

# ABB LS4000 laser analyzer datasheet

<http://www.manuallib.com/abb/ls4000-laser-analyzer-datasheet.html>

The LS4000 is an in situ crossduct 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 standalone system and is approved for use in hazardous areas according to international standards.

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# LS4000

## Tunable 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

- Flameproof housing (Ex-d), no purging
- No nitrogen purging for O<sub>2</sub> measurement
- Compact and lightweight, insensitive to vibrations
- Ease of maintenance

Power and productivity  
for a better world™



# LS4000

## Tunable diode laser analyzer

### 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 and is approved for use in hazardous areas according to international standards.

The analyzer 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.

#### Measurement 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.

### Technical data

#### Sample components and measurement ranges

##### Sample component

O<sub>2</sub>

##### Min./max. measurement range

0–1/100 vol.%

##### Max. abs. pressure

2 bar (29 psi)

2 to 20 bar (29 to 290 psi) on request

##### Max. temperature

800 °C (1472 °F)

800 to 1500 °C (1472 to 2732 °F) on request

##### Measurement range quantity

1 physical measurement range per sample component,

1 x transmission

##### Optical path lengths (OPL)

##### Standard optical path lengths

0.5 to 20 m. Other optical path lengths on request.

##### Remarks

- 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.

### Stability

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

### Linearity deviation

≤ 1% of span

### Repeatability

< 0.2 % of reading

### Zero drift

No zero drift due to the measuring principle

### Span drift

< 1% of smallest measuring range per week

### Output fluctuation (2 $\sigma$ )

≤ 0.5 % of smallest measurement range

### Detection limit (4 $\sigma$ )

≤ 1% 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.

### Process temperature

< 1 % of measuring range per 100 K

### Process pressure

< 0.0001 % of reading per 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 5)

#### Calibration/validation interval

Depending on application, typically once a year

### Housing

Transmitter and receiver unit	
Protection class	IP65
Material	Stainless steel AISI 304H (1.4308), painted
Weight	4.1 kg each
Color	Light gray (RAL 7035)
Dimensions	See pages 6 to 9

### Junction boxes

General purpose	
Protection class	IP65
Material	Steel, painted
Weight	4.7 kg
Color	Light gray (RAL 7035)
Dimensions	See page 6

### ATEX, IECEx

Protection class	IP65
Material	Aluminum, painted
Weight	Version without power supply: 4.5 kg, version with power supply: 10 kg
Color	Light gray (RAL 7035)
Dimensions	See pages 7 and 8

### CSA Class I

Protection class	Type 3, 4X, 7 & 9
Material	Copper free aluminum, not painted
Weight	28 kg
Dimensions	See page 9

# LS4000

## Tunable diode laser analyzer

### 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

DN50/PN10, ANSI 2 inch-150 lb

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

### Weight

3.1 kg

### Gas ports for purging

1/4 inch Swagelok® hose nozzle with 8 mm inner diameter

### Purging medium

Instrument air, dry and oil-free (compliant with standard ISO 8573.1, Class 2–3)

Nitrogen (required only for low level O<sub>2</sub> measurements)

### Electrical interfaces

#### Analog outputs

Up to three 4–20 mA outputs (one for each measuring 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 pages 6 to 9 for connection drawings

### 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 temperature correction
28	T probe out (4–20 mA)	
29	P probe in (4–20 mA)	Analog input for dynamic pressure correction
30	P probe out (4–20 mA)	

### 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 (–4 to 131 °F)
General purpose junction box	(no direct solar radiation)
ATEX, IECEx junction box <sup>1)</sup>	–20 to +55 °C (–4 to 131 °F)
CSA Class I junction box <sup>1)</sup>	–25 to +50 °C (–13 to 122 °F)

#### Ambient temperature during storage and transport

Transmitter and receiver unit	–40 to +70 °C (–40 to 158 °F)
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1) The temperature data is given only for information. The documentation of the junction box manufacturer is relevant.

