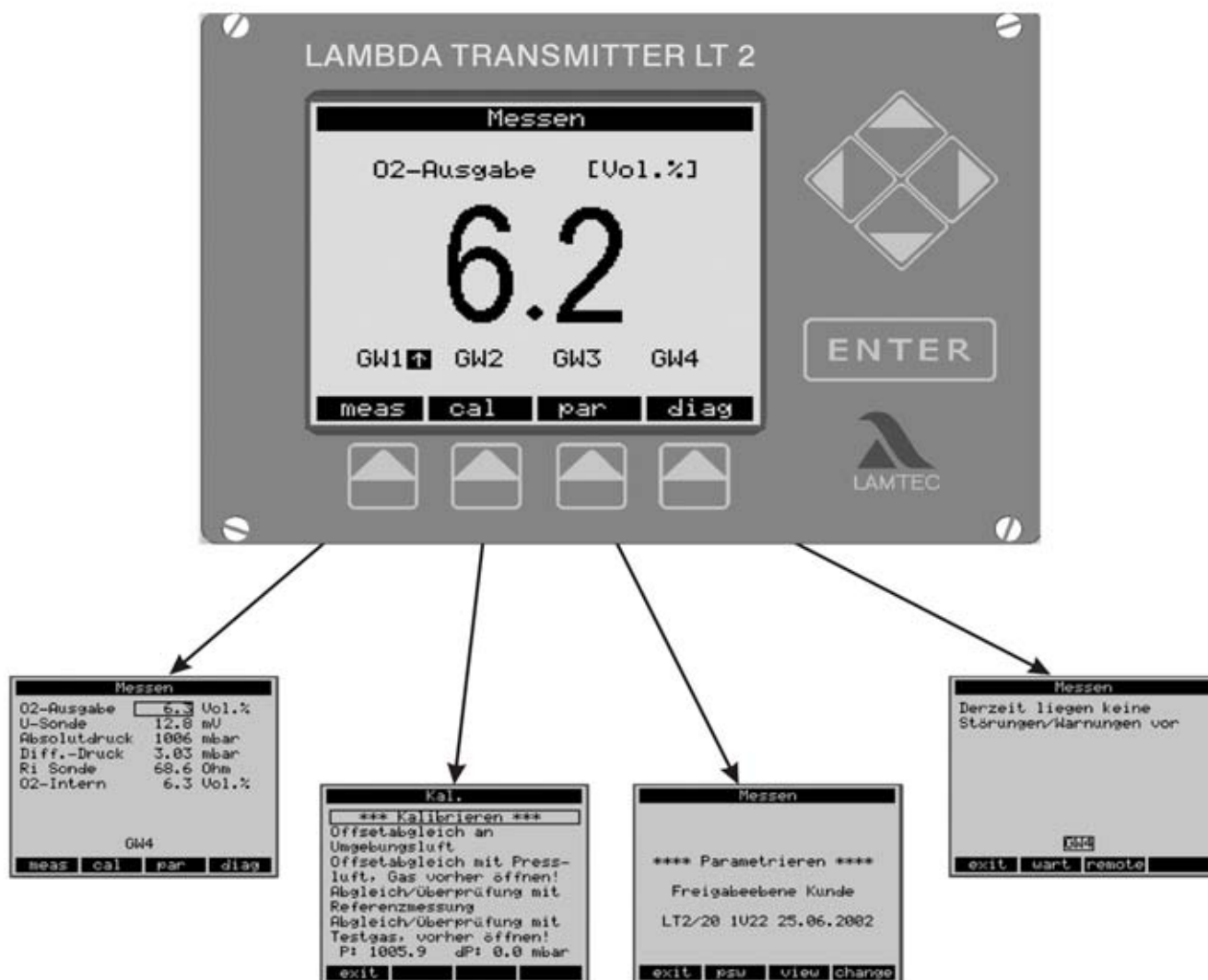


Fig. 5-10 Optional with LT2 in wall-mounting housing type 657R102

5 Technical Description

5.8.2 Remote Display Software

The Remote Display Software is a PC software to configure the LT2. Use it instead of the display and operating unit, and to store and restore the data set.

- Remote Display Software including interface RS 232 module for PC type 657R1101
- Other licences for the Remote Display Software type 657R1102
- Suitable with windows-based computers
- Connection with LT2 via RS 232 interface.

Refer to special documentation DLT1004.

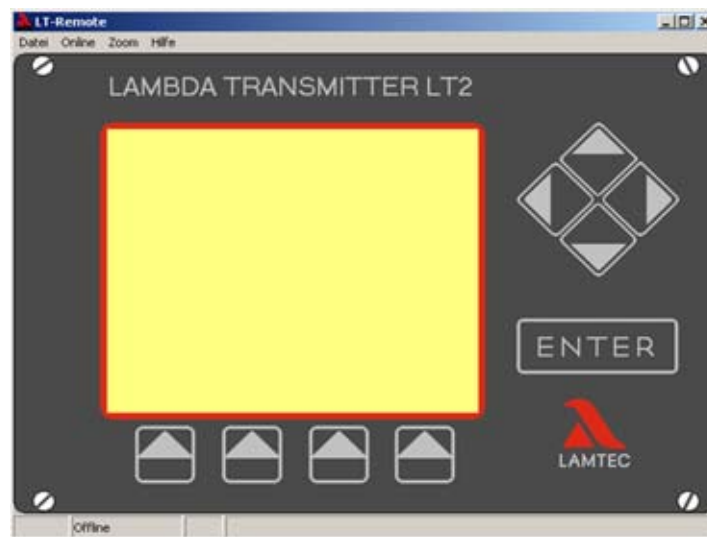


Fig. 5-11 Remote Display Software

5.8.3 Calculation of Combustion Efficiency

The calculation follows the formula:

$$h_F = (1 - q_A) * 100\%$$

q_A = Exhaust gas loss

$$q_A = (t_A - t_L) * [(A_2 / (21 - O_2)) + B]$$

with the oxygen content in the exhaust gas in O_2 in Vol.% and with the fuel-specific factors

Oil $A_2 = 0,68$; $B = 0,007$

Gas $A_2 = 0,66$; $B = 0,009$

Function only starting from $< 14,9$ Vol.% O_2

It is assumed that the combustion is CO and soot-free.

Display:

Efficiency 0 ... 100 %

Exhaust gas losses 0 ... 100 %

Exhaust gas temperature 0 ... 320 °C

Intake air temperature 0 ... 320 °C

Other ranges on request

Measurement accuracy:

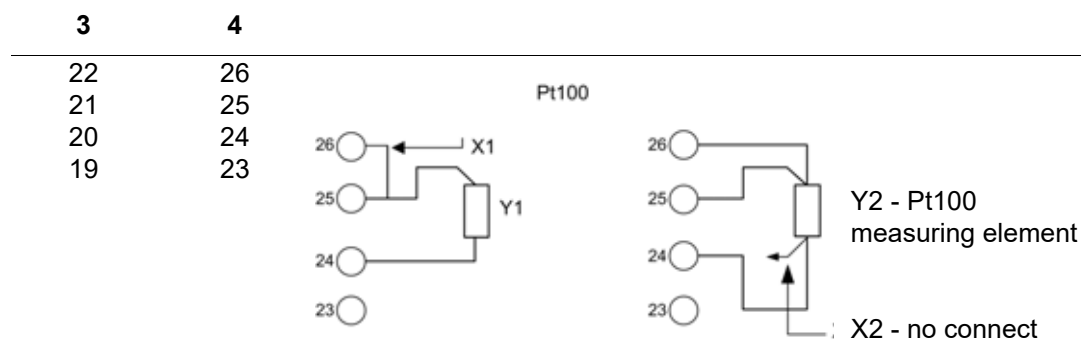
Temperature - better than 2 K

Efficiency/exhaust gas losses - better than 0.2 %

Electric connections:

depending on configuration/components

Measurement card:



In the 657R0896 version, the intake air is specified as a constant.

The intake air temperature is not measured. Only recommended where the intake temperature remains nearly constant over the whole year.

Set the average temperature of the intake air in parameter 1450.

5 Technical Description

5.8.4 Calculation of the CO₂ Concentration

Calculated by referring to the fuel from the measured O₂ value and the CO₂ maximum value type 657R0910

The calculation follows the formula:

$$\text{CO}_2 = \text{CO}_2 \text{ max} - (21 \% - \text{O}_2 / 21 \%)$$

The calculation is based on the following max. CO₂-contents at $\lambda = 1 \Delta = \text{O}_2 = 0 \% \text{ vol.}$ referenced **to dry** exhaust gas.

Light fuel oil	EL	15.4 Vol. %
Natural gas	H	12.0 Vol. %
Heavy fuel oil	HFO	15,9 %
Natural gas	L	11.7 Vol. %

Individual specification of CO₂ max. is possible via the parameters 846, 862, 878 and 894.

5.8.5 Firing Rate Dependent and Fuel Specific Limit Values/Limit Curves

The burner firing-rate value or some other measured quantity is supplied via analogue input 4 or via LAMTEC SYSTEM BUS. Instead of fixed limit values you can enter fuel-specific curves with 2 up to a maximum of 8 checkpoints.

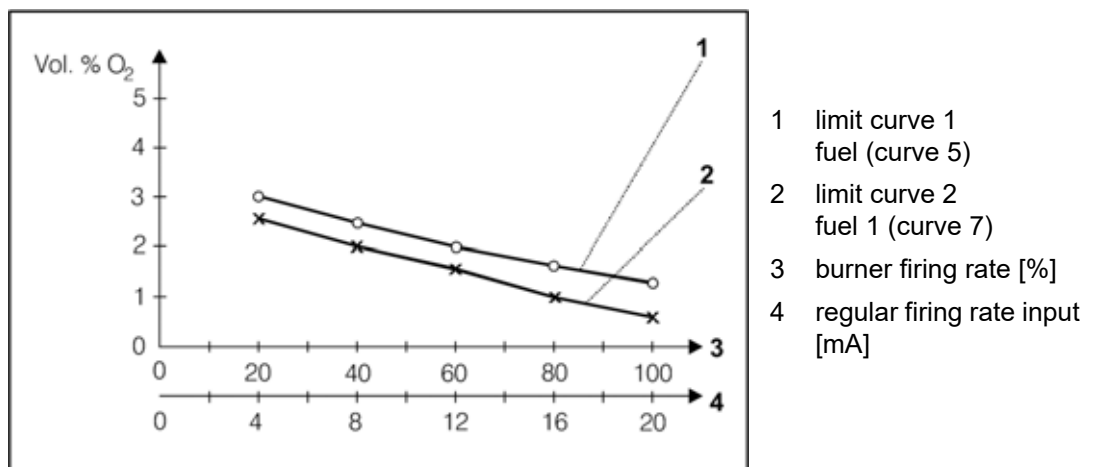


Fig. 5-12 Limit curves (factory settings), parameters adjusted to values below threshold.

Possible combinations:

either

- 2 fuels with 4 limit curves / limit values per fuel
- 4 fuels with 2 limit curves / limit values per fuel

For details see supplement to the operating instructions for the optional "Display and operating unit"

5 Technical Description

5.8.6 Combination Probe KS1 for the Detection of Combustibles (CO/H₂) on Demand

5.8.7 Output of the Internal Firing Rate by the Analogue Output 2

5.8.8 1 ... 4 Analogue Output (0/4 ... 20 mA, 1 ... 10 V)

Max. 2 floating (output 1 and 2), max. potential difference ± 20 V, configurable in any order

Direct current 0/4 ... 20 mA, load 0 ... 600 Ω

Direct voltage 0 ... 10 V, load ≥ 10 k Ω

Analogue output card 0/4 ... 20 mA, 0 ... 10 V type 657R0050

Analogue output card 0/4 ... 20 mA, 0 ... 10 V, floating, max. potential difference ± 20 V type 657R0051

5.8.9 Digital Outputs

Parameter group 1030 to 1099

Digital output 1: Via internal relay (1 switch over) to LT2supply section electronics
1 ... 48 VDC/AC, 3 A
as standard
0 ... 230 VAC, 2 A

Digital output 2 to 7:
type 660R0857
(optional) Via internal relay module
6 relays (1 switch over), switching capability
max. 230 VAC, 4 A
alternative (on request)

The outputs can be configured arbitrarily via the (optional) display and operating unit and the Remote Display Software. (parameter 1030 ... 1099)

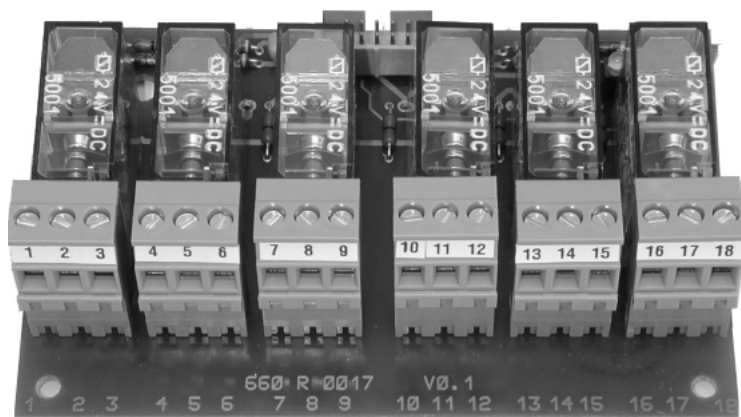


Fig. 5-13 Relay module type 657R0857

NOTICE

To avoid EMC faults shield the branch lines of the relay modules.

When using unshielded cables loop them twice through the provided ferrite ring.

5.8.10 1 ... 4 Analogue Inputs

- Analogue inputs by measurement cards, arbitrary configuration e.g. for temperature sensor, further pressure sensors, LS2 Lambda Probe, standard signals etc; max. 2 of these floating,
max. potential difference ± 20 V

External communication processor with PROFIBUS DP module

By plug-in card on LT2power pack electronic (max. 2)

- Analogue input card 0/4 ... 20 mA type 663P6001
- Analogue input card 0/4 ... 20 mA with supply 24 VDC for transmitter LT1/LT2type 663P6002
- Analogue input card for potentiometer 1 ... 5 k Ω type 657P6000
- Input temperature for Pt100 type 657R0890
range of measuring alternative 0 ... 320 °C/608 °F
0 ... 850 °C/1562 °F (please specify when ordering)

Electric connection see chapter 11.4 *Electric Connections Device Side*

5.8.11 BUS interface

Electrical connector via LAMTEC SYSTEM BUS to external communications processor.

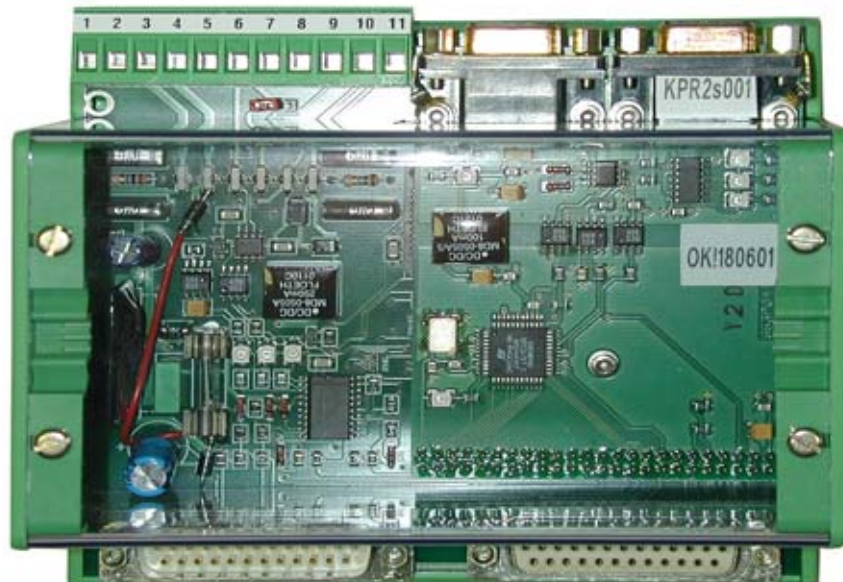


Fig. 5-14 External communication processor with PROFIBUS-module

- For the systems:
 - PROFIBUS DP, type 663R040-1PB/LT
 - Modbus RTU, type 663R040-3MBK/LT
- (Details see separate publication)

6 Installation

6.1 General Information

Measured gas temperature	LS2 < 300 °C/572 °F LS2-HT with GED FLEX up to 1400 °C/2,552 °F (max. 450 °C/842 °F at probe head)
Fuels	Suitable for: – light hydrocarbons such as natural gas, propane, butane – light heating oil – other fuels on request
Measuring site	The measurement site should be chosen so, that representative exhaust gas (complete mixing) is present. Exhaust gas temperature at the measurement site: max. 300 °C (572 °F)(LS2), max. 1200 °C/2192 °F (LS2-HT)
Gas extraction device (GED ECO)	The gas extraction device is simply fitted onto the probe and fastened with a screw.

