



## System overview

**LT1 Lambda Transmitter**  
**LS1 Lambda Probe**



Sensors and systems for combustion technology

[www.lamtec.de](http://www.lamtec.de)

# O<sub>2</sub> measurement at the highest level - the LT1 Lambda Transmitter.

LAMTEC supplies leading technology for measuring exhaust gas in combusting systems. Our range of O<sub>2</sub> probes and measuring transducers can be combined to meet specific requirements and are easy to integrate into control systems.

### LT1/LS2 system:

The LT1 Lambda Transmitter is a universal application O<sub>2</sub> measurement instrument for direct measurement of the O<sub>2</sub> concentration of gases in the superstoichiometric range ( $\lambda > 1$ ) in combination with the LS1 Lambda Probe.

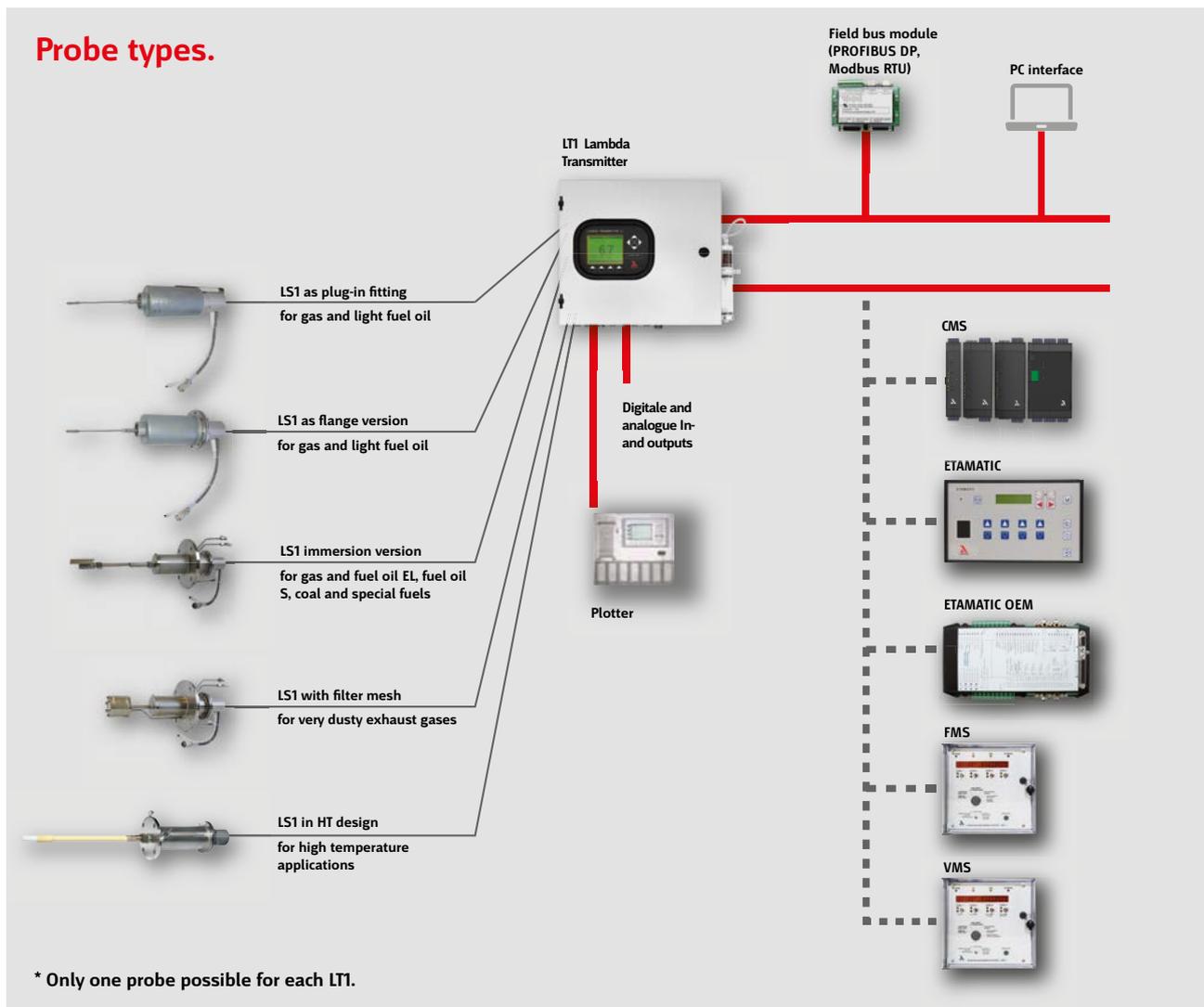
- in combustion flue gases
- in industrial flue gases
- in furnace atmospheres
- in process gases

