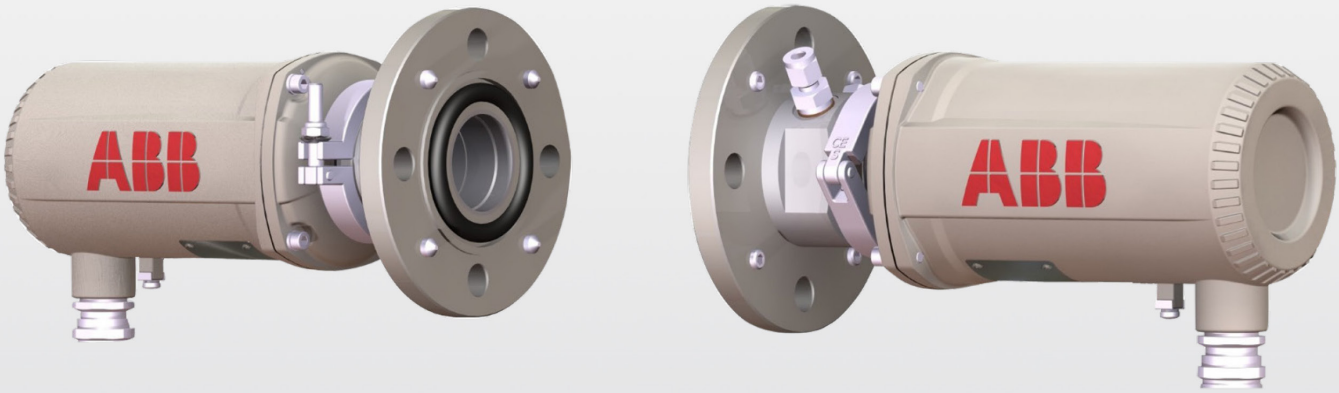
ABB MEASUREMENT & ANALYTICS | DATA SHEET

LS4000

Diode laser analyzer



Measurement made easy

Highest precision under harshest conditions

High precision

- Lowest detection limits, highly accurate measurements
- Highly selective, virtually cross interference free

Suitable for harsh process conditions

- In-situ, direct measurement of hazardous gas streams
- For high pressure, high temperature applications

Fast and direct

- In-situ, no sample transport or conditioning
- Fast response

Safe, compact and easy

- Compact and lightweight, insensitive to vibrations
- Ease of maintenance

Introduction

Application and design

The LS4000 is an in situ cross-duct analyzer for measuring gas component concentrations. It applies the highly selective optical measuring principle of tunable diode laser (TDL) absorption spectroscopy.

The LS4000 is a stand-alone system which consists of a transmitter unit with a laser light source and a receiver unit with a photodetector.
Both units are mounted opposite each other on the process pipe or stack and are connected by a junction box.

Measuring principle – TDLAS

The LS4000 employs the optical measuring technique of absorption spectroscopy, which utilizes the fact that a specific gas absorbs specific light wavelengths.

The light beam is emitted from a tunable laser diode located in the transmitter unit. The laser light passes through the process gas and strikes the photodetector in the receiver unit. The measured gas component present in the optical path absorbs the laser light, attenuating the light received.

A sophisticated signal algorithm processes the amount of light attenuation and calculates the gas concentration on the basis of the Beer-Lambert law. The influence of temperature and pressure variations is eliminated by dynamic automatic correction.