NOTICE

It is not necessary for the GED ECO/GED FLEX to reach all the way to the centre of the flue gas channel. It suffices to have representative measured gas at the GED ECO flow apertures.

Distance probe → LT2 Lambda Transmitter (cable length!)	• up to 20 Meter/65.612 ft: Connection via ready-to-connect extension of 2 m (6.562 ft), 5 m (16.405 ft), 10 m (32.81 ft) and 20 m (65.617 ft) recommended; or through locally-made wiring via probe junction box. • more than 20 m (65.617 ft): via probe connection box, see chapter 5.3.2 <i>Probe Connection Box (PCB)</i> Connection via a probe connection box has the advantage, compared with a probe extension, that conventional cable can be used for wiring from the probe connection box onward. Thus, the cable length can be adapted on site to local conditions.
---	--

Recommended cable cross-sections for probe heating (shielding is required) (from LT2 Lambda Transmitter terminals 35 and 36, to probe connection box)

Cable length	Cross-section
up to 20 m/(65.617 ft)	= 1.5 mm ² (16 AWG)
up to 50 m/164.042 ft	= 2.5 mm ² (14 AWG)
all other connecting cables (screening necessary)	
up to 20 m/(65.617 ft)	= 0.75 mm ² (19 AWG)
up to 50 m/164.042 ft	= 1.75 mm ² (15 AWG)

6.2 Mounting LS2 Lambda Probe Standard Type 650R1000



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.

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 LT2 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 G 1¼ ".
2. Firmly weld a half-collar, interior thread G 1¼ "tight" at the measurement site.

NOTICE

Apply the collar's thread, the male coupling and the clamping ring with anti-size-paste type 650R1090. This avoids the seizing and guarantees a smooth dismounting of the probe.

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

6 Installation

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.

6. Install, position and tighten probe in PIF after commissioning.

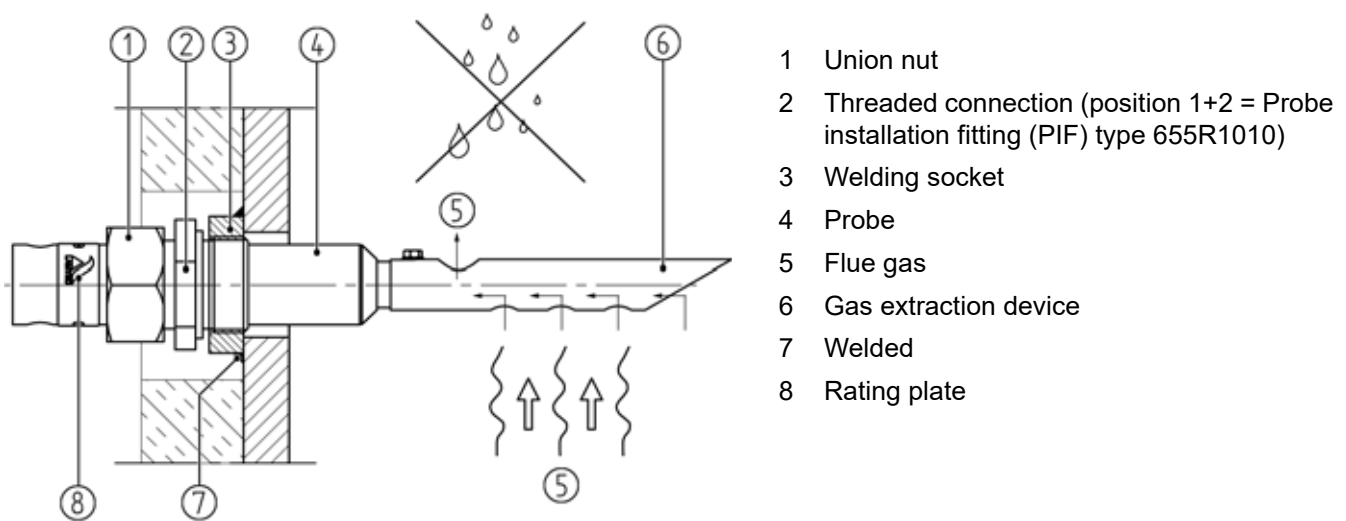


Fig. 6-1 Correct Probe installation with GED ECO

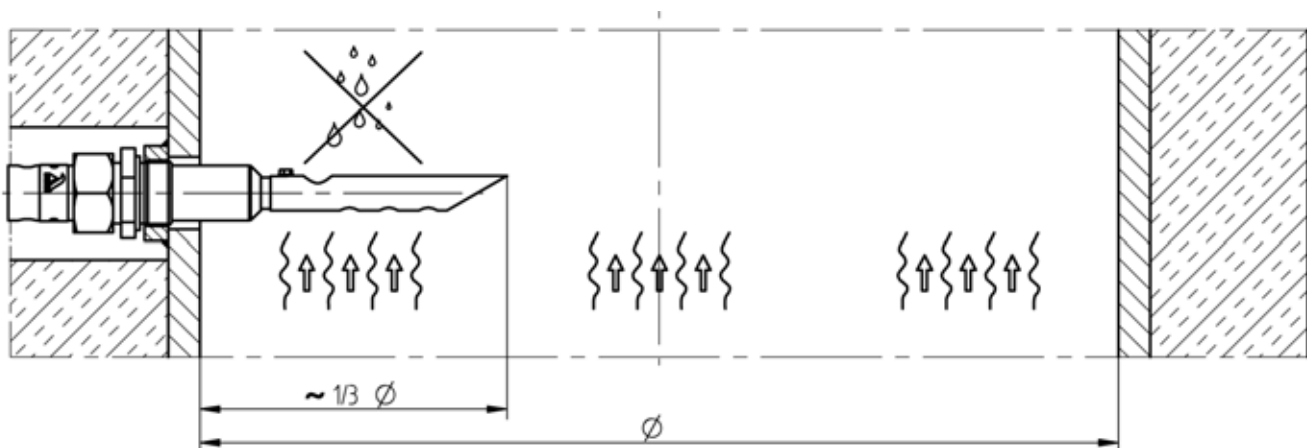


Fig. 6-2 Correct probe installation in flue gas duct

6 Installation

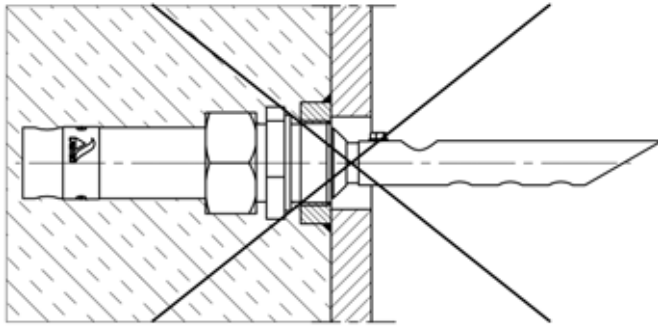


Fig. 6-3 Wrong probe installation



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

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).

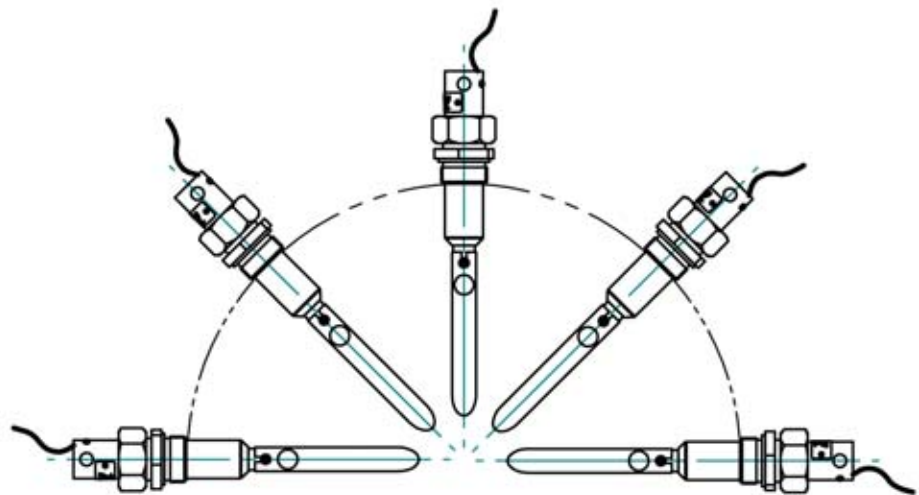


Fig. 6-4 Installation position, any from horizontal to vertical

6.3 Mounting LT2 Lambda Transmitter

Ambient temperature	Operation:	-20 °C to +60 °C (-4 °F to 140 °F)
	Transport and storage:	-40 °C to +85 °C (-40 °F to 185 °F)

NOTICE

Cold electronic - good electronic

This slogan should always be observed when determining the LT2 Lambda transmitter's installation site.

6.3.1 Electric Connections LT2 Lambda Transmitter



WARNING!

Danger of electric shock!

The device contains electrically conductive parts. Should you touch it, there is a risk of electric shock

- ▶ When you are working on any electric facilities, disconnect them from supply and check for zero voltage.
- ▶ Protect the device against an unintended restart!
- ▶ You must respect all relevant safety regulations all the time.

Mains connection for wall mounting housing

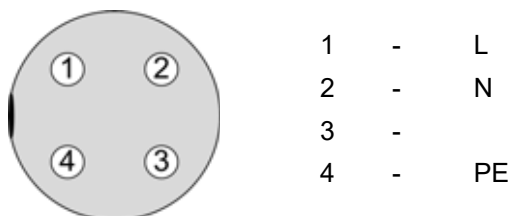


Fig. 6-5 Pin assignment for mains connection

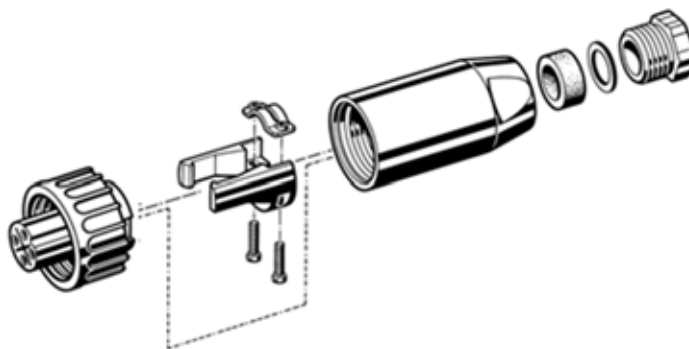


Fig. 6-6 Suitable coupling

Electric connection see chapter 11.5 *Electric Connection LT2*

Connecting diagrams see chapter 11.5 *Electric Connection LT2* to chapter 11.8 *Electric Connection at PROFIBUS Module*

NOTICE

Respect the standards for installation and shielding.

Connect the shielding as effective as possible to the EMC brush of the screwed cable gland. Therefor the connection to the PE-bar is not necessary.

Probe connections:

Do not lay the signal line, LT2 terminals 33 and 34 together with supply cables, particularly revolution speed control cables from frequency converters. Avoid any coupling to the power circuit.



Fig. 6-7 Screwed cable gland with EMC brush

NOTICE

Incorrect probe connections can destroy the probe. Check probe connections at terminals 33 to 36 before commissioning.

- 33 (-) probe signal
- 34 (+) probe signal
- 35 probe heating
- 36 probe heating

Cable diameters

Recommended diameters for cables between probe connection box and LT

	Probe heater terminal 35/36	Other connecting cables
up to 20 m (65.617 ft)	$\geq 1,5 \text{ mm}^2$ (16 AWG)	$\geq 0,75 \text{ mm}^2$ (19 AWG)
up to 50 m (164.042 ft)	$= 2,5 \text{ mm}^2$ (13 AWG)	$= 1,5 \text{ mm}^2$ (16 AWG)



- 1 = (+) Probe signal (black) (PCB/LT2 term. 34)
- 2 = (-) Probe signal (grey) (PCB/LT2 term. 33)
- 3 = Socket sensor signal
- 4 = Probe heater (white) (PCB/LT2 term. 35)
- 5 = Plug probe heater
- 6 = Probe heater (white) (PCB/LT2 term. 36)