### 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°

## Explosion-proof versions

The type LS4060 gas analyzer is suitable for use in hazardous areas:

Explosion protection to European standards – ATEX	
Transmitter and receiver unit (Zone 1)	 II 2(1)G Ex d [op is Ga] IIC T6 Gb  II 2D Ex tb IIIC T88°C Db
Transmitter and receiver unit (Zone 2)	 II 3(1)G Ex d [op is Ga] IIC T6 Gc  II 3D Ex tc IIIC T88°C Dc
Junction box without power supply <sup>1)</sup>	 II 2G Ex e IIC T6 Gb  II 2D Ex tb IIIC T80°C Db
Junction box with built-in power supply additionally <sup>1)</sup>	 II 2G Ex d IIC T6  II 2D Ex tD A21 IP66 T85°C

Explosion protection to international standards – IECEx	
Transmitter and receiver unit	Ex d [op is] IIC T4 Gb Ex tb IIIC T88°C Db
Junction box without power supply <sup>1)</sup>	Ex e IIC T6 Gb Ex tb IIIC T80°C Db
Junction box with built-in power supply <sup>1)</sup>	Ex de IIC T6 Gb

Explosion protection to U.S. and Canadian standards – UL, CSA	
Transmitter and receiver unit	Class I, Div. 1, Groups B, C, D; Class I, Div. 2, Groups A, B, C, D; T4A Class I, Zone 1, AEx d, IIB+H2 T4
Junction box with built-in power supply <sup>1)</sup>	Class I, Div. 1, Groups B, C, D Class I, Zone 1, Group IIB + H2

1) The data regarding the explosion protection of the junction boxes is given only for information. The documentation of the junction box manufacturer is relevant.

## 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 inch Swagelok® hose nozzle with 8 mm inner 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 97/23/EC.

### Available flange size

DN50/PN16, ANSI 2 inch-150 lb

### Material

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

### Gas ports for purging

1/4 inch Swagelok® hose nozzle with 8 mm inner 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

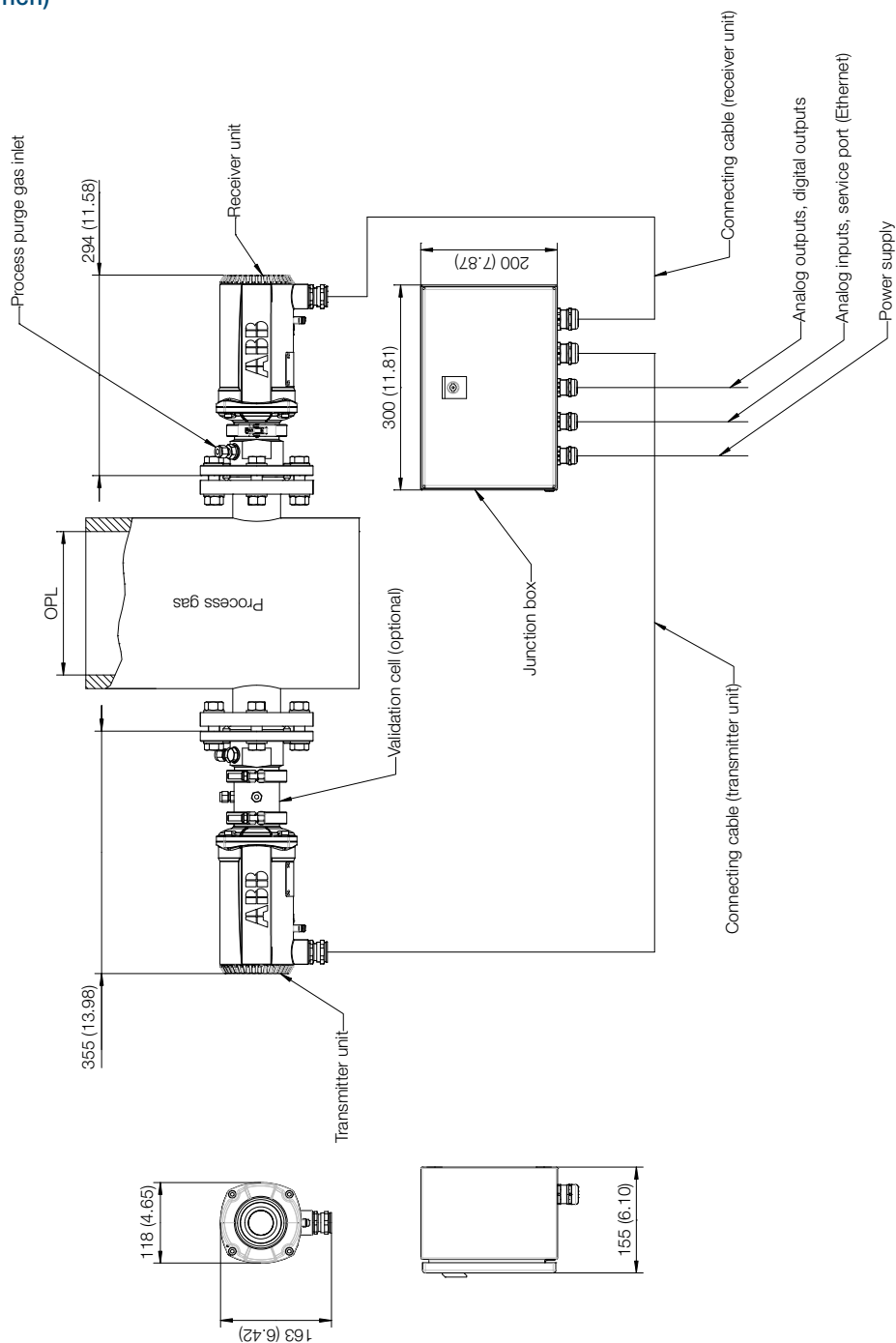
AISI 316L (1.4404)