The measurement of the O<sub>2</sub> concentration is continuous with the LS1 Lambda Probe. A small quantity of gas (approx. 0.5 l/h) is extracted directly from the measuring gas via a capillary tube. A 7-wire cable with plug, as well as a Teflon hose, connect the LS1 Lambda Probe to the LT1. The probe signal is evaluated using the latest micro-processor technology in the LT1 Lambda Transmitter.

Output of the measurement values via:

- a monitor output 0 ... 2.55 VDC 0 ... 25.5 vol. % O<sub>2</sub>
- up to 4 analogue outputs 0/4 ... 20 mA, 0 ... 10 V
- up to 7 digital outputs

Internal LEDs provide information on the operation and indicate any system errors detected in the diagnostics.



Functions in the LT1

#### The LT1 has the following functions:

- Automatic check and calibration of the LS1 Lambda Probe with ambient air (20.96 vol. % O<sub>2</sub>)
- Automatic ageing compensation of the ZrO<sub>2</sub> measuring cell to determine the cell internal resistance and heating power adaptation.
- Compensation of the effect of the gas composition on the measuring gas flow with heavily imbalanced measuring gases such as flue gas after wet scrubbers or in exhaust vapours due to deviating sound velocity and density, compared to the calibration conditions (air).
- Intermittent measuring gas pump with automatic determination of the optimal pump runtime. Long-life mode with restricted measurement accuracy can be selected.
- Automatic cold start delay 5 ... 120 min.
- Integrated maintenance switch.
- LAMTEC SYSTEM BUS for direct coupling to the LAMTEC burner control units VMS/FMS/CMS/BT300/ETAMATIC for O<sub>2</sub> optimisation.
- As an alternative to the LAMTEC SYSTEM BUS, an RS 422 interface is also available for coupling to customer devices.
- Optional RS 232 interface for remote control via PC - only in combination with the remote display software (option).

#### Advantages:

- Linear probe signal (direct current [mA]) with fixed physical zero point
- No special test gases required, automatic calibration with ambient air (20.96 vol. % O<sub>2</sub>)
- Measurement accuracy greater than 0.2 vol. % O<sub>2</sub> across the entire measuring range 0 ... 21 vol. % O<sub>2</sub>, following calibration 0.1 vol. %.
- No gas preparation required
- No reference gas required
- Adjustment time <15 s to 90 % value (T90) with gas extraction device, 450 mm long
- No effect of the measuring gas temperature on the measurement accuracy
- No temperature control of the ZrO<sub>2</sub> measuring cell required
- Automatic adaptation of the cell temperature to the cell internal resistance (ageing compensation)
- SIL 1 confirmation
- Up to 1400 °C with ceramic removal
- Does not represent a source of ignition in the flue gas duct. Confirmation from TÜV is available.
- Intermittently operated measuring gas pump with determination of the optimal pump runtime
- Easy operation
- Low-maintenance

On the hot sensor, installed into a measurement chamber, the oxygen in the measuring gas is ionised and "pumped" from the external electrode to the internal

electrode by applying voltage (figure 1). This means that a current flows (0 ... 21 vol. % O<sub>2</sub> corresponds to around 0 ... 500 mA) that is proportional to the oxygen content in