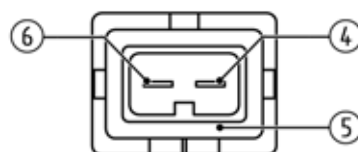


Fig. 6-8 Terminal assignment probe connection plug

6 Installation

6.4 LAMTEC SYSTEM BUS (LSB)

6.4.1 Jumpers, LED, Fuses and Terminals

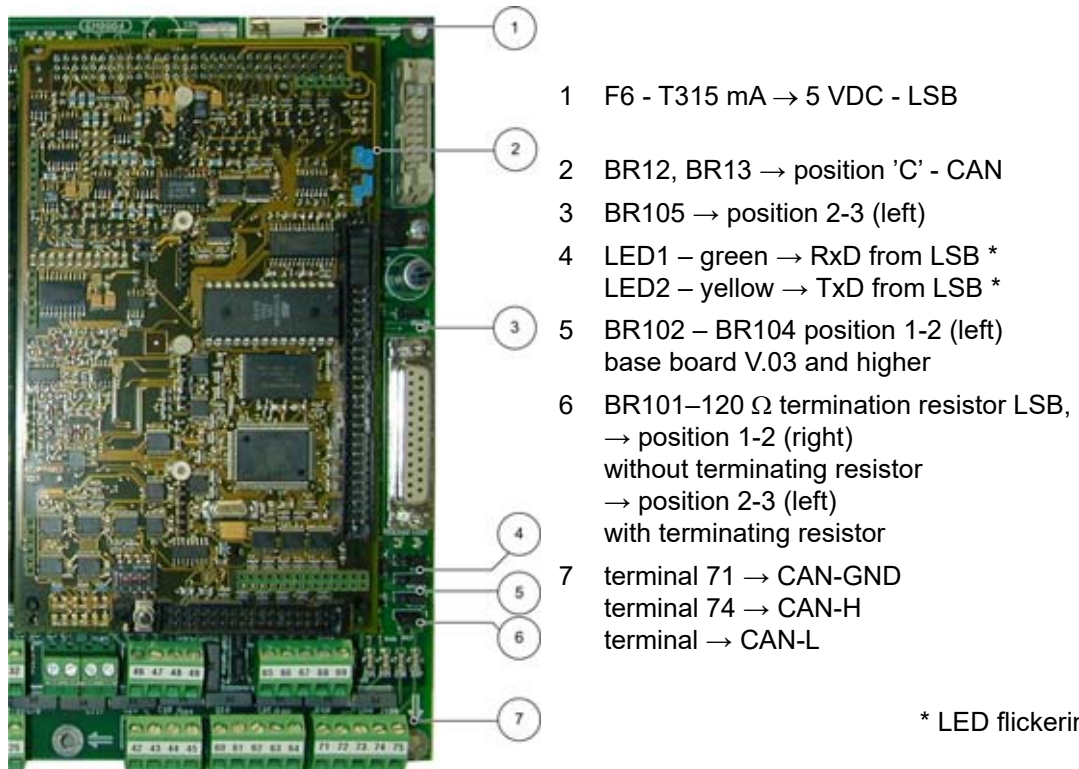


Fig. 6-9 LT2 assignment

6.4.2 Function

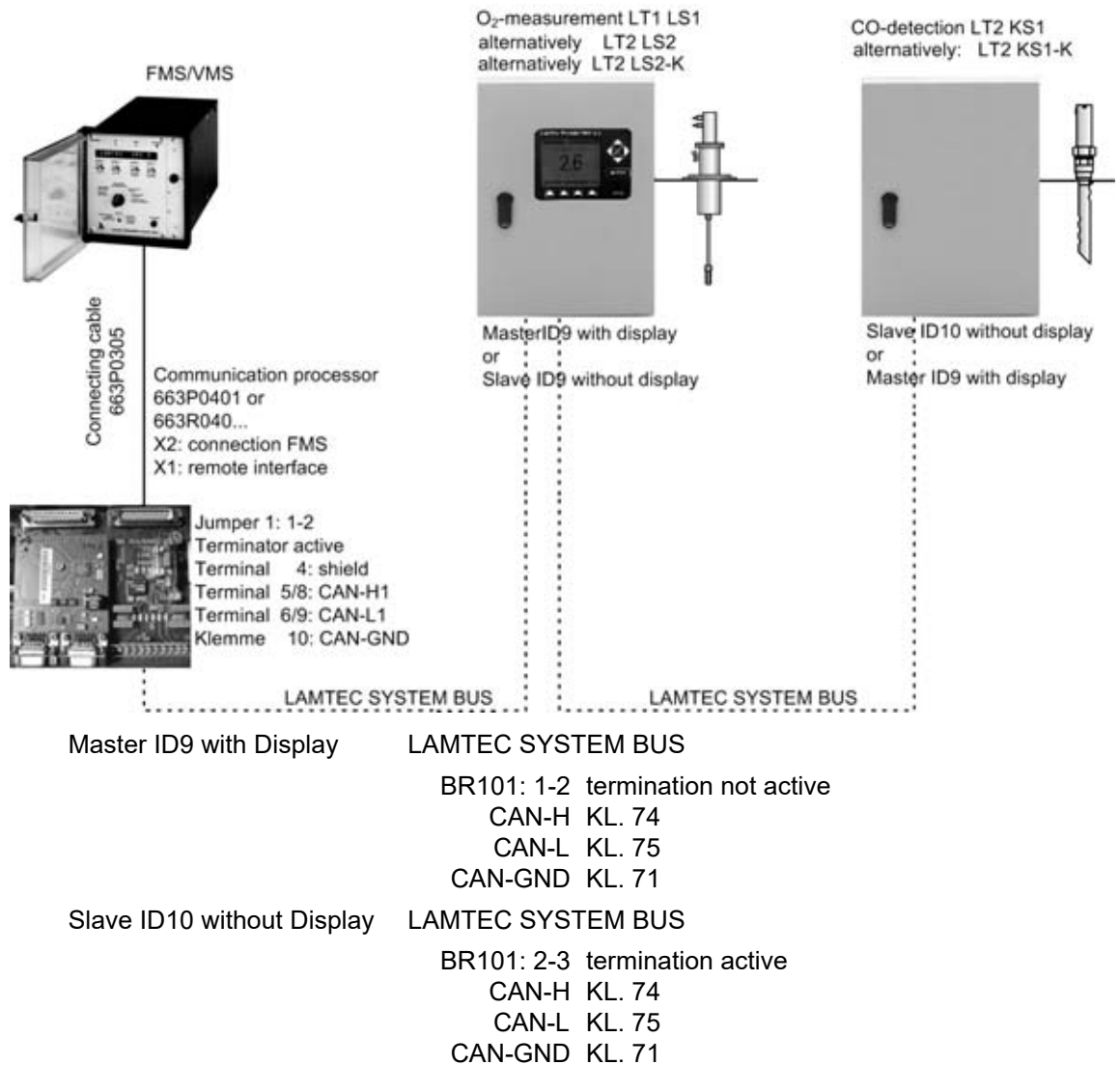
NOTICE

The data of the LT2 is only transferred by LAMTEC SYSTEM BUS if the device is set to MEASURING and not to MAINTENANCE or ERROR.

If the communication works properly LED 1 and LED 2 are flashing.

6 Installation

6.4.3 Connection Example O₂ Trim or CO/O₂ Control at FMS/VMS



NOTICE

Set the master LT (with display) to LSB- device ID 9 and the slave to ID 10 for remote display via LSB (LT-parameter 3801).

It is not possible to connect the master (LT with display) to the remote software and to the remote display at the same time. The connection which is established first takes priority over the other.

It is possible to use the remote software on the slave LT (LT without display) simultaneously. Establish and interrupt the remote connection in the menu diag/remote. It is possible to interrupt the connection at the master and the slave as well.

6 Installation

6.5 Spare Parts

6.5.1 LT2 Spare Parts

The following is a list of relevant spare parts. It is recommended to maintain a stock of the spares marked ⁽¹⁾.

Spares marked with the footnote ⁽²⁾ should be kept if considered appropriate.

Spares marked with the footnote ⁽³⁾ should be kept only if the system is equipped with the relevant option.

Spare parts	
Display and Operation Unit LT2	657R0833 ⁽³⁾
1 Replacement main board for LT2, without connector set	657E1882 ⁽²⁾
1 Processor electronic board for LT2	657R1874 LT2 ⁽²⁾
1 Replacement power supply transformer for LT2	657P0342 ⁽²⁾
1 Analogue output module 0/4 ... 20 mA; 0 ... 10 V	657R0050 ⁽²⁾
1 Analogue output module 0/4 ... 20 mA; 0 ... 10 V floating, Max. potential difference ± 20 V	657R0051 ⁽³⁾
1 Analogue input module LT1/LT2 Potentiometer 1 ... 5 Ω	657P6000 ⁽³⁾
1 Analogue input module 0/4 ... 20 mA	663P6001 ⁽³⁾
1 Analogue input module 0/4 ... 20 mA with supply 24 VDC for transmitter	663P6002 ⁽³⁾
1 Analogue input module 0/2 ... 10 V	657P6005 ⁽³⁾
1 Temperature input for Pt100	657R0890 ⁽³⁾
1 Temperature sensor Pt100, 250 mm (9.843" in) long	657R0891 ⁽³⁾
1 Relay card for digital outputs, 6 relays, 1 switcher each	660R0017 ⁽³⁾

6.5.2 Spare Parts Lambda Probe LS2 in Housing

Wear parts	
1 LS2 Lambda Probe average lifetime ca. 10.000 - 20.000 operating hours (depending on fuel) (without gas extraction device (GED ECO))	650R1000 ⁽¹⁾
Spare parts	
1 Gas extraction device (GED ECO), e.g. 300 mm (11.81" in) long, for standard lengths see price lists	655R1002 ⁽³⁾
1 Gas extraction device (GED ECO) 150 mm (5.91" in)	655R1001 ⁽³⁾
1 Gas extraction device (GED ECO) 450 mm (17.72" in)	655R1003 ⁽³⁾
1 Gas extraction device (GED ECO) 1000 mm (39.37" in)	655R1004 ⁽³⁾
1 Anti-size-paste (package of 5)	650R1090 ⁽¹⁾
1 Probe installation fitting (PIF)	655R1010 ⁽¹⁾
1 Clamping ring for PIF655R1010 (package of 5)	650R1013 ⁽¹⁾

⁽¹⁾ Recommendation: Add these spare parts into stock

6 Installation

6.5.3 Spare Parts LS2-HT Lambda Probe

Spare parts	Type
1 Replacement probe average lifetime ca. 2 ... 5 years (depending on fuel) with PTFE-connecting cable, in housing	650R1515
1 Replacement sensor, consists of sensor, seal for connecting head, filter discs and metal c-ring	650R1520 ⁽¹⁾
1 Mounting compound - Anti-seize-paste (5 pcs. per pack)	650R1090
1 Flange seal between counter flange/GED FLEX	655P4211
1 Flange seal between probe High temperature /GED FLEX	656P0263

⁽¹⁾ Recommendation: Add these spare parts into stock

7 Commissioning/Decommissioning

7.1 Factory Settings

7.1.1 Device Configuration

(unless otherwise specified in the order)

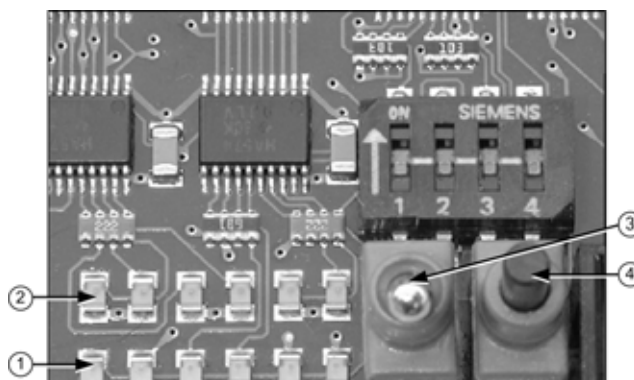
- | | |
|--------------------|--|
| Measuring range: | 0 ... 30 % vol O ₂ |
| Resolution: | 0,1 % vol O ₂ in range of 0 ... 18 % vol O ₂
1 % vol O ₂ in range over 18 % vol O ₂ |
| Probe temperature: | 880 K
(Parameter 141) |
| Analogue output 1: | 4 ... 20 mA = 0 ... 10 % vol O ₂
via parameter 531
0 ... 20 mA adjustable |
| Load: | 0 ... 600 Ω |
- Measurement span can be freely configured via the parameters 532 and 533
 - Relay outputs Idle current principle
 - Relay output 1: Collecting fault message
 - Relay output 2: Warning and maintenance
 - Relay output 3: Measurement
 - Relay output 4: Boundary value 1
 - Relay output 5: Boundary value 2
 - Relay output 6: Boundary value 3
 - Relay output 7: Boundary value 4
 - Boundary values
 - Boundary value 1: Switched off
 - Boundary value 2: Switched off
 - Boundary value 3: Switched off
 - Boundary value 4: < -5 mV value smaller than threshold
 - 3 seconds release delay
 - Reset mode "automatic"
 - (for monitoring the probe;
air value))
 - Digital inputs
 - Input 1: Reset fault/warning
 - Input 2: Reset boundary value messages
 - Input 3: Offset-calibration maintenance on/off
 - Input 4: PID-controller off
 - Input 5: Maintenance on/off (from software 1V33a)
 - Input 6: Fuel 2 (Gas)*
 - Input 7: Fuel 3*
 - Input 8: Fuel 4*
- * Parameter 836 - service level must be present at digital inputs.
Without signal default heating oil EL.
- RS 232-interface device address 1
 - 9600 Baud
 - parity none

7 Commissioning/Decommissioning

7.2 Preliminary Works

7.2.1 The LT2 Lambda Transmitter's Display and Operating Elements

The LT2's operation and the display of measured values, operational and error messages take place by the (optional) display and operating unit, or by a PC in combination with the Remote Display Software. The LT2 itself has only limited operating capabilities, which do not allow LT2 to display or process all the functions necessary for operation, maintenance and servicing.



- 1 Display of operating mode
- 2 Warning / Fault display
- 3 Maintenance switch
- 4 Multifunction key

Fig. 7-1 Internal display and operating elements on the processor board

7.2.2 Monitor Output

The monitor output (terminals 31 (-) and 32 (+)) makes it possible to connect a multimeter for example. The device indicates the following values by the monitor output:

- O_2 measured value
- Probe voltage [U]
- The measuring cell's AC internal resistor [R_i]

DIP switch processor card

SW 1	SW 2	Monitor output function		
OFF	OFF	O_2 measured value	$0 \dots 2.5 \text{ V} = 0 \dots 25 \% \text{ vol } O_2$	
ON	OFF	O_2 probe voltage ($U-O_2$)	$0 \dots 2.5 \text{ V} = 0 \dots 250 \text{ mV}$	
OFF	ON	O_2 cell's internal resistance	$0 \dots 2.5 \text{ V} = 0 \dots 250 \Omega$	

Input resistance of the connected measuring device greater than $10 \text{ k}\Omega$.

7 Commissioning/Decommissioning

7.2.3 Internal Display and Operating Elements

Legend: LED



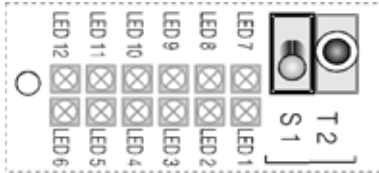
is off



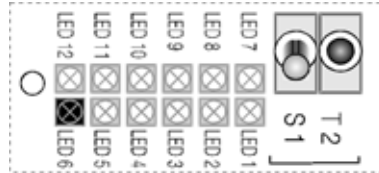
flashes



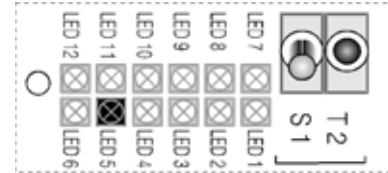
lights up



Multifunction key T 2
Maintenance switch S 1



Operation (green) LED 6



Operating mode (green) LED 5



Operation

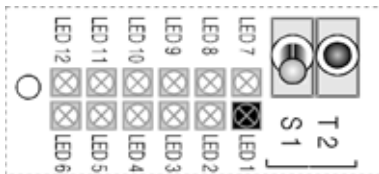


Measurement



Calibration

Offset compensation (flashes slowly)
With test gas/comparative measurement (flashes quickly)



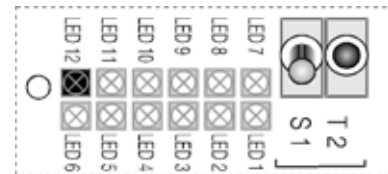
Maintenance (orange) LED 1



Maintenance mode off



Maintenance mode on



Warning/fault (red) LED 12



Maintenance mode active



Normal operation



No warning / fault



At least one warning present



At least one fault present

NOTICE

Function	Key operation
Toggle the displayed warning/ fault	Press briefly
Reset the displayed warning/fault	Press for longer than 3 sec*
Abort cold-start	Press for longer than 3 sec**
Trigger an offset calibration to ambient air	Press key for longer than 3 sec during measurement**
* Some warnings and faults cannot be reset if the error is still present or the routine is still running.	
** If at least one warning or fault is still present, the key must be pressed for longer than 6 seconds.	

7 Commissioning/Decommissioning

7.3 Measurement Start-up

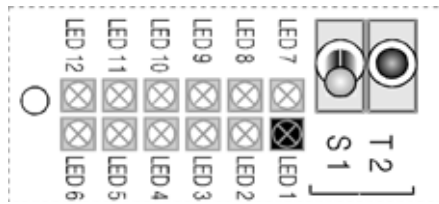


Fig. 7-2 Maintenance (orange) LED 1

- Connect the probe but do not install it
Switch to MAINTENANCE
either via the display and operating unit in menu
[diag] or with the maintenance switch S1

NOTICE

The maintenance switch always has priority.

- – MAINTENANCE mode active
- ⊗ – Normal OPERATION

-  – MAINTENANCE mode OFF
-  – MAINTENANCE mode ON

Start up measurement:

- Switch on voltage
- LED 1 shows MAINTENANCE
- Probe heats up
- COLD START is shown
LED 6 OPERATION ON
LED 5 MEASUREMENT OFF

NOTICE

During cold start the display and operating unit or the monitor output indicate the cell's inner resistance R_i .

The measurement function is ready for operation after 10 minutes.

Measurement is shown
LED 6 OPERATION is ON
LED 5 MEASUREMENT is ON

NOTICE

The cold-start delay can be activated from the display and operating unit → [cal] key. Proceed as prompted by the menu, or interrupt by pressing the multifunction key T2 (for longer than 3 seconds, or if a warning or a fault is still present, for longer than 6 seconds).

- Observe the cell's inner resistance and read the probe voltage alternatively via display and operating unit (if available) or at the monitor output.

NOTICE

To read the probe voltage --> confirm with [meas] and choose probe voltage U_S .

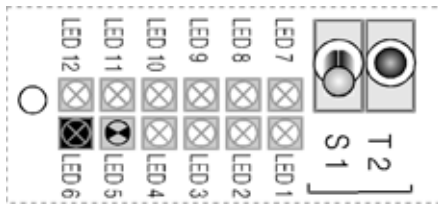


Fig. 7-3 Multifunction key T2

After a 10 minutes heating phase, the probe voltage would be stabilised to values between -5 and -15 mV and the measuring cell (R_i probe) internal resistance would be stabilised to values below 100Ω , for new probe below 20Ω . Are positive values displayed in air, the probe's polarity is reversed. Swap probe connection on terminals 33/34.

Proceed with offset calibration alternatively by using display and operating unit in [cal] or the multifunctional key T2 (hold for more than 3 seconds in MEASURING mode).

NOTICE

Calibration is displayed
LED 6 OPERATION is ON
LED 5 MEASUREMENT is flashing

- Wait for offset calibration to be finished.
Flashing has stopped.
- Enter probe temperature from the test protocol, parameter 141 'customer access level'; alternatively see separate manual in
 - Display and operating unit (optional)
 - Remote display software (optional)
- Exit MAINTENANCE

NOTICE

"Probe temperature T"

The LT2 Lambda Transmitter and LS2 Lambda Probe are not adjusted to each other. The LS2 Lambda Probe is subject to production dispersion, which can be compensated by offset calibration and probe temperature. A probe calibration with test gas is not necessary. The probe temperatures determined by the end test can be found in the test protocol (which is part of the delivery).

- Install probe as described in chapter 6.2 *Mounting LS2 Lambda Probe Standard Type 650R1000*.

NOTICE

When installing or operating the probe, ensure that the probe does not get into contact with oil, grease or boiler cleaning materials.

This does not apply only to the cell, but also to the connector region!

The thread and the clamping ring should be treated with mounting paste type 655R1090 to prevent for seizing.

Poisoned or contaminated probes can be identified by an air voltage of -20 ... -30 mV.

The probe must always be in operation when it is installed. This avoids the precipitation of moisture on the measuring cell, which in certain cases can lead to erroneous measurements and to the probe's destruction!