Specification

Measurement components and measurement ranges

NH_3, H_2O, NH_3 + H_2O	
Min. / max. measurement range NH_3	0–10/0–1000 ppm
Min. / max. measurement range H_2O	0–10/0–50 vol.-%
Max. abs. pressure	0.5–1.7 bar (7–24 psi)
Max. temperature	450 °C (842 °F)
Optical path lengths (OPL)	0.5–5 m (1.6–16.4 ft)
H_2O	
Min. / max. measurement range	0–10/0–50 vol.-%
Max. abs. pressure	0.5–1.7 bar (7–24 psi)
Max. temperature	450 °C (842 °F)
Optical path lengths (OPL)	0.5–5 m (1.6–16.4 ft)

Measurement range quantity
1 physical measurement range per sample component,
1 x transmission

NOTICE

- The analyzer performance characteristics have been determined according to IEC 61207-1:2010 “Expression of performance of gas analyzers – Part 1: General”. They are based on nitrogen as the associated gas. Compliance with these characteristics when measuring other gas mixtures can only be assured if their composition is known.
- All specifications refer to an optical path length (OPL) of 1 meter, tested in ABB’s test and calibration jig. However, application-dependent variations may occur. The specific detection limit, minimum and maximum measurement range for a specific application will depend on the gas conditions (pressure, temperature and gas composition) and optical path length. Minimum measurement range, maximum pressure and maximum temperature cannot necessarily be realized simultaneously under all conditions.
- The maximum pressure and maximum temperature given are physical (spectroscopic) limits.
- Applications exceeding the above given spectroscopic limitation might be possible on request.

... Specification

Stability

Performance data below is given at standard conditions. Data may vary depending on the specific application.

	NH_3, $NH_3 + H_2O$
Linearity deviation	≤ 1 % of span
Repeatability	< 2 % of reading
Zero drift	negligible
Span drift	not specified
Output fluctuation (2 σ)	≤ 1 % of smallest measurement range
Detection limit (4 σ)	≤ 2 % of smallest measurement range

Influence effects

For large variations of process temperature and pressure, LS4000 applies an automatic dynamic correction which requires 4–20 mA inputs. Influence effects and necessity for temperature or pressure sensor depend on the specific application and are defined by ABB.

	NH_3, $NH_3 + H_2O$	H_2O
Process temperature	< 3 % of measuring range per 20 K	< 3 % of measuring range per 20 K
Process pressure	< 2 % of reading per 30 hPa	< 4.5 % of reading per 30 hPa

Dust load
Instrument remains operable if transmission loss < 97 %.

Accompanying gases/cross sensitivity
No cross sensitivity within normal operation conditions.

Flow effect
No effect on the measurement, but the flow will determine the amount of gas needed for process purging.

Ambient temperature
In permissible range: no effect

Dynamic response

Warm-up time
< 5 min

Response time
Typically 5 sec

Maintenance interval and calibration/validation

Maintenance interval
Depending on application and dust load

Calibration
Single point calibration with test gas and an external off-line calibration cell (see **Accessories** on page 7).

Calibration/validation interval
Depending on application, typically once a year

Housing

Transmitter and receiver unit	
Protection class	IP 65
Material	Stainless steel AISI 304H (1.4308), painted
Weight	4.1 kg each
Color	Light gray (RAL 7035)
Dimensions	See page 8

Junction box – General Purpose	
Protection class	IP 65
Material	Steel, painted
Weight	4.7 kg
Color	Light gray (RAL 7035)
Dimensions	See page 8

Process purging

Depending on the application, purging on the process side is typically necessary. It is not required to purge the instrument housing.

Available flange size
DN 50 / PN 10, ANSI 2 in.-150 lb, JIS 10K 50A

Material
Flanges: AISI 304 (1.4301), standard
AISI 316L (1.4404), optional
O-rings (process): FPM (standard), FFKM

Weight
3,1 kg

Gas port for purging
1/4 in. Swagelok® connectors for tubes with 8 mm outer diameter.

Purging medium
Instrument air (dry and oil-free, compliant with standard ISO 8573.1, Class 2–3) or nitrogen (depending on the application)

Electrical interfaces

Analog outputs
Up to three 4–20 mA outputs (one for each measurement component and transmission), working resistance max. 500 Ω, not isolated

Analog inputs
Up to two 4–20 mA inputs for dynamic process temperature and pressure correction, working resistance max. 100 Ω, not isolated

Digital outputs
Up to two digital outputs, 1 A at 30 V DC/AC, NO, for error and gas alarm

Service port
Ethernet

See page 8 for connection drawing.