**Characteristic curve for current probe measuring principle LT1/LS1.**

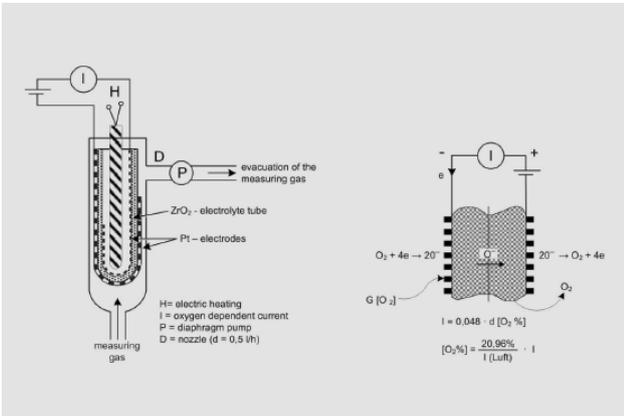


Figure 1.

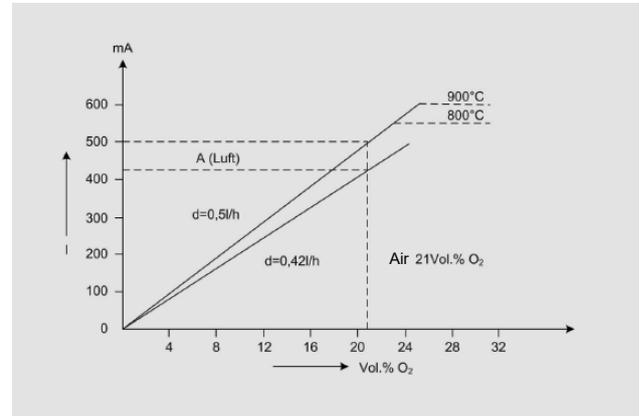
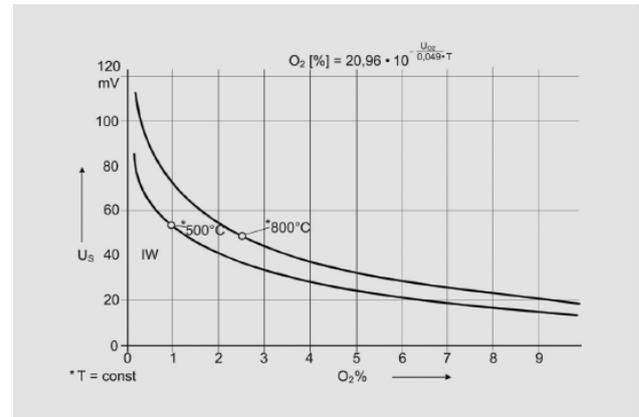
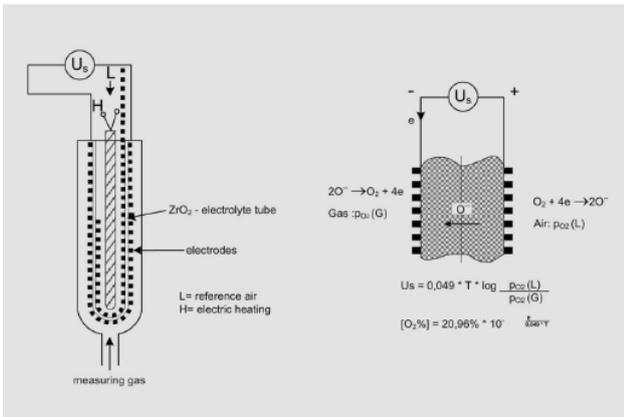
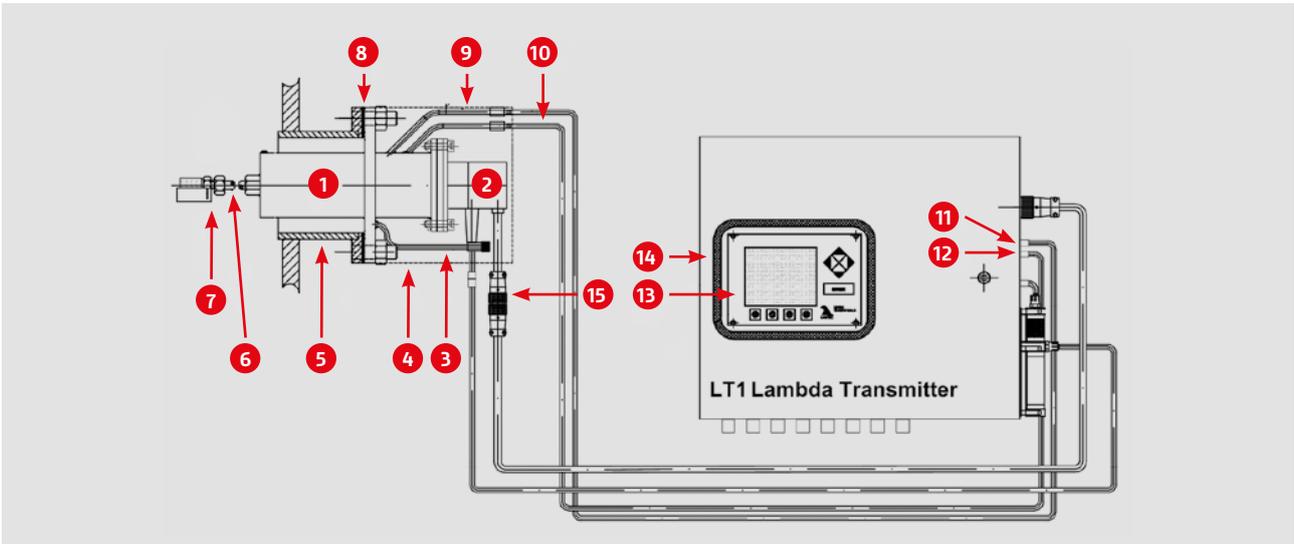