- Start up combustion
- Measured value plausible?
Check if necessary via comparative measurement

NOTICE

Almost all extractive O₂-meters measure 'dry', in contrast to the in-situ ZrO₂-meters; i.e. moisture is extracted from the flue gas through a purification process (cooler) or a chemical absorber (silica gel). This reduces the volume of the measured gas, and thus the proportion of O₂ increases. This fact must be taken into account during comparative measurement. A diagram for converting wet into dry measurements can be found in chapter 11.4 *Electric Connections Device Side*

- If large deviations are present, it is possible to compensate for the values obtained via
 - the display and operating unit, in [cal]
 - the service and diagnostic software
 - as follows, using the multifunction key:

Measure the O₂ value at the monitor output or analogue output. Start calibration with the multifunction key. LED 5 should flash rapidly

Briefly pressing the multifunction key increases the output O₂ value by 0.1 %

Pressing for a longer (time > 3 s)
The modification direction is inverted.

NOTICE

Calibration should only be carried out if it was previously ascertained that the comparison instrument is measuring correctly (e.g. by using test gases).

In any event, offset calibration should previously have been carried out in operational (warm) conditions.

It is necessary to ensure that ambient air is present at the measurement site. If this is not ensured, the probe must be dismantled again for the offset

7.3.1 Test Certificate

Test Certificate Lambda Probe LS2
Prüfprotokoll LambdaSonde LS2 / certificat de test de la sonde LS2

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

Heater data <i>Heizerdaten / données du chauff.</i>	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <th style="width: 25%;">Voltage U_H</th> <th style="width: 25%;">Current I_H</th> <th style="width: 25%;">Resistor R_H</th> <th style="width: 25%;">Power P_H</th> </tr> <tr> <td>10,8 V</td> <td>1,55 A</td> <td>7,0 Ω</td> <td>16,7 W</td> </tr> </table>	Voltage U_H	Current I_H	Resistor R_H	Power P_H	10,8 V	1,55 A	7,0 Ω	16,7 W
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 <i>Sensoroffset / offset de la sonde</i>	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <th style="width: 50%;">before <i>vor / avant</i></th> <th style="width: 50%;">after <i>nach / après</i></th> </tr> <tr> <td>-5,1 mV</td> <td>-4,6 mV</td> </tr> </table>	before <i>vor / avant</i>	after <i>nach / après</i>	-5,1 mV	-4,6 mV
before <i>vor / avant</i>	after <i>nach / après</i>				
-5,1 mV	-4,6 mV				

Calculated values <i>Berechnete Werte / données calculée</i>	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <th style="width: 70%;">Sensor temp. <i>Sensortemp. / temp. du capteur</i></th> <th style="width: 30%;">910 K</th> </tr> <tr> <td>rel. diff at <i>bei / à</i> 5,4% O_2</td> <td>1,9 %</td> </tr> </table>	Sensor temp. <i>Sensortemp. / temp. du capteur</i>	910 K	rel. diff at <i>bei / à</i> 5,4% O_2	1,9 %
Sensor temp. <i>Sensortemp. / temp. du capteur</i>	910 K				
rel. diff at <i>bei / à</i> 5,4% O_2	1,9 %				

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Tel.: +49 (0) 6227 / 60 52 -0 Fax: +49 (0) 6227 / 60 52 -57 Internet: <http://www.lamtec.de>

Fig. 7-4 LS2 test log (gas burner) page 1

NOTICE

If no reference device is available, you must enter the value entered in the "Calculated Values" field in LT2 LS2 (O_2 measurement) P 141 (in this example 910). The LT2 KS1 is then calibrated to the O_2 value of the LT2 LS2 (CO_e measurement). This is possible using the display and operating unit and LSB remote software.

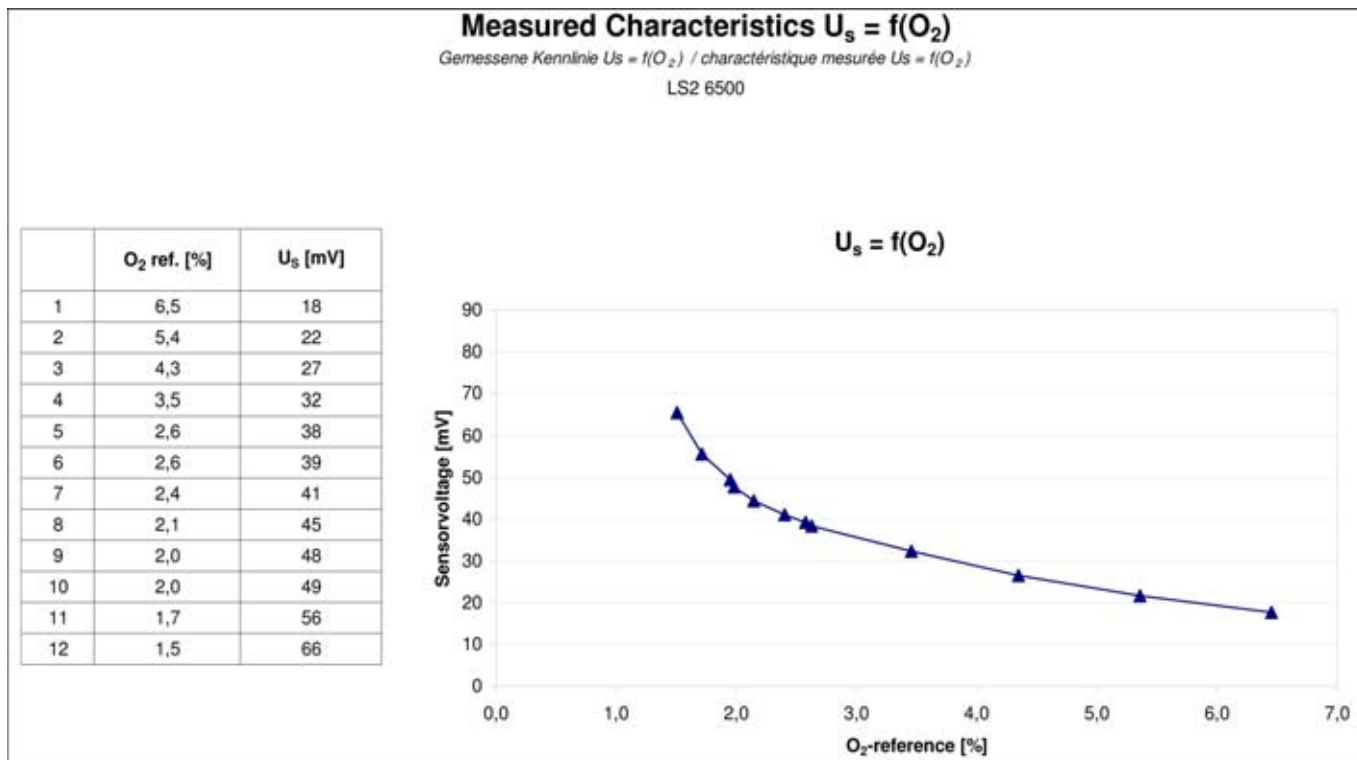


Fig. 7-5 LS2 test log (gas burner) page 2

7.3.2 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 <i>Probe certificate / Certificat de la sonde</i> 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. <i>Probe no. / No. de la sonde :</i>		
Artikel-Nr. <i>Article no. / No. d'article:</i>		
Kunde <i>Customer / Client:</i> Kunden-Nr. <i>Customer no. / Code client:</i> Auftrags-Nr. <i>Order no. / No. de commande:</i>		
Sondenpass bei Inbetriebnahme ausfüllen und im Falle einer Reparatur der Sonde beilegen. Keine Kulanz ohne ausgefüllten Sondenpass! <i>Please return probe with certificate. No warranty claim without certificate.</i> <i>Joindre le certificat de la sonde rempli au cas de renvoi. Sans certificat rempli, pas de réparation amiable.</i>		
Anlage <i>Installation</i>		
Adresse <i>Address / Adresse</i>		
Datum der Inbetriebnahme <i>Startup date / Mise en service, le</i>		
Brennstoff <i>Fuel / Combustible</i>		
Bitte vor Rücksendung ausfüllen <i>Fill in please before return / Remplir avant retour:</i>		
Betriebsstunden <i>Operating hours / Heures de marche</i>		
Bemerkungen <i>Remarks / Remarques</i>		

7 Commissioning/Decommissioning

7.4 Setting up Service Warnings

Service warnings 1 and 2 are designed to draw attention to regular servicing. The service warnings can be freely defined by the operator, e.g.

Service warning 1 → check probe

Service warning 2 → dismantle and clean probe

The appropriate cycle times can be specified via the parameters 1260 and 1261 in the range 1 to 65535 hours.

7.5 Decommissioning

In order to be sure to avoid damaging the probe's ZrO_2 measuring element, the probe must be dismantled before the system is shut down or immediately after the supply voltage is switched off.

NOTICE

Dismantle the probe before shutting down the measurement system.



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

Once dismantled, the probe can be stored indefinitely. The zirconium element is only consumed during operation (measuring cell at operating temperature). This also applies where a probe has already been used previously.



8 Operation

8.1 Operation/Measurement Value Display

- Display and operating unit (optional) is included as a standard in LT2 19" for panel installation.
- Service and diagnostic software (optional)
- Limited by multifunction key and monitor output

8.1.1 Measurement Value

• O ₂ actual value	0 ... 30 % vol O ₂ Resolution: 0.1 % vol O ₂ up to 18 % vol O ₂ 1.0 % vol O ₂ above 18 % vol O ₂
• Probe voltage	-30 ... +150 mV Resolution: 0.1 mV
• AC internal resistance of the ZrO ₂ cell	0 ... 750 Ω Resolution: better than 0.2 Ω Displayed up to 999.9 Ω
• Exhaust gas temperature (optional)	0 ... 320 °C/32 °F ... 608 °F Resolution: 1 °C/33.8 °F Alternatively: 0 ... 850 °C/ 32 °F ... 1562 °F Resolution: better than 2 °C/ 35.6 °F
• Combustion efficiency (optional)	0 ... 100 % Resolution: 0.1 %
• Calculated CO ₂ -concentration (optional)	0 ... 20 % vol Resolution: 0.1 % vol
• CO/H ₂ concentration, shown as CO _e [CO _{equivalent}]	0 ... 10,000 ppm Resolution: variable 1 ... 100 ppm depending on measured value Alternatively: 1 % of measured value, not better than 1 ppm
• Customised values	Can be freely configured, e.g. exhaust gas, temperature, efficiency, CO ₂ concentration etc.

8.1.2 Commands

- Abort 'Cold-start delay' → Directly during measurement
- Offset compensation → Compensate probe to ambient air, 21 % vol O₂
- Calibration → Perform measured value compensation by comparative measurement. Test calibration only in connection with a special testing device (see chapter 9.3.1 *Checking/Calibrating with Test Gas*) or with LS2-HT possible.
- Fault/warning → Reset
- Limit values → Reset

8.1.3 Status Signals

- Measurement
- Calibration offset [Cal - offs]
- Calibration [Cal - gas]
- Maintenance
- Cold-start
- Probe heating active
- Measurement/no measurement
- At least one warning active
- At least one fault active

Status message during calibration

- Offset
- Cal-Gas

8.1.3.1 Warnings

No.	Description
1	Inner resistance LS2 too high
2	LS2 offset calibration with ambient air is not valid
19	Analogue input 1: input value to high/low
20	Analogue input 2: input value to high/low
21	Analogue input 3: input value to high/low
22	Analogue input 4: input value to high/low
24	Service warning 1
25	Service warning 2
26	Probe dynamic LS2 is missing
27	Dynamic test triggered

see chapter 10.5 Warnings - Causes and Solutions

8.1.3.2 Faults

No.	Description
1	Probe voltage < - 30 mV
2	Probe heating LS2 defective
5	Broken wire probe/probe defective
9	Probe dynamic LS2 is missing
11	Error analogue outputs

see chapter *10.4 Faults - Causes and Solutions*

8.1.4 Operating Parameters

- Downward counter, cold-start delay
- Time, date
- Operating hours counter

8 Operation

8.2 General Instructions for Operation

8.2.1 Measurement During Distinct Pressure Surges at the Measuring Site

If the display jumps badly, damping can be increased via the (optional) display and operating unit and the service and diagnostic software (i.e. by increasing the integration's time-constant); this steadies the display: parameter 360 - Operational release level. However, this slows down the display in terms of reaching an end state.

NOTICE

Large damping simultaneously leads to an artificial slowing down of the measurement signal.

8.2.2 Operational Failure, Switching On and Off

In the event of long interruptions during operation, which are lasting for longer than approx. 3 months, it is recommended to switch off the measuring system. The probe should be dismantled to avoid damage (see chapters *7.4 Setting up Service Warnings*, *7.5 Decommissioning*).

NOTICE

Recommendation: Continue with the measurement in case of short service interruptions.

8.2.3 Liquid Purification

To perform a liquid purification of the boiler is possible, if the probe is dismantled before. Performing a liquid purification to an installed probe, can damage the probe. An error free operation is no longer possible.

NOTICE

For the liquid purification, the probe must be dismantled by all means. A liquid purification of an installed probe will damage the probe.

9 Service and Maintenance

9.1 Checking the O₂ Probe

9.1.1 Checking the Air Voltage

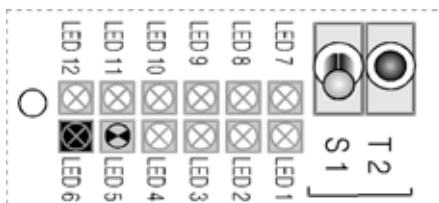


Fig. 9-1 T2 multifunction key

- Switch off the facility
- Pre purge, until no more flue gas is present at the measurement site (approx. 1 minute).
- Turn off the pre purge.
- Carry out offset calibration either by
 - the (optional) display and operating unit in [cal] - menu-driven
 - the (optional) service and diagnostic software
 - T2 multifunction key

NOTICE

Functions	Handling of the Keys
Toggle the displayed warning/fault	Press shortly
Reset the displayed warning/fault	Press for longer than 3 sec.*
Quick start of the measuring gas pump - abort of the cold start	Press for longer than 3sec.**
Trigger an offset calibration	Press key for longer than 3 sec. during measurement **
* Some warnings and faults cannot be reset if the error is still present or the routine is still running.	
** If at least one warning or fault is still present, the key must be pressed for longer than 6 seconds.	

If probe voltage is outside the permissible range, the warning 'Offset calibration to air invalid' is indicated.

- Read out probe voltage at LT2 either by
 - the display and operating unit (option)
 - the service and diagnostic software (option)
 - measure probe voltage with a multimeter;
Connect a digital voltmeter in parallel to the probe at terminal 33 (-) and 34 (+).
Compare the measured voltage with the displayed voltage (US).
- Valid range: 5 mV ... -30 mV
- If the probe's voltage is above/below this range → replace probe

NOTICE

Do not forget!

Perform a new offset-calibration in ambient air and enter the probe's new temperature value after replacing the probe.

Limit value 4 is set at the factory: An automatic check of the probe is possible at downtime and at pre-purge of the plant. No response of the limit values!

Limit value 4 → 5 mV shortfall, automatic reset
Delay time of the trigger 3 seconds
-30 mV shortfall is monitored by fault no. 1

An intact probe does not cause fault no. 1.
If fault no. 1 'probe voltage < -30 mV' occurs reset it manually.

NOTICE

After the loss of the power supply (and therefore the heating of the probe) the probe voltage may decrease for a moment to -30 mV in the heating period.

Recommendation: Retain the factory-set limit value 4 for safety reasons.

If the facility cannot be switched off, the probe must be dismantled for examination.

After dismantling of the damaged probe remove the union nut.



CAUTION!

Hot probe!

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

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



Remove the union nut

✂ Torx screwdriver size TX10

1. Remove the rating plate with suitable tools.
(by sliding and withdrawing a suitable flat head screwdriver under the rating plate in the rivet area or by drilling and removing the rating plate in the rivet area with a suitable drill.
2. Remove the two screws of the strain relief with the torx screwdriver.
You can remove the union nut now.

NOTICE

If you send the damaged probe for repair, the rating plate has to be attached.

The union nut is not included in the spare part kit (connector set, anti-size-paste, clamping ring) for LS2. You can order it on request.

9.1.2 Checking by Counter Measurement

Precise checking of the measurements is only possible through counter measurement with a second probe, or by comparing the measured values after probe replacement.

NOTICE

During counter measurement, check whether the instrument being used measures wet or dry. Those with an advance gas cooler are always used for dry measurement. This also applies to instruments that extract moisture via a chemical compound. The LS2 Lambda Probe measures wet. The difference between wet and dry measurements can be obtained from the diagram in the Appendix (see chapter 11.9 *Wet/Dry Measurement Deviations, Conversion Table*).