# LS4000

## Tunable diode laser analyzer

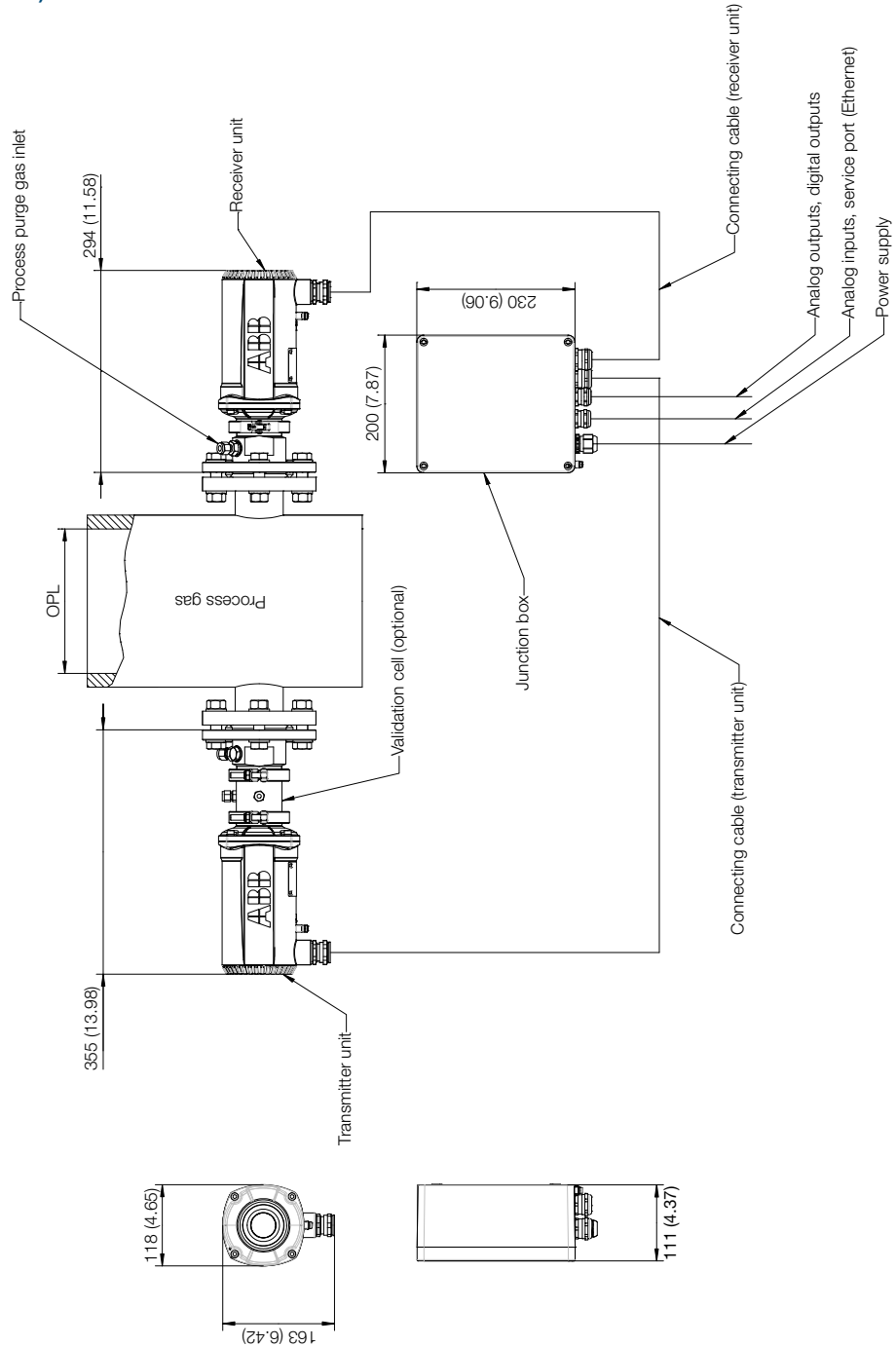
### LS4000 with junction box in general purpose version