Figure 2.

**For comparison: Voltage probe measuring principle, e.g. LT2/LS2.**



# System components.



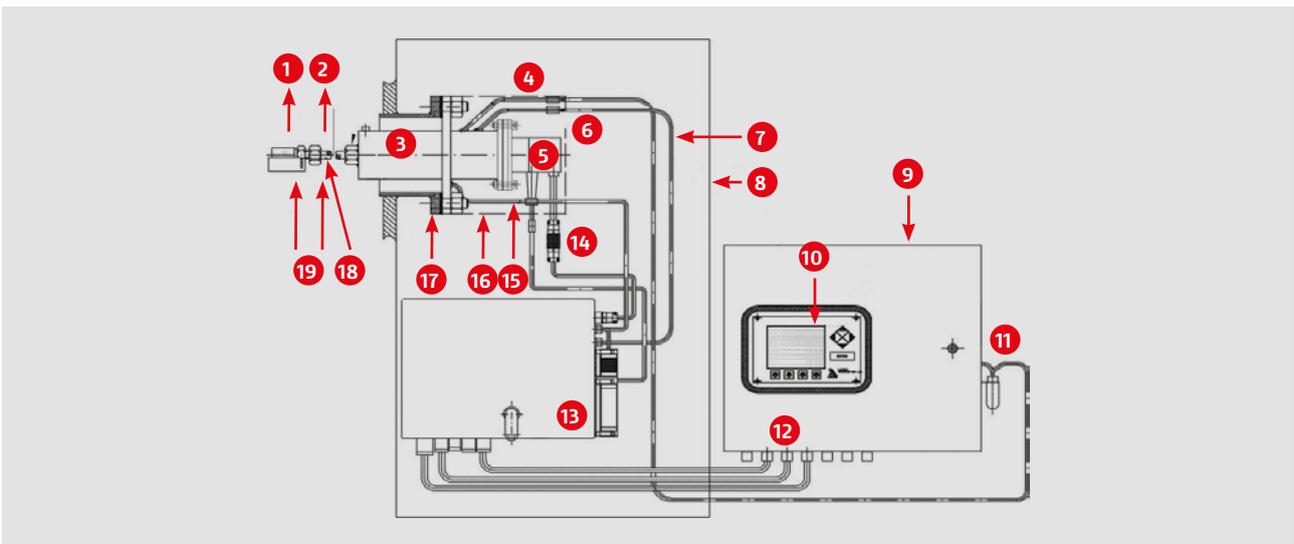
Design principle with integrated measuring gas pump and calibration system for installation under cover.