- If large deviations are present, it is possible to compensate for the values obtained via
 - the display and operating unit, in [cal]

NOTICE

Confirm the new calibration value with ENTER or OK during the calibration of the measurement value with the display and operating unit → [cal]. If not, the menu will be quit automatically after 15 sec. and the new calibration value is discarded.

- the service and diagnostic software
- as follows, using the multifunction key:
 - Measure the O₂ value at the monitor output or analogue output.
 - Start calibration with the multifunction key.
 - LED 5 should flash rapidly (see chapter 7.2.1 *The LT2 Lambda Transmitter's Display and Operating Elements*).
 - Press briefly: The O₂ value is changed by 0.1 %
 - Press long (> 3 seconds): The direction of change is reversed.

NOTICE

Which instrument measures correctly?

Compensation should only be carried out if it was previously ascertained, e.g. by using test gases, that the comparison instrument is measuring correctly.

9.2 Checking the LT2

9.2.1 Checking the LT2's Measuring Input

Connect a digital voltmeter between terminals 33 (-) and 34 (+), in parallel to the probe. Compare the measured voltage with the probe voltage displayed (U_S).

Range: -30 mV ... +300 mV.

If the difference is less than 1 mV, the LT2 is operating correctly.

If the difference exceeds 1 mV, repeat the above step with another digital voltmeter.

NOTICE

Check the accuracy of the digital voltmeter used.

If the difference persists → exchange the instrument.

9.2.2 Checking the Probe's Internal Resistance Measurement

Checking the probe's inner resistance

✓ Available only with a probe simulator, type 655R1030.

1. Connect the probe simulator to terminals 33 (-) and 34 (+)
2. Set an internal resistance < 200 Ω with a potentiometer
3. Check with volt meter:
 - a) AC voltage between terminals 33 (-) and 34 (+).
 - b) Indication in mV = corresponds to one half of the probe's internal resistance.
 - c) $R_i > 200 \Omega$ – after 10 s Warning 'Inner resistance [Probe Name] too high'
 $R_i > 300 \Omega$ – after 10 s Failure 'Probe broken wire/Probe defective'

Example: 75 mV $\triangleq$ 150 Ω

NOTICE

During COLD START the monitoring of the probe's internal resistance is disabled.

9.3 Maintenance

Check the measurement system on a monthly, quarterly or semi-annual basis, depending on the application.

9.3.1 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.

Choose a test gas combination so that O₂ content lies in the usual plant specific range and within the specified measuring range of the probe.

Description:

The testing device is a device for the task of testing gases via the test gas connection ON (No. 4 in *Fig. 9-2 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 be used lying on the table or plugged into the flue gas channel (*Fig. 9-2 Testing device laying on the table* and *Fig. 9-3 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.

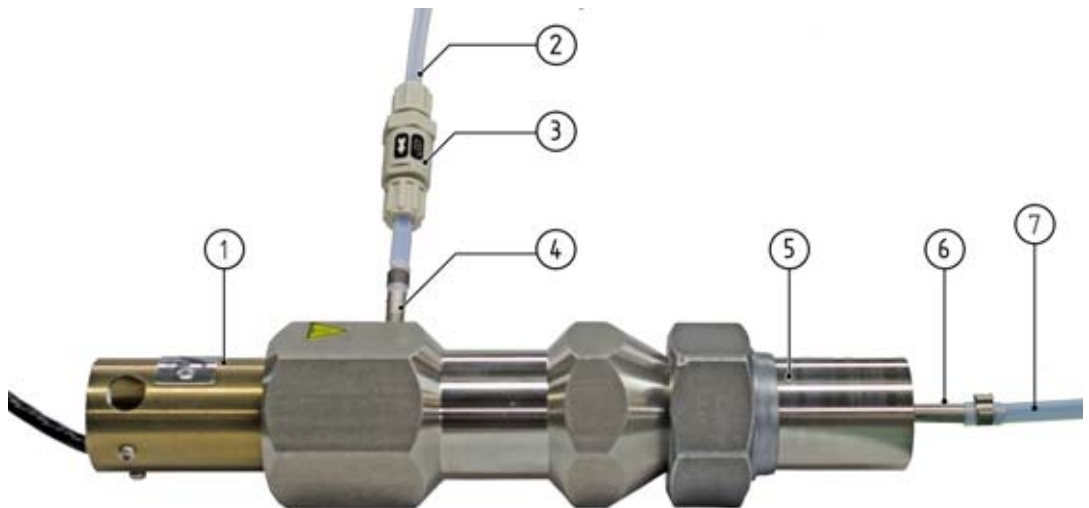


Fig. 9-2 Testing device laying on the table

- 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. 9-3 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.

4. Calibration/probe testing:
According to table 4, LS2 is to be tested within 2 steps while.

Testing/ calibration	Description
1 Offset	Offset testing/calibration Compare oxygen values of probe and test gas A. Should the deviation of oxygen value be less than or equal to 0.2 vol.% of 21 vol.% (as shown in parameter 15, internal value O_2), the probe is fine. Should the deviation of oxygen value be more than 0.2 vol.%, the probe must be calibrated according to the manual.
2 O_2	O_2 testing/calibration Compare oxygen values of probe and test gas B. Should the deviation of oxygen value be less than or equal to 0.1 vol.% of 3 vol.%, the probe is fine. Should the deviation of oxygen value be more than 0.1 vol.%, the probe must be calibrated according to the manual.

NOTICE

With LS2-HT, the test gas to be tested/calibrated can be connected directly at the hose connection for calibration gas, this can be done while combustion is running, the probe does not have to be removed.. A special testing device is not necessary. The required test gas quantity lies between 40 ... 60 l/h, if no flow meter is available, a test gas pressure of 5-10mbar can be set.

Probe calibrated

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 O₂ electrode, use a test gas with 3 vol. % O₂ in N₂.

9.3.2 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. 9-4 Probe head*.
 2. Loose Allan key and remove them → remove probe head *Fig. 9-5 Sensor without probe head*
 3. Remove sensor and seal *Fig. 9-6 Mounting/dismounting the sensor and Fig. 9-7 Dismounted sensor with seal*.
 4. Unscrew filter cap and remove filter *Fig. 9-8 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.



Fig. 9-4 Probe head



Fig. 9-5 Sensor without probe head

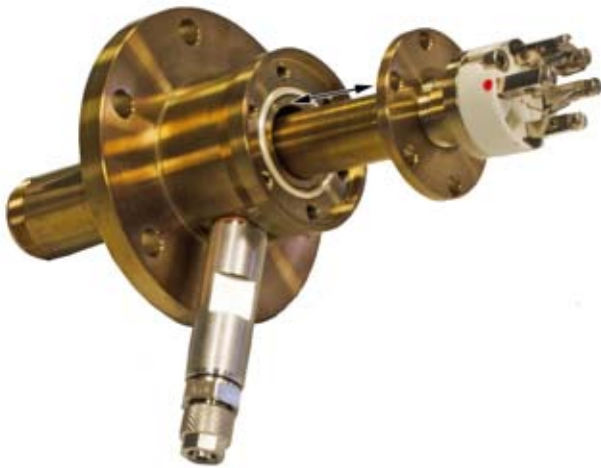


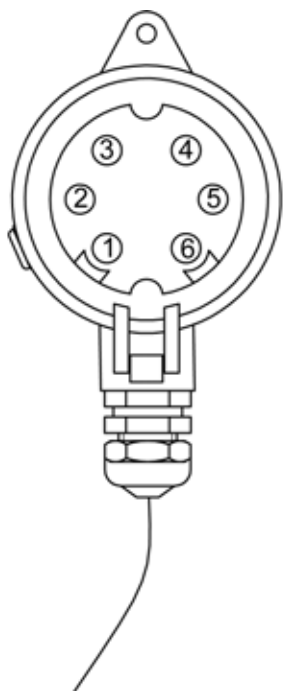
Fig. 9-6 Mounting/dismounting the sensor



Fig. 9-7 Dismounted sensor with seal



Fig. 9-8 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. 9-9 Terminal socket LS2-HT from 6/2015

9.3.3 Consumables

Lambda Probe → Average lifetime

- natural gas and light fuel oil: 3 ... 5 years
- with heavy fuel oil, coal and biogas: 1 ... 3 years

10 Faults/Warnings

10.2 Warnings

Legend: LED



is off



flashes



lights up

Message by LED row, LED 7 to 12, LED 12 lights up.

Warnings (LED ON)

	12	11	10	9	8	7	Warning No.:
Display of active warnings (red), LED(s) permanently on.							No warnings/faults active
							1 Internal resistance too high
							2 Offset voltage to air invalid
							19 Analogue input 1: input value too high/low
							20 Analogue input 2: input value too high/low
							21 Analogue input 3: input value too high/low
							22 Analogue input 4: input value too high/low
							23 Configuration error analogue output
							24 Service warning 1
							25 Service warning 2
							26 No probe dynamics *
							27 Dynamic test triggered *

* Only relevant in conjunction with an integrated O₂ control system.

Without an integrated O₂ control system the dynamic test should remain OFF → parameter 1330 = 0.

10 Faults/Warnings

10.3 Resetting Faults/Warnings

- by (optional) display and operating unit, in [diag], menu-driven
- by service and diagnostic software in [status], menu-driven
- by digital inputs – input 1
- by pressing the T2 multifunction key (for longer than 3 seconds per fault).

If several faults are present simultaneously, press the multifunction key several times.

Press the key **[diag]** to switch to warnings and faults. Select the single warnings, faults or limit values with the cursor keys (up/down).

NOTICE

Limit values are displayed only if they are activated in parameters 930/940/950/960 (access level 'Service').



NOTICE

Reset all warnings or faults by quitting them. If necessary eliminate the cause of the warning/fault.

10.4 Faults - Causes and Solutions

10.4.1 Probe voltage too low

- Probe + / - reversed → probe connection terminal 33-34 change
- Probe poisoned → replace

NOTICE

Probe voltage to air +5 to –30 mV

10.4.2 Defective LS2 Probe Heating

NOTICE

In 99 % of all cases, the LS2 Lambda Probe was disconnected during operation. Reset fault either by the multifunction key or by the display and operating unit etc.

1. Reset fault either by the multifunction key or by the display and operating unit etc.
2. A defect only exists if the fault cannot be reset.

Possible causes:

- Check fuse F 5 (see chapter 11.4.4 LT2 Power Electronic Type 657E1882)
- Check the probe heater. In an intact heater, ca. $10\ \Omega$ ($9\ \Omega \dots 11\ \Omega$) can be measured between terminal 35 and 36. If not ($R \rightarrow \infty$) $\rightarrow$ heater faulty. Replace probe.
- If intact, check the supply voltage: The probe heater must be supplied with about 13 VDC, cyclically reversed. If not, check the wiring and the terminals and tighten if necessary.

NOTICE

The probe is heated with direct current at approx. 13 V, cyclically reversed. Therefore the use of a multimeter to measure it is somewhat difficult.

NOTICE

The current heating data can be read out from LT2 operating parameters 41/42/43.

10.4.3 Broken Wire Probe/Defective Probe

This message is indicated if the AC internal resistance (R_i) or the ZrO_2 cell exceeds the permissible limit of $300\ \Omega$. Before or after this message you normally will get the warning 'Inner resistance [probe] too high'.

Possible reasons:

- The probe is disconnected (measuring signal on terminals 33 to 34)
- Loose connection $\rightarrow$ check the terminals, re-tighten
- Probe too cold, possibly enhance the heating power gradually (0.5 W)
- Check wiring, if OK $\rightarrow$ replace probe

10.4.4 No Probe Dynamics

No probe dynamic detected. Check the probe.

NOTICE

Testing is shut off on delivery.

Activate testing in parameter group 1330 to 1334.

The testing checks, if the measuring value changes more than the parameter set threshold value during a specified time.

Only valid in combination with an integrated O₂ control.

10.4.5 Fault Analogue Output

Check the parameters of the analogue outputs.

- Parameter 530 ... 539 analogue output 1
- Parameter 540 ... 549 analogue output 2
- Parameter 550 ... 559 analogue output 3
- Parameter 560 ... 569 analogue output 4

Check the analogue outputs on the processor electronic and replace them if necessary. An analogue output might be activated, but is not assembled? →

Check assembly.

(see chapter 11.4.3 Fuses)

The parameters can only be viewed via the display and control unit or remote display software.

Without these options, the computer electronics must be sent in.

10.4.6 O₂ Value Is Incorrect

If a control measurement results in a different O₂ value than the one displayed:

- Has the relationship between wet/dry measurement been taken into account?
see chapter 11.9 *Wet/Dry Measurement Deviations, Conversion Table*
- Check LT2 and probe, see chapter 9.2 *Checking the LT2*
- Commission the new probe as described in chapter 7 *Commissioning/Decommissioning*
- Measuring value too high? Secondary air, check sealing and hose connections if they are tight.

NOTICE

During counter measurement, check whether the instrument being used measures wet or dry. Those with an advance gas cooler are always used for dry measurement. This also applies to instruments that extract moisture via a chemical compound. The LS2 Lambda Probe measures wet. The difference between wet and dry measurements can be obtained from the diagram in the Appendix, see chapter 11.9 *Wet/Dry Measurement Deviations, Conversion Table*

10.5 Warnings - Causes and Solutions

In general: Warnings do not affect the measurement functions.

10.5.1 LS2 Internal Resistance too High

This message is output if the AC internal resistance (R_I) of the ZrO_2 cell exceeds the permissible limit of 200 Ω during operation.

Possible cause:

Probe aged (worn out) → Obtain a spare probe and replace.

Measurement can continue, using caution. Check accuracy by counter-measurement, see chapter 8 *Operation*

- Check fuses F2, see chapter 11.4.3 *Fuses*
- Fault in supply section electronics → replace

Check the Lambda Transmitter's electronic:

Measure the AC voltage across LT2 terminals 33 and 34, using a multimeter.
The result in mV corresponds approx. to half the AC internal resistance.

10.5.2 Offset Voltage to Air Invalid

The voltage determined during offset compensation is not permissible.
Check whether probe is in air.

If yes - check probe voltage to air.

Permissible voltage range +5 ... -30 mV.

10.5.3 Analogue Inputs 1/2/3/4 Input Value too Large/too Small

The input value at the relevant analogue input is outside the permissible range.

- Check parameters 574/584/594/604 (minimum) and parameters 578/585/595/605 (maximum). Parameters 570/580/590/600 indicate the current value.
- Check wiring → poles reversed?
- Check source (connected instrument).
- Analogue input card defective? → Replace it.

10.5.4 Configuration Error at Analogue Outputs

Parameters have been set for analogue outputs not physically found. Check parameters 539, 549, 559, 569 and 530, 540, 550, 560 and compare with the fitted cards.
If necessary, replace the analogue output cards and/or processor card.

10.5.5 Service Warning 1/Service Warning 2

The service warnings are designed to draw attention to regular servicing. The service warnings can be freely defined by the operator, e.g.

Service warning 1 → check probe

Service warning 2 → replace probe

The appropriate cycle times can be freely configured by the parameters 1260 and 1261.