Dimensions in mm (inch)



# LS4060 with junction box in ATEX/IECEx version without power supply

Dimensions in mm (inch)



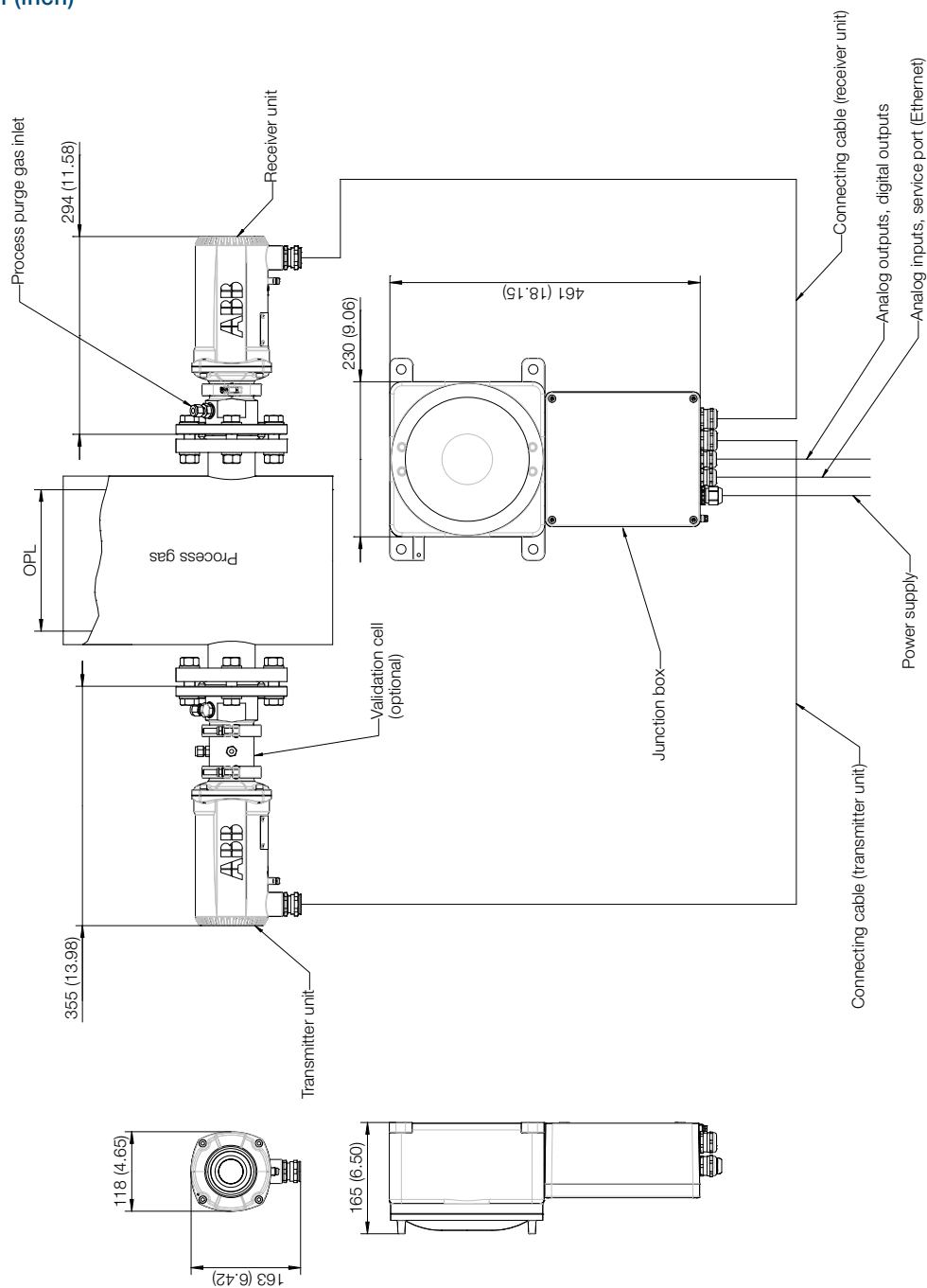