… Specification

Electrical connections

Terminal	Signal	Function
12	AO1 (4–20 mA)	Analog output 1
13	AO2 (4–20 mA)	Analog output 2
14	AO3 (4–20 mA)	Analog output 3
15	AO GND	Analog outputs GND
16	DO1_A	Digital output 1
17	DO1_B	
18	DO2_A	Digital output 2
19	DO2_B	
27	T probe in (4–20 mA)	Analog input for dynamic
28	T probe out (4–20 mA)	temperature correction
29	P probe in (4–20 mA)	Analog input for dynamic
30	P probe out (4–20 mA)	pressure correction

Power supply

Without power supply	
Input voltage	DC 24 V nominal (DC 18 to 32 V)
Power consumption	< 10 W
With power supply (integrated in the junction box)	
Input voltage	AC 100 to 240 V, ± 10 %, 50 to 60 Hz
Output voltage	DC 24 V
Power consumption	30 VA

Installation site requirements

Ambient temperature in operation	
Transmitter and receiver unit,	–20 to +55 °C
General purpose junction box	(no direct solar radiation)
Ambient temperature during storage and transport	
Transmitter and receiver unit	–40 to +70 °C

Installation location

The measurement gas must be well stirred at the selected location to produce a representative measurement result. Stratification in the measurement gas path results in erroneous measurement.

Alignment tolerances

Flanges parallel within 1.5°

Accessories

Calibration cell

The calibration cell is used for calibrating the instrument.

Material
Aluminum (6082-T6) or AISI 316L (1.4404)

Validation cell

The validation cell is permanently mounted between the process pipe and the transmitter/receiver unit and is used for a validation of the instrument.

Material
AISI 316L (1.4404)

Gas ports
1/4 in. Swagelok® connectors for tubes with 8 mm outer diameter

Isolation flanges

For applications with high pressure or toxic or flammable gas, isolation flanges may be used to seal the process. The isolation flanges are compliant with PED 2014/68/EU.

Available flange size
DN 50 / PN 16, ANSI 2 in.-150 lb

Material	
Flanges	AISI 316L (1.4404)
Window	Pre-stressed hardened borosilicate to DIN 7080 with antireflex-coating
Flat gaskets (process)	Graphite

Gas port for purging
1/4 in. Swagelok® connector for tubes with 8 mm outer diameter

Limitation	
Temperature	Max. 300 °C (572 °F)
Pressure	Max. 16 bar (232 psi) absolute