11 Appendix

11.1 Technical Data LT2 Lambda Transmitter

11.1.1 Technical Data LT2 in Wall Mounting Housing



Fig. 11-1 LT2 in wall-mounted housing

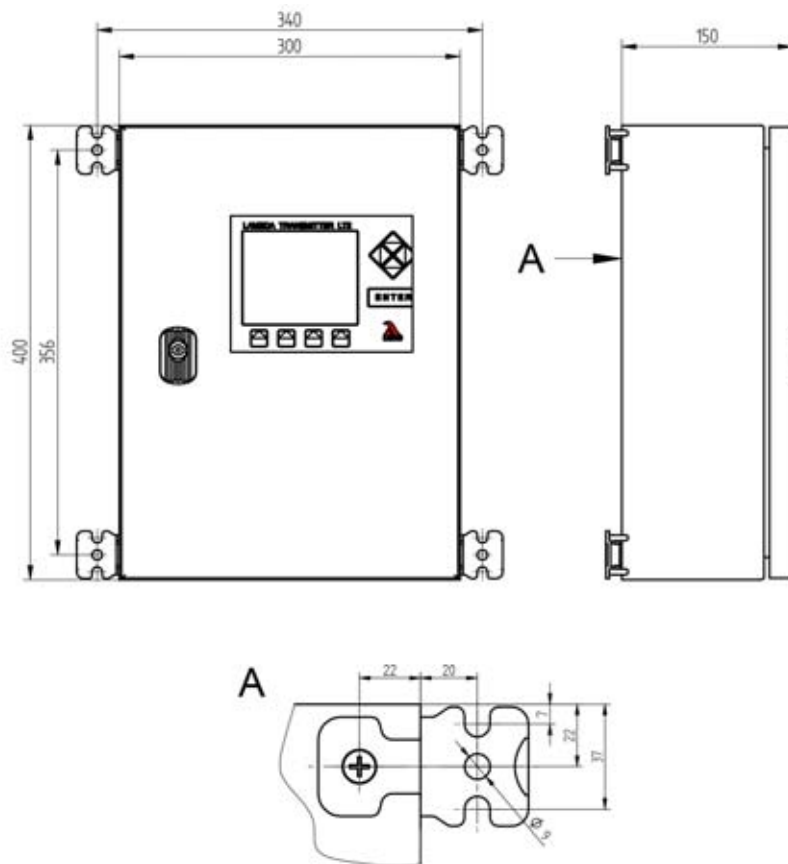


Fig. 11-2 Wall mounting housing

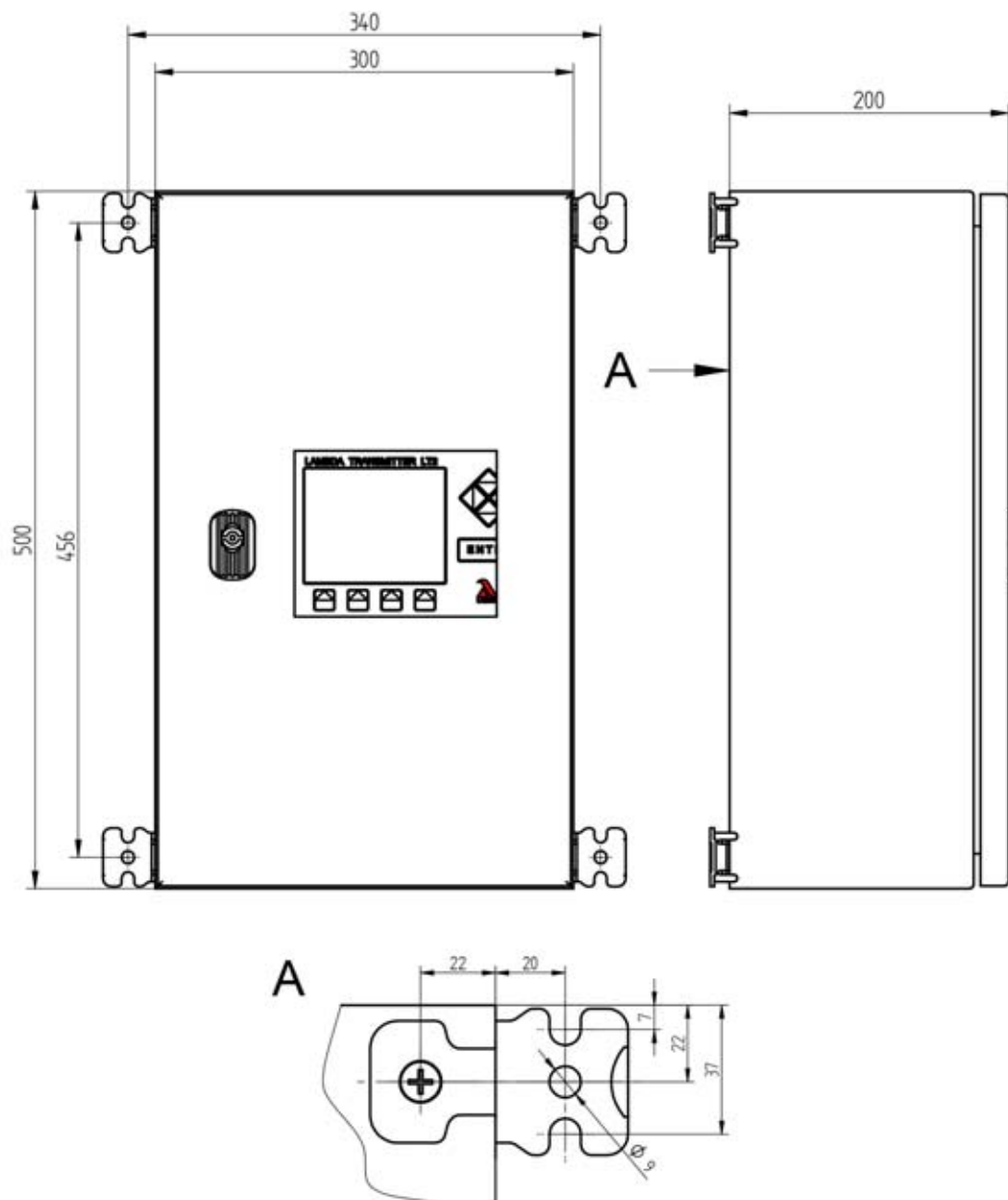


Fig. 11-3 Wall mounting housing with reference air pump

LT2 in wall mounting housing		
	without reference air pump	with reference air pump
Housing material	sheet steel, powder-coated	sheet steel, powder-coated
Dimensions (HxWxD)	400x300x150 mm / 5.75"x11.81"x5.91" in	500x300x200 mm / 19.69"x11.81"x7.87" in
Colour	light grey RAL 7035	light grey RAL 7035
Weight	10 kg / 22.05 lb with display and operating unit +0,5 kg /1.10 lb	13 kg / 28.66 lb with display and operating unit +0,5 kg /1.10 lb

11 Appendix

LT2 in wall mounting housing	
Control elements	Display and operating unit with LCD graphic display (option) LSB Remote Software (option)
Characteristics	
Power supply	230 VAC and 115 VAC +10 % / -15 %, 48 Hz ... 62 Hz Use only in earthed networks!
Power consumption	max. 50 VA short-term 150 VA (heating phase probe)
Display	LCD graphic display 100x80 mm (WxH) / 3.94" in.x3.15" in in panel installation housing = standard in wall mounting housing = optional
Resolution	O ₂ : 0,1 Vol. % O ₂ in range 0 ... 18 Vol. % O ₂ 1,0 Vol. % O ₂ in range 18 ... 30 Vol. % O ₂ CO: 1 ppm in CO range
Time for operational readiness	approx. 10 minutes after MAINS ON
Cold start delay	automatically cold start delay, 10 min.
Analogue outputs	
Monitor output	0 ... 2,55 VDC, load >10 k Ω , $\leq$ 100 nF
1 ... 4 current/voltage outputs	1 (LS2, KS1) or 2 (KS1D) standard – up to 4 options direct current 0/4 ... 20 mA load 0 ... 600 Ω direct voltage 0 ... 10 V load $\geq$ 10 k Ω non floating (potential isolation optional)
Analogue inputs	
Analogue inputs: 1 ... 4	via plug-in card on LT2 power pack electronic – Analogue input module potentiometer 1 ... 5 kΩ type 657P6000 – Analogue input module 0/4 ... 20 mA type 663P6001 – Analogue input module 0/4 ... 20 mA with supply 24 VDC for transducer type 663P6002 – Temperature input for Pt100 sensor type 657R0890 temperature range 0 ... 320 °C/32 °F ... 608 °F/ 0 ... 850 °C/32 °F ... 1562 °F resolution 1 °C/33.8 °F
Digital output	
Digital output	1 standard + 6 optional – 1 relay output 0 ... 230 VAC, 2 A – 0 ... 42 VDC, 3 A collective fault indicator – relay card with 6 relays (1 changeover switch) 0 ... 230 VAC, 2 A – 0 ... 42 VDC, 3 A
Digital input	
Digital input	8 inputs - configurable (any) Factory settings: 24 VDC referenced to instrument potential, Can be switched via jumper to floating, for external voltage source.

11 Appendix

Interface	
Interface	LAMTEC SYSTEM BUS RS 232 only in combination with PC Remote Software
BUS connection	PROFIBUS DP Modbus RTU

Environmental Conditions LT2

Operation	Per, Temperature Range	-20 ... +60 °C / -4 ... +140 °F
Transport	Per, Temperature Range	-40 ... +85 °C / -40 ... +185 °F
Storage	Per, Temperature Range	-40 ... +85 °C / -40 +185 °F
Degree of protection	According to DIN 40050	IP66
CE Declaration of Conformity	2014/30/EU – EMC Directive 2014/35/EU – Low Voltage Directive 2011/65/EU – RoHS Directive	

11.2 Technical Data LS2 Lambda Probe



Fig. 11-4 Lambda Probe LS2 in housing with gas extraction device GED ECO and probe installation fitting (PIF)

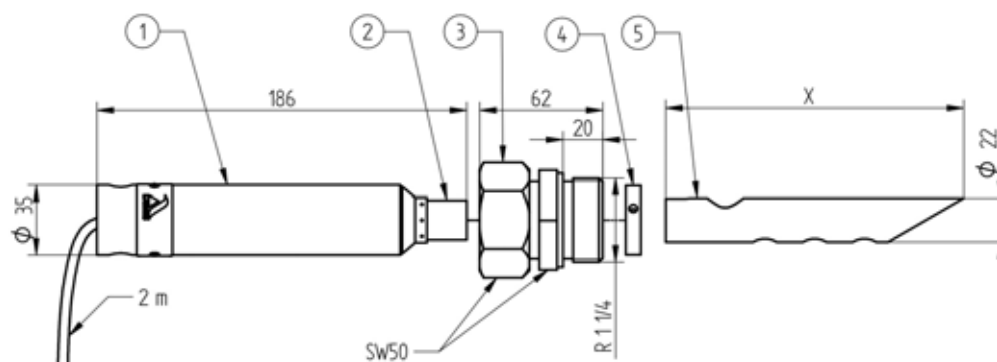


Fig. 11-5 Lambda Probe LS2 in housing with gas extraction device (GED ECO) and probe installation fitting (PIF)

1	LS2 Probe in housing	650R1000 / 650R1007
2	Probe heat	
3	Probe installation fitting 1 1/4"	655R1010
4	Locking ring for GED ECO	655R1021
5	Gas extraction device (GED ECO) length X = 150 mm / 5.91" in	655R1001
	Gas extraction device (GED ECO) length X = 300 mm / 11.81" in	655R1002
	Gas extraction device (GED ECO) length X = 450 mm / 17.72" in	655R1003

11 Appendix

Characteristics *	
Measurement range	O₂ : 0 ... 21 % O ₂
Measuring precision	O₂ : ± 5 % of measured value - not better than ± 0,3 Vol. %
Sensor signal	O₂ : -15 ... +150 mV (0,01 ... 21 Vol. % O ₂)
Response time	O₂ : t ₆₀ : < 3 s t ₉₀ : < 9 s
Relaxation time (measurement readiness after over- load)	O₂ : t ₉₀ : < 8 s
Offset in ambient air	O₂ < 0,3 Vol. %
Hysteresis	O₂ < 1 % from measured value
Linearity	O₂ < 1 % from measured value
Repeat accuracy	O₂ < 0,1 % deviation from measured value
Ambient pressure dependency	O₂ < 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	O₂ < -1,8 mV U _{O2} pro 100 mbar / 1.45 psi overpressure in the measuring chamber in comparison with environment
Drift	O₂ < 1,7 % from measured value (after 1000 h of operation in EL light fuel oil and 1004 switching cycles ON/OFF)
Cross sensitivity **	O₂ : to CO ₂ (15 Vol. %) < 0,1 Vol. % O₂ : to CO (874 ppm) < 0,1 Vol. % O₂ : to CH ₄ (76 ppm) < 0,1 Vol. % O₂ : to SO ₂ (76 ppm) < 0,1 Vol. % O₂ : to NO (245 ppm) < 0,1 Vol. %
Influence of humidity	O₂ : < 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
Material probe housing	1.4571/1.4301

11 Appendix

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

** O₂: Information assumes an operating gas composition of 5 Vol. % O₂, rest is N₂

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

11.3 Technical Data Lambda Probe LS2-HT

11.3.1 Terminal Assignment Terminal Socket for Probe HT

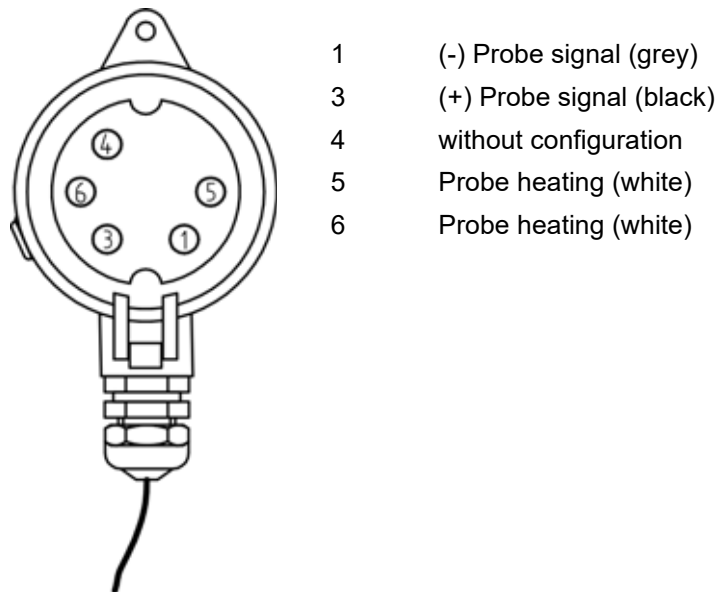


Fig. 11-6 Terminal socket
LS2-HT up to 6/2015

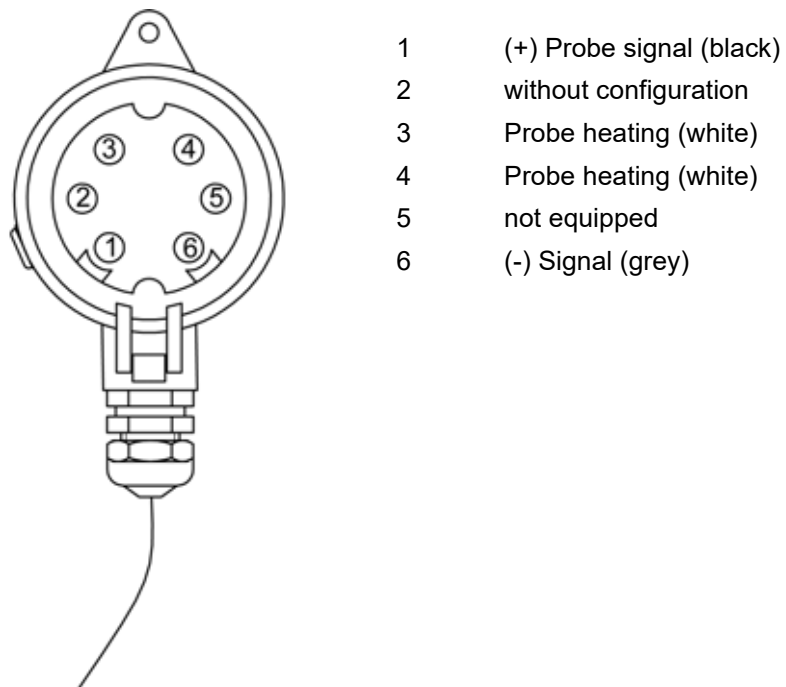


Fig. 11-7 Terminal socket LS2-HT from 6/
2015

11 Appendix

11.4 Electric Connections Device Side

11.4.1 Jumpers

LAMTEC SYSTEM BUS

BR101: Selection of connection resistance: 1-2 off, 2-3 on.

BR105: Position 2-3

The new processor card must also be set up for the LAMTEC SYSTEM BUS (BR12 and BR13 in position "C").

Digital inputs

BR106, 107: Position 1-2: Digital inputs referenced to instrument potential.

Position 2-3: Digital inputs, galvanic isolation.