# LS4000

## Tunable diode laser analyzer

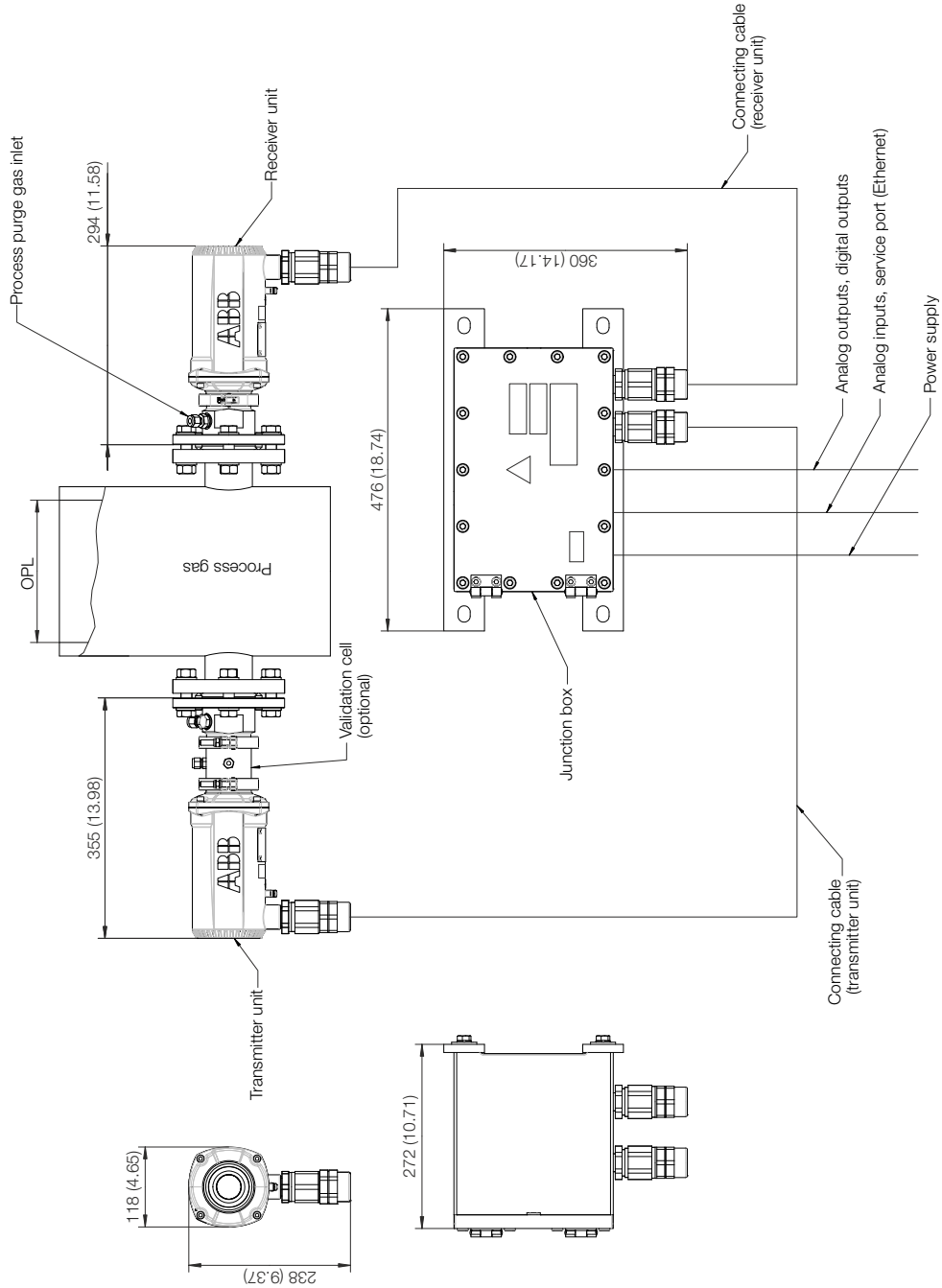
### LS4060 with junction box in ATEX/IECEx version with power supply