Insertion tubes

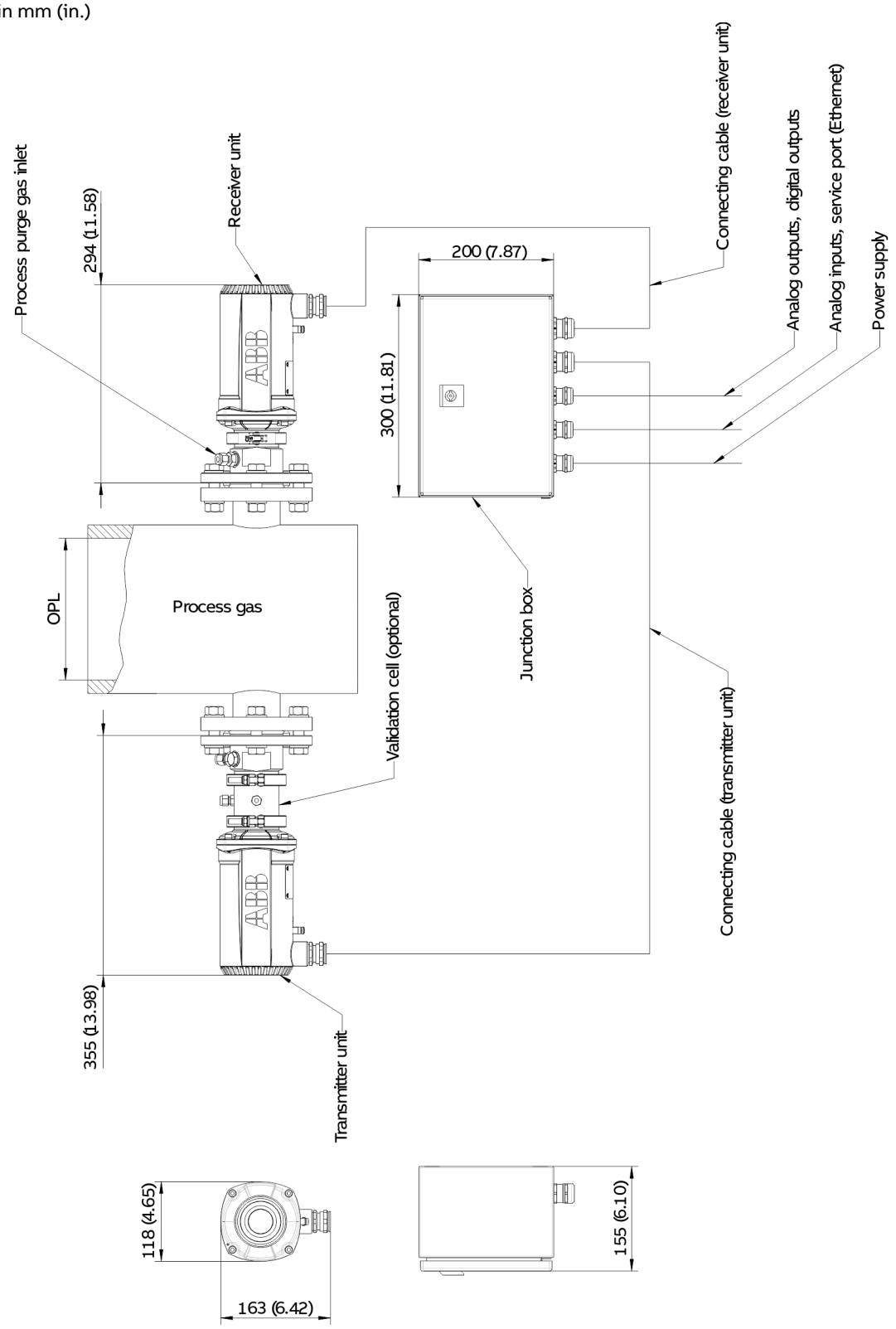
Insertion tubes (length 1 meter) may be used to shorten the optical path length for high dust applications.

Material
AISI 316L (1.4404)

Dimensions and electrical connections

LS4000 with junction box in general purpose version

Dimensions in mm (in.)



Approvals and certifications

CE conformity

The LS4000 gas analyzers satisfy the requirements of the European directives
2014/35/EU Low voltage directive,
2014/30/EU EMC directive.
Compliance with the requirements of directive 2014/35/EU is evidenced by full compliance with the European standard EN 61010-1:2010.
Compliance with the requirements of directive 2014/30/EU is evidenced by full compliance with the European standard EN 61326-1:2013.

Electrical safety to IECEE CB scheme

The LS4000 gas analyzers are certified to the “IEC system for mutual recognition of test certificates for electrical equipment”, evidenced by full compliance with standard IEC 61010-1 (Ed. 3).
CB Test Certificate No. DE1-52306

Electrical safety to UL, CSA

The LS4000 gas analyzers are certified for use in general purpose environment, evidenced by full compliance with standards CAN/CSA-C22.2 No. 61010-1-12 and UL Std. No. 61010-1 (3rd Edition).
Certificate No. 70001037

Notes

Sales

Service

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