11.4.2 DIP Switch

DIP switch processor card

(see illustration at 7.2.2 *Monitor Output*)

SW 1	SW 2	Monitor output function		
OFF	OFF	O ₂ measured value	0 ... 2.5 V = 0 ... 25 % vol O ₂	
ON	OFF	O ₂ probe voltage (U-O ₂)	0 ... 2.5 V = 0 ... 250 mV	
OFF	ON	O ₂ cell's internal resistance	0 ... 2.5 V = 0 ... 250 Ω	

11.4.3 Fuses

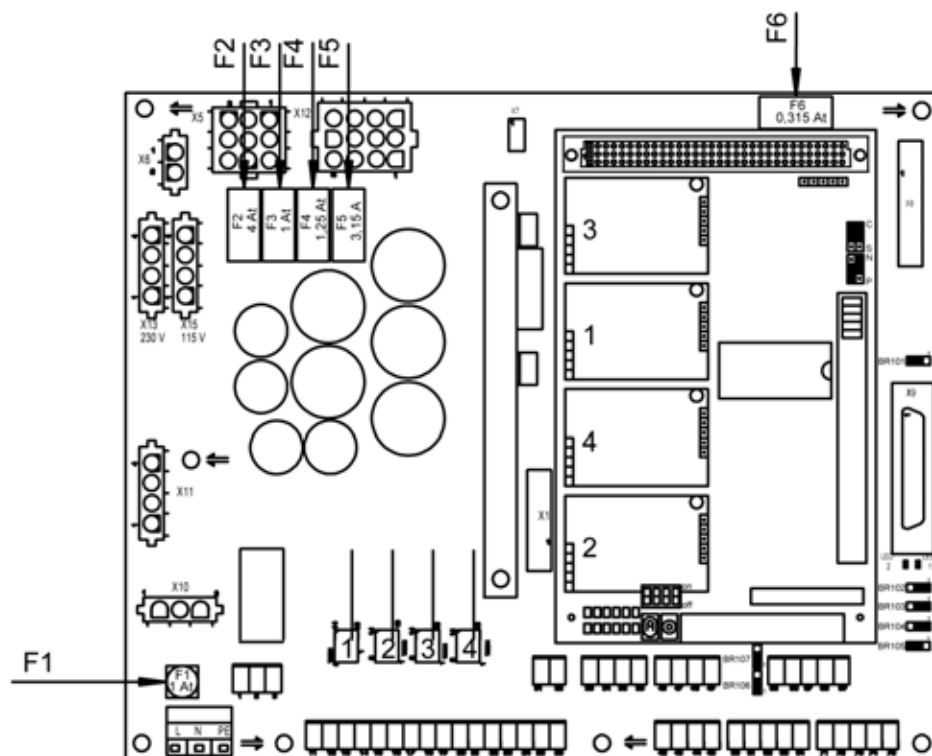


Fig. 11-8 Schema of fuses

Designation	Value	Function
F1	1A inertial for 230 V (IEC60127-2/5) 2A inertial for 115 V (IEC60127-2/5)	Primary fuse
F2	0.4 A inertial (IEC60127-2/3 or /5)	Probe measuring electronics
F3	1 A inertial (IEC60127-2/3 or /5)	12 V for display background illumination
F4	1.25 A inertial (IEC60127-2/3 or /5)	± 5 V supply for processor card
F5	4 A inertial from 11/2016 3,15A ultra slow fuse	Probe heating and 24 V supply
F6	0.315 A inertial (IEC60127-2/3 or /5)	LAMTEC SYSTEM BUS

11.4.4 LT2 Power Electronic Type 657E1882

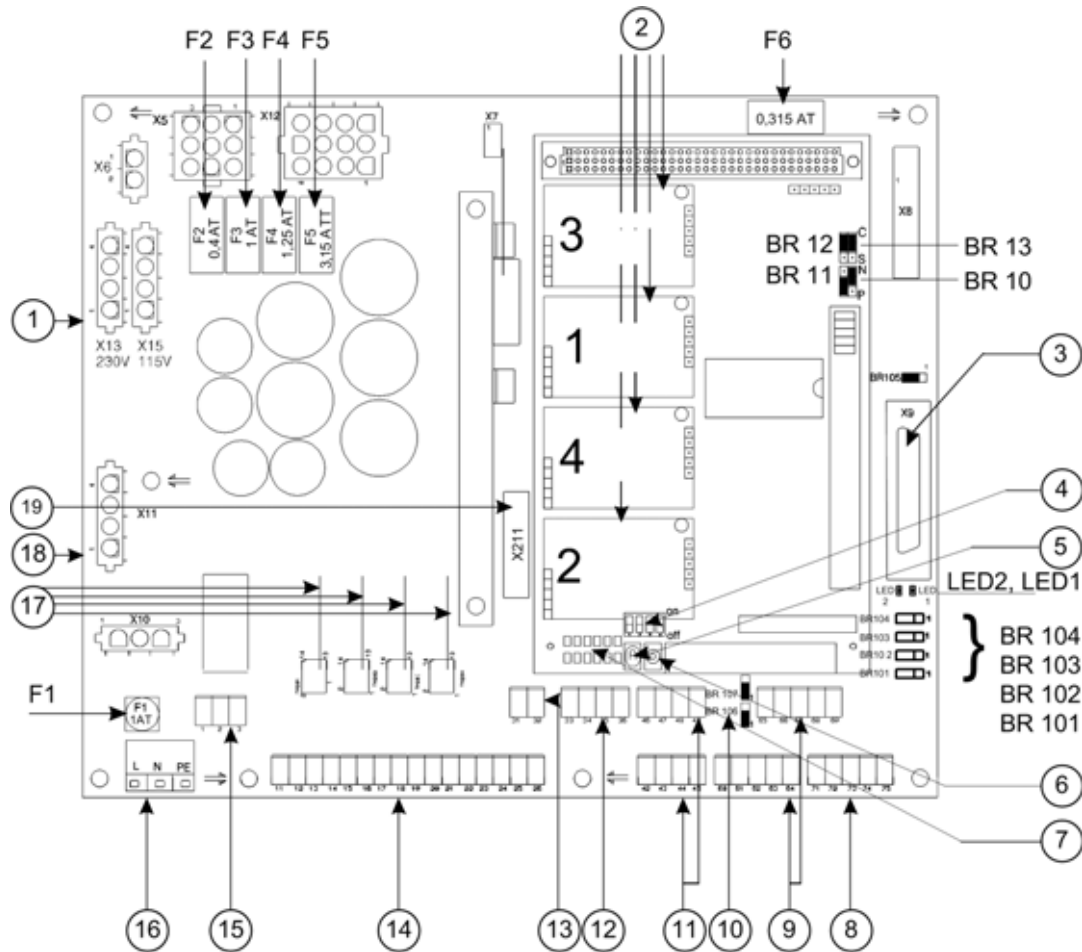


Fig. 11-9 LT2 Power electronic type 657E1882

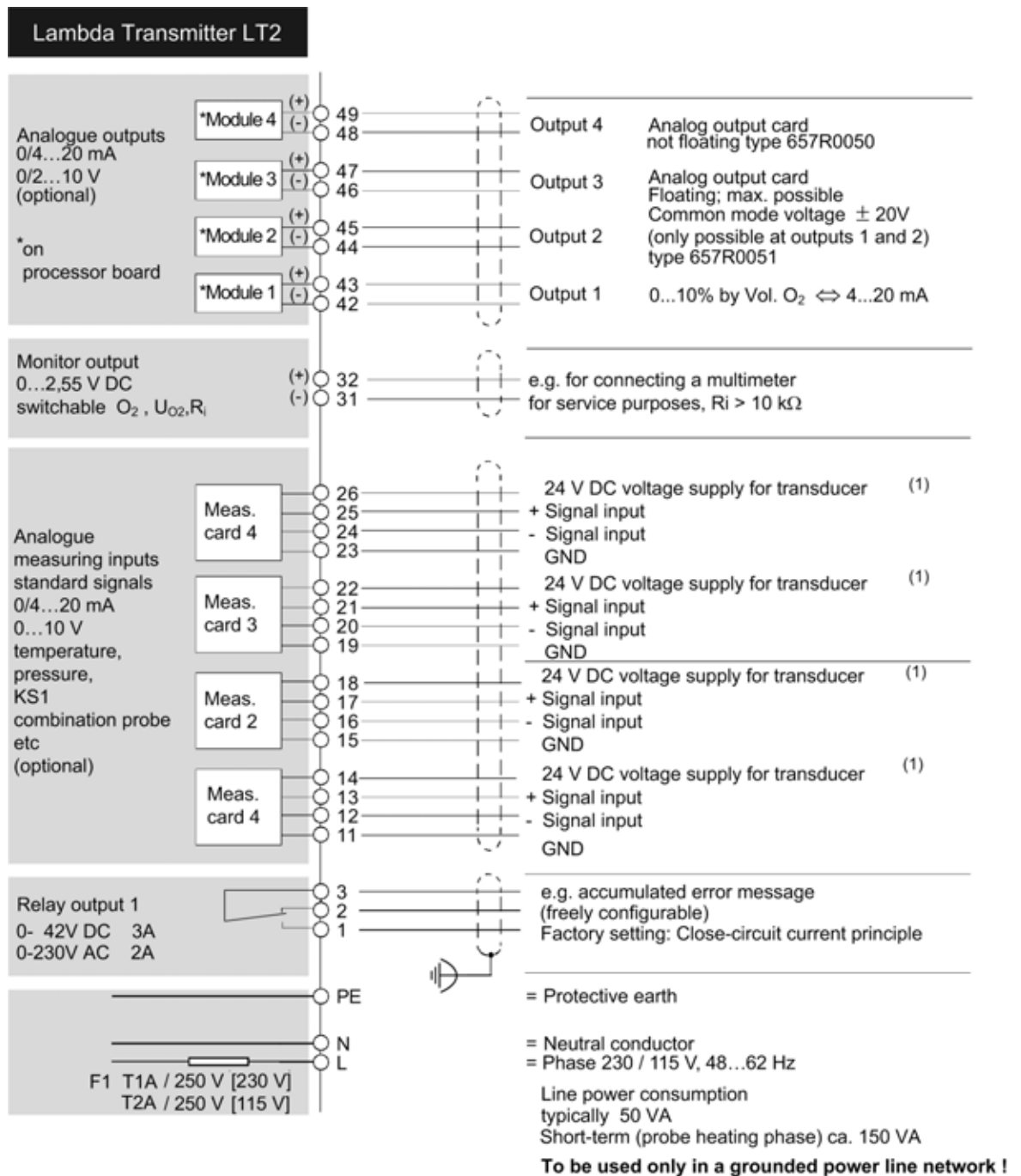
- | | | | |
|---|--|----|---|
| 1 | Transformer LT2 230/115 V change over | 10 | BR 106, BR 107 |
| 2 | Module 1-4 Analogue outputs | 11 | Analogue outputs |
| 3 | Plug connector for interface modules,
e.g. RS232 in combination with interface module | 12 | Probe connection |
| 4 | DIP-switch | 13 | Monitor output |
| 5 | Maintenance switch | 14 | Analogue inputs |
| 6 | Multifunction push button switch | 15 | Relay output 1 e.g. for combined fault indication. |
| 7 | Row of LED's for operating and status messages
(fault/warning) | 16 | Power supply connection 230/115 V, 50/60 Hz |
| 8 | LAMTEC SYSTEM BUS | 17 | Module 1-4
Analogue inputs (voltage, current, potentiometer) |
| 9 | Digital inputs (open collector) | 18 | Power supply switch |
| | | 19 | Electrical connection X211 for relay module |



CAUTION!

Different fuse figures F1 for 230 V and 115 V supply voltage.
Guard against supply voltage toggling!

11.5 Electric Connection LT2



* Other level/signal inputs possible, depending on meas. card.
Max. 2 of these floating (meas. card 1 and 2); max. possible potential difference ± 20 V.

⁽¹⁾ Max. total current drawn by all 4 meas. cards together = 80 mA

Fig. 11-10 Wiring diagram Lambda Transmitter LT2

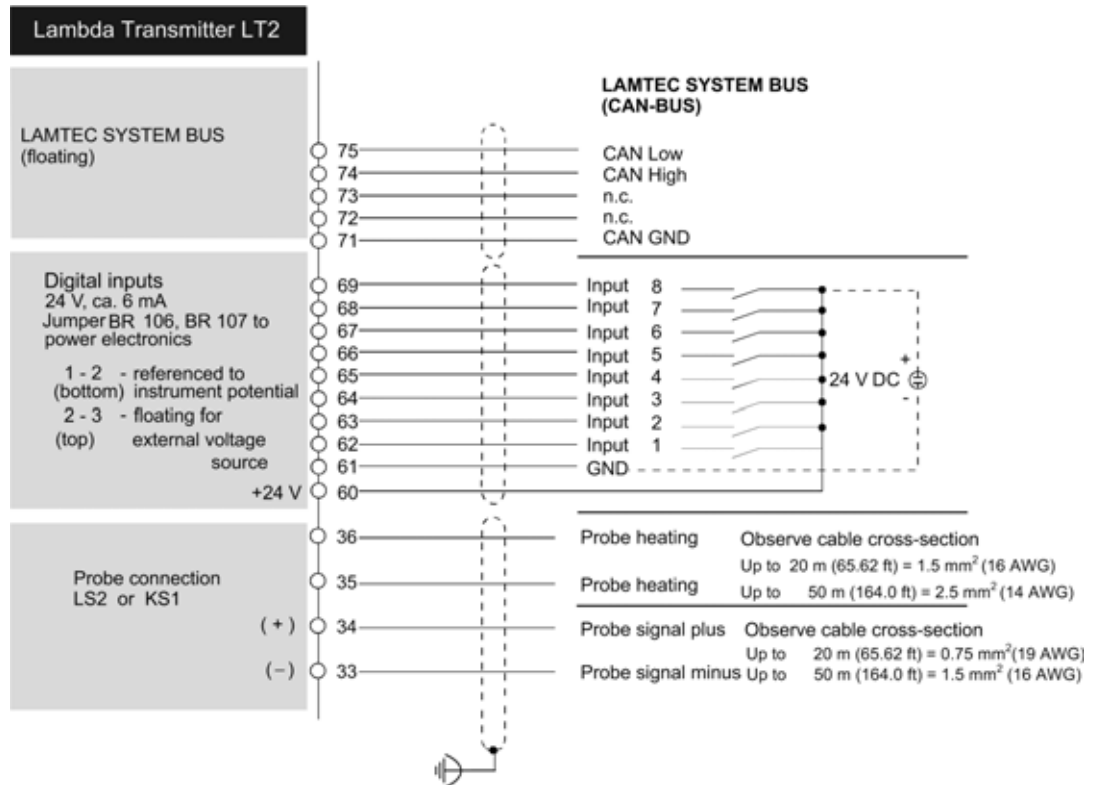


Fig. 11-11 Wiring diagram Lambda Transmitter LT2

- 33 Probe signal (grey)-
- 34 Probe signal (black) +
- 35 Probe heating (white)
- 36 Probe heating (white)

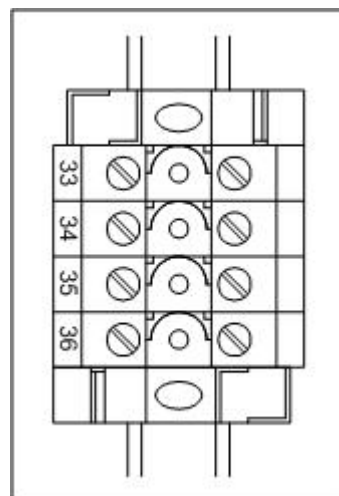


Fig. 11-12 SAK wiring diagram type 655R1025

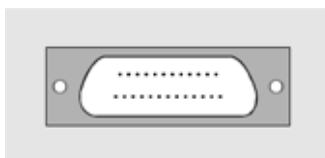
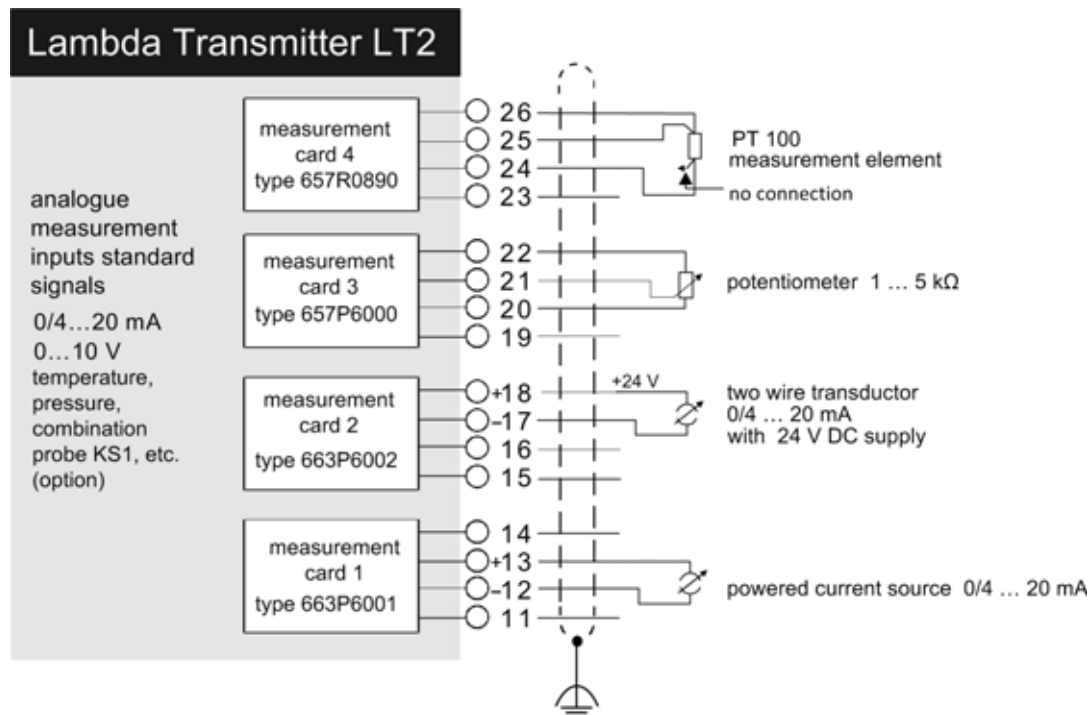