1 Probe installation fitting (PIF). 2 LS1 Lambda Probe. 3 Measuring gas feedback sealed via blind plug. 4 Outside Insulation. 5 Counterflange. 6 Gas extraction device (GED) with extraction filter. 7 Measuring gas. 8 Flange seal. 9 Pressure sensor connection (PIF). 10 Calibrating gas connection (PIF).

11 Pressure sensor. 12 Calibrating gas connection LT. 13 Display and operating unit (optional). 14 LT1 Lambda Transmitter with integrated measuring gas pump and automatic calibration system (optional). 15 Electrical connection with plug.

If the distance between LS1 Lambda Probes and LT1 Lambda Transmitter is greater than 10 m, we recommend that you fit a probe connection box (PCB) to the measuring gas pump and where appropriate the automatic calibration

system (optional) close to the probe. For outdoor installation a protective transmitter box is also required as weather protection.



Design principle with external measuring gas pump and calibration system.

1 Flue gas duct. 2 Measuring gas temperature. 3 Probe installation fitting (PIF). 4 Pressure sensor connection. 5 LS1 Lambda Probe type 655R0031/0034. 6 Calibrating gas connection. 7 Calibrating gas output. 8 Protective transmitter box. 9 LT1 Lambda Transmitter, external measuring gas pump. 10 Display and operating unit (optional). 11 Condensate trap/

pressure sensor connection LT. 12 LT1 Lambda Transmitter, electrical connection. 13 Probe connection box with measuring gas pump and calibration system. 14 Electrical connection with plug. 15 Measuring gas feedback. 16 Insulation for LS1 and PIF. 17 Counterflange. 18 Gas extraction device (GED) and protecting tube with sintered metal prefilter. 19 Measuring gas.

## Basic system.



LT1 in IP65 wall-mounting housing.



19" rack.

The LT1 Lambda Transmitter is available in three basic versions:

- Sheet steel housing, lockable door at the front, impact-resistant inspection window, optional display and control unit IP65.
- Sheet steel housing, lockable door at the front, impact-resistant inspection window, with integrated air pump for automatic calibration with ambient air, optional display and control unit IP65.
- Panel-mounted housing (3HU/50DU) for installation in a control cabinet door or 19" rack. Display and control unit included as standard IP20, front IP40.

## Probes.

### LS1 Lambda Probe as plug-in fitting



#### Properties:

- Measurement directly in the moist flue gas up to 600 °C
- Cannot be used with negative boiler pressure (infiltrated air).
- IP42 protection class.

#### Applications:

- Natural gas, heating oil (extra-light), boiler flame tube.

### LS1 Lambda Probe as flange version



#### Properties:

- Measurement directly in the moist flue gas up to 600 °C
- Can be used with negative boiler pressure, gas-tight design.
- IP42 protection class.

#### Applications:

- Natural gas, heating oil (extra light), boiler flame tube.

### LS1 Lambda Probe immersion version



#### Properties:

- Measurement directly in the moist flue gas up to 600°C with Inconel protecting tube up to 900°C.
- Gastight design with option for automatic calibration.
- IP42 protection class.