Dimensions in mm (inch)



# LS4060 with junction box in CSA Class I version

Dimensions in mm (inch)



# LS4000

## Tunable diode laser analyzer

### Certifications

#### CE conformity

The LS4000 and LS4060 gas analyzers satisfy the requirements of the European directives 2006/95/EC Low voltage directive, 2004/108/EC EMC directive and 94/9/EC ATEX directive.

Compliance with the requirements of directive 2006/95/EC is evidenced by full compliance with European standard EN 61010-1:2010.

Compliance with the requirements of directive 2004/108/EC is evidenced by full compliance with European standards EN 61326-1:2006, EN 61000-3-2:2006 + A1:2009 +A2:2009, EN 61000-3-3: 2008.

Compliance of the explosion protected versions type LS4060 with the requirements of directive 94/9/EC is evidenced by full compliance with the European standards listed in the "Explosion protection to European standards – ATEX" section.

#### Electrical safety to IEC CB scheme

The LS4000 and LS4060 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 U.S. and Canadian standards – UL, CSA

The LS4000 and LS4060 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

#### Explosion protection to European standards – ATEX

The LS4060 gas analyzer (transmitter and receiver unit) in the version for use in zone 1 satisfies the European standards EN 60079-0:2011, EN 60079-1:2007, EN 60079-28:2007, EN 60079-31:2009.

Designation:

 II 2(1)G Ex d [op is Ga] IIC T6 Gb

 II 2D Ex tb IIIC T88°C Db

EC-Type examination certificate No. BVS 13 ATEX E 008 X

The LS4060 gas analyzer (transmitter and receiver unit) in the version for use in zone 2 satisfies the European standards EN 60079-0:2011, EN 60079-1:2007, EN 60079-28:2007, EN 60079-31:2009.

Designation:

 II 3(1)G Ex d [op is Ga] IIC T6 Gc

 II 3D Ex tc IIIC T88°C Dc

Certification by manufacturer's declaration

#### Explosion protection to international standards – IECEx

The LS4060 gas analyzer (transmitter and receiver unit) satisfies the European standards EN 60079-0:2011, EN 60079-1:2007, EN 60079-28:2006, EN 60079-31:2008.

Designation:

Ex d [op is] IIC T4 Gb

Ex tb IIIC T88°C Db

Certificate No. IECEx BVS 13.0013X

#### Explosion protection to U.S. and Canadian standards – UL, CSA

The LS4060 gas analyzer (transmitter and receiver unit) is certified for use in explosion hazard areas Class 1, Div. 1, Groups B, C, D; Class I, Div. 2, Groups A, B, C, D; T4A; Class I, Zone 1, AEx d, IIB+H2 T4  
Certificate No. 12.2589676X

#### Remark

Information regarding the explosion protection of the junction boxes can be found in the documentation of the junction box manufacturer.

Notes

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