Fig. 11-13 25-pin plug for interface module

Interface Module:

- RS232 only in combination with Remote-Display-Software
- RS422 / 485 at terminals

11.6 Analogue Inputs Terminals 11 to 26 - Connecting Variants



11.7 Relay Module for Digital Outputs

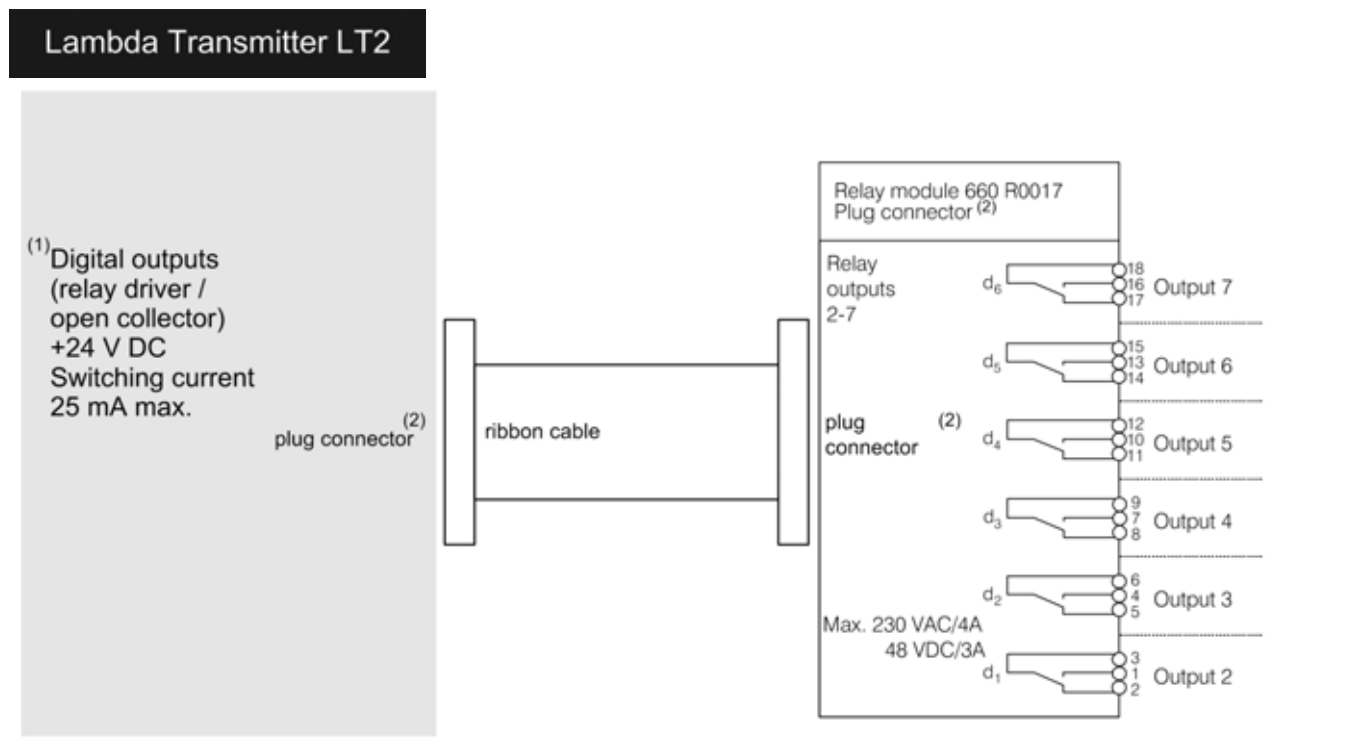


Fig. 11-14 Relay module for digital outputs

(1) not available for OEM

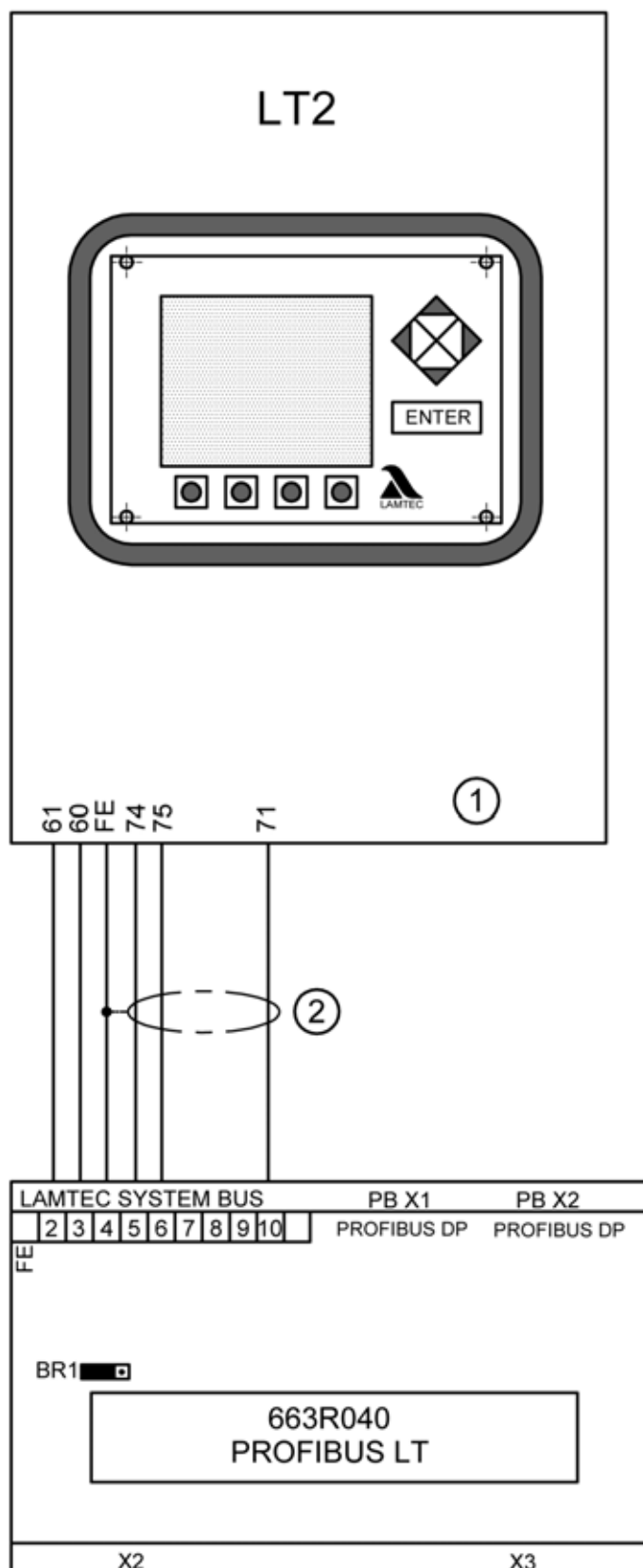
(2) Plug connector X211

NOTICE

To avoid EMC faults shield the branch lines of the relay modules.

When using unshielded cables loop them twice through the provided ferrite ring.

11.8 Electric Connection at PROFIBUS Module



LT2 Terminal assignment

61 0V

60 +24 VDC

FE Functional earth

74 CAN-H

75 CAN-L

71 CAN_GND

1 LSB with termination resistor
2 shielding

2 0 VDV
3 +24 VDC
4 shielding
5 CAN-H1
6 CAN-L1
7 shielding
8 CAN-H2
9 CAN-L2
10 CAN-GND

BR1 LSB with termination resistor

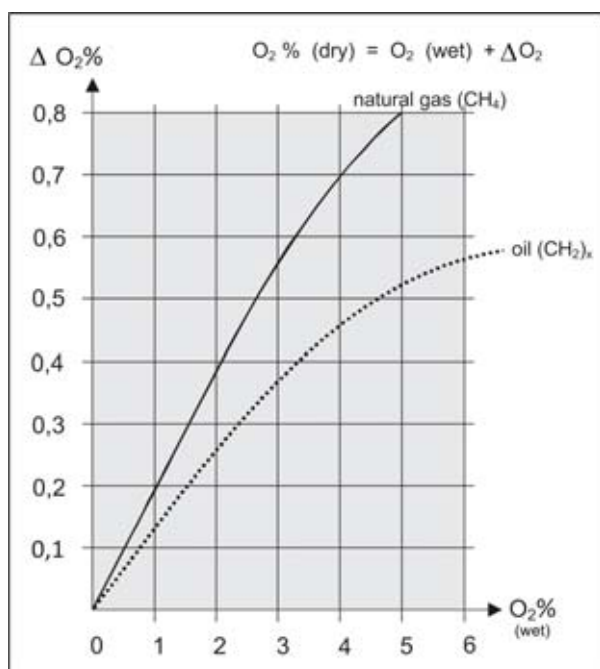
X2 without function

X3 without function

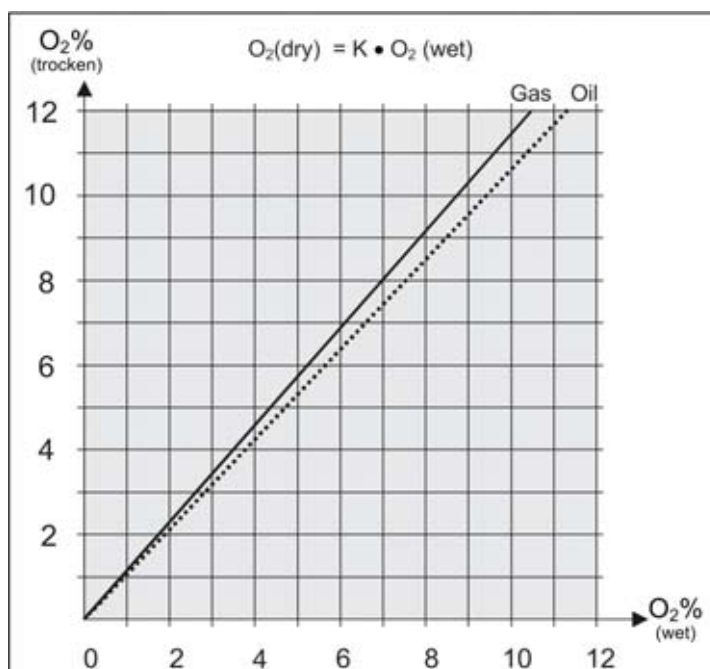
11.9 Wet/Dry Measurement Deviations, Conversion Table

NOTICE

The LT2 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).



Theoretical maximum deviations between wet and dry measurement of the O_2 concentration with natural gas (CH_4) or oil ($(CH_2)_x$) as fuel



Calibration diagram and conversion table of the concentration values of wet ($O_{2(n)}$) and dry ($O_{2(tr)}$) measured oxygen

O_2 concentration range	Constant K Gas/ CH_4	Constant K oil/ $(CH_2)_x$
0 - 6% O_2	1.18	1.115
6 - 12% O_2	1.12	1.08
0 - 12% O_2	1.15	1.10

Alternatively, the H_2O share can be automatically calculated via a fixed factor.

12 EU Declaration of Conformity



Sensoren und
Systeme für die
Feuerungstechnik

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
declares that product /
déclarons que produit

LT2 – Lambda Transmitter

inklusive
inclusive / y compris

Varianten

variants / variantes

LT2 im Wandaufbauehäuse
LT2 in wall mounting housing / LT2 coffret mural

657R102

Sonden

probes / sondes

LS2

650R100X

LS2-HT

650R1515

mit Optionen

with options / avec options

Sondenanschlusskasten SAK

Probe connection box PCB /

Bâtiment de raccordement de sondes BRS

655R1025

Kombinierte Ausblase-Spülluft-Einheit für HT

Combined blow-out / purge-unit for HT /

Unité combinée de purge à air comprimé pour HT

657R0934

Schnittstellen-Modul RS232

Interface module RS232 / Module de interface RS232

663P0600

Schnittstellen-Modul RS422

Interface module RS422 / Module de interface RS422

663P0503

Schnittstellen-Modul RS485

Interface module RS485 / Module de interface RS485

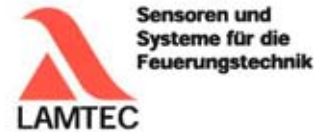
663P0502

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12 EU Declaration of Conformity



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 61326-1: 2013-07
DIN EN 61010-1: 2011-07

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:
Placing of the CE marking / L'apposition du marquage CE

ja

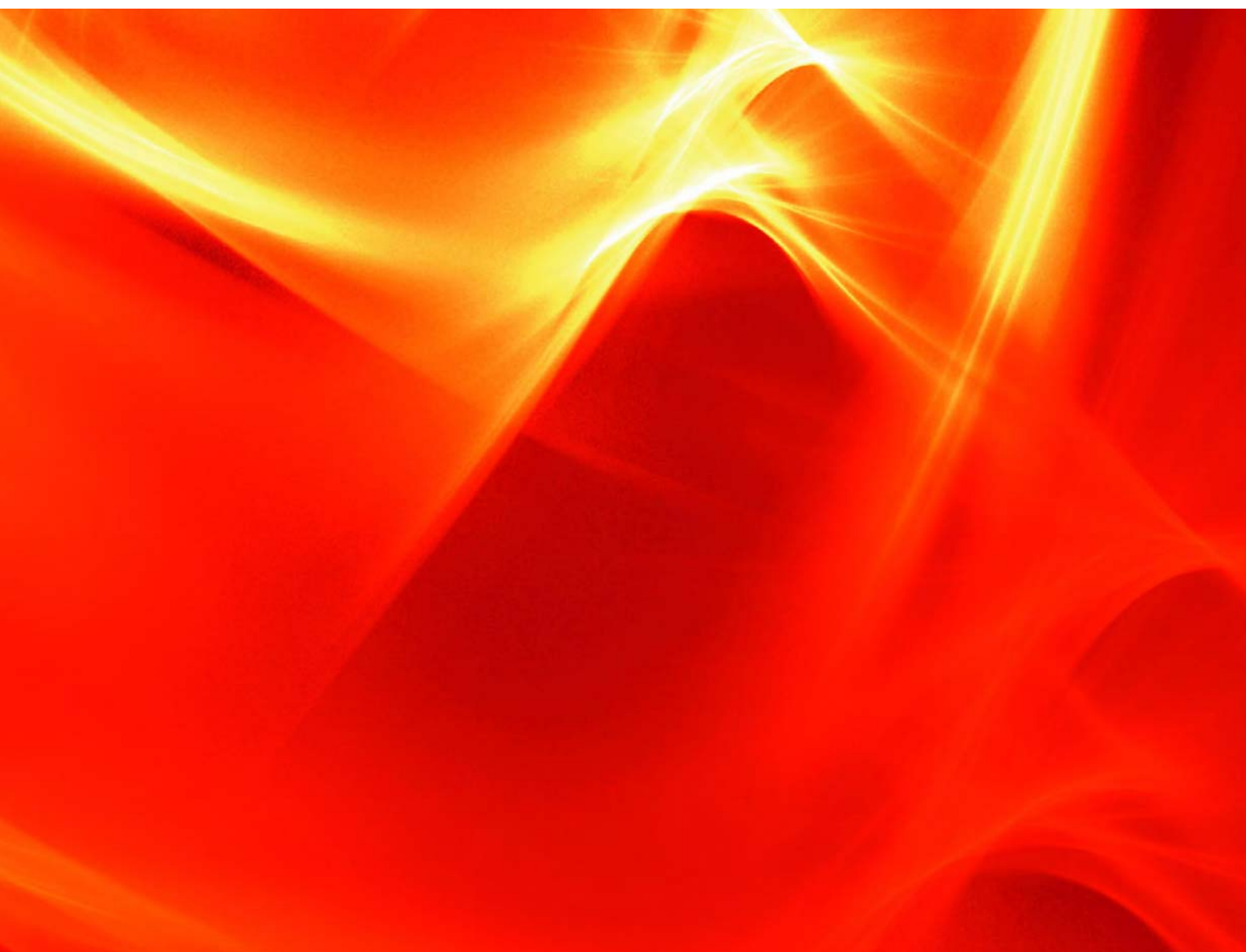
Rechtsverbindliche Unterschrift
Authorized signature / Signature autorisée

Walldorf, 20.04.2016
H. Weber, General Manager

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The information in this publication is subject to technical changes.



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