#### Applications:

- Natural gas, heating oil (extra-light), heating oil (heavy), coal, biomass, non-standard fuels

### LS1 Lambda Probe in HT design



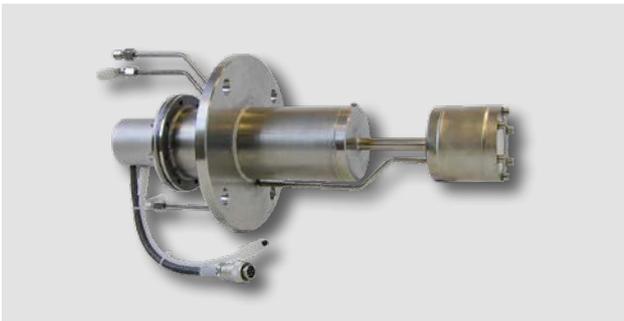
#### Properties:

- Measurement directly in the moist flue gas up to 1400 °C
- Gastight design with option for automatic calibration.
- IP42 protection class.

#### Applications:

- Measurement with very high flue gas temperatures, fuel, natural gas, extra-light heating oil, heavy heating oil, coal, biomass, special fuels.

### LS1 Lambda Probe with filter mesh



#### Properties:

- Measurement directly in the moist flue gas up to 200 °C
- Gastight design with option for automatic calibration, purge function and filter mesh.
- IP42 protection class.

#### Applications:

- Flue gases with very high dust proportion, e.g. pulverised lignite combustion, biomass.

## Optional components.

- Display and operating unit
- Automatic calibrating unit for fully automated check and calibration of LS1 Lambda Probe in installed status for operating the system with ambient air; or alternatively via integrated air pump or compressed air
- Test gas connection (1 ... 4 test gases) for monitoring the calibration (EPA standard)
- Purge unit
- Pressure compensation of the measurement value; pressure range 800 ... 1200 mbar
- Temperature compensation of the measurement value
- Measurement of flue gas and suction air temperatures and calculation of combustion efficiency
- Calculation of CO<sub>2</sub> concentration, calculated for specific fuel from the measured O<sub>2</sub> value and the max. CO<sub>2</sub> value
- Load-dependent and fuel-specific limit values/limit curves
- Electric heating of the gas extraction device and the sintered metal preliminary filter
- Up to 4 additional analogue outputs, max. 2 floating (outputs 1 and 2) max. potential difference 20 V. Range and physical size configurable
  - Direct current 0/4 ... 20 mA, load 0 ... 600 Ω
  - Direct voltage 0 ... 10 V, load > 10 Ω
- Electrically isolated analogue outputs
- Relay module for digital outputs with 6 relays (1 changeover switch) for the output of operating, status and limit value messages, switching capacity 230 VAC, 4 A
- 1 ... 4 analogue inputs via measurement cards can be configured as required, 2 of which are floating, potential difference 20 V, e.g. for connecting temperature sensors, other pressure sensors, norm signals, etc.
- Bus interface for
  - PROFIBUS DP
  - Modbus RTU
  - Ethernet
- Remote display software for PC on Windows
- Measuring gas pump 12 VDC for corrosive measuring gases
- Measuring gas extraction via ejector
- Electric housing heating for ambient temperature below -10 °C and -25 °C

## Approvals

SIL 1 confirmation DIN EN 61508:2011, parts 1-7

# Inputs.

# Outputs.

<b>LT1 Lambda Transmitter</b>		
→	LS1 Lambda Probe	
→	Display and operating unit	→
→	Calibrating unit	→
→	LAMTEC SYSTEM BUS	→
→	RS 232 operation and servicing	→
	Operating mode/service display	→
→	Multi-function pushbutton	
→	Maintenance switch	
→	PROFIBUS DP, CANopen, Modbus RTU, Ethernet	→
→	Pressure sensor	
	Monitor output 0 ... 2.55 VDC	→
→	Test gas connection	
	Housing heating	→
	PIF filter heating	→
	GED heating system	→
	4 analogue outputs: 1 x standard, 3 x optional configurable as required	→
	7 digital relay outputs: 1 x standard, 3 x optional	→
→	8 digital inputs: configurable as required	







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