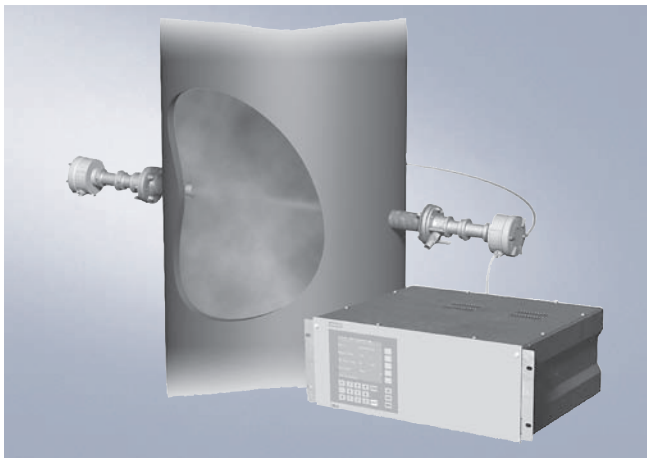
LDS 6
In-situ Laser Gas Analyzer

General

Overview

LDS 6 is a diode laser based gas sensor with a measuring principle based on the specific light absorption of different gas components. LDS 6 is suitable for fast and non-intrusive measurements of gas concentrations or temperatures in process or flue gases. One or two signals of up to three measuring points are processed simultaneously with one central analyser unit. The cross duct in-situ sensors at each measuring point can be separated up to 1 kilometer from the central unit by using fiber optic cables. The sensors are designed for operation under harsh environmental conditions and contain a minimum of electrical components. By connecting a bypass stream to a separate flow cell measurements can also be carried out extractively instead of in-situ.



LDS 6, typical installation with cross duct sensors

Benefits

The in-situ gas analyzer LDS 6 is characterized by a high operational availability, unique analytic selectivity and by a broad scope of suitable applications. LDS 6 enables the measurement of one or two gas components or - if desired - the gas temperature directly in the process

- At the presence of up to 100 vol.% steam
- At high levels of dust load (up to 100 g/Nm^3)
- In hot, corrosive, explosive, or toxic gases
- In applications showing strong varying gas compositions
- Under harsh environmental conditions at the measuring point
- Highly selective, i.e. mostly without cross interferences.

LDS 6 allows:

- Little installation efforts
- Minimum maintenance requirements
- High ruggedness and long-term stability
- Real-time measurements.

Moreover, the instrument provides warning and failure messages at:

- Need for maintenance
- Erroneous self calibration
- Bad signal quality
- Exceeding a lower or upper alarm level for the measurement variable
- Transmission exceeding upper or lower limit.

Application

Application areas

- Process optimisation
- Continuous emission monitoring for all kinds of fuels (oil, gas, coal, and others)
- Process measurements in power utilities and any kind of incinerator
- Process control
- Explosion protection
- Measurements in corrosive and toxic gases
- Quality control
- Environmental protection
- Plant and job safety.

Branches

- Power plants
- Waste incinerators
- Cement industry
- Chemical and petrochemical plants
- Automotive industry
- Glass and Ceramics production
- Research and development.

Special applications

- In addition to the standard combinations special applications are available upon request.

General

Design

LDS 6 consists of a central unit, accomplished by up to three pairs of cross duct sensors in a transmitter/ receiver configuration. The connection between the central unit and the sensors is established by a so-called hybrid cable, which contains optical fibers and copper wires. An additional loop cable connects both sensor parts.

Central unit

The central unit is housed in a 19"-rack with 4 holders for assembly

- in a swing gate
- in racks with or without telescope rails.

Display and control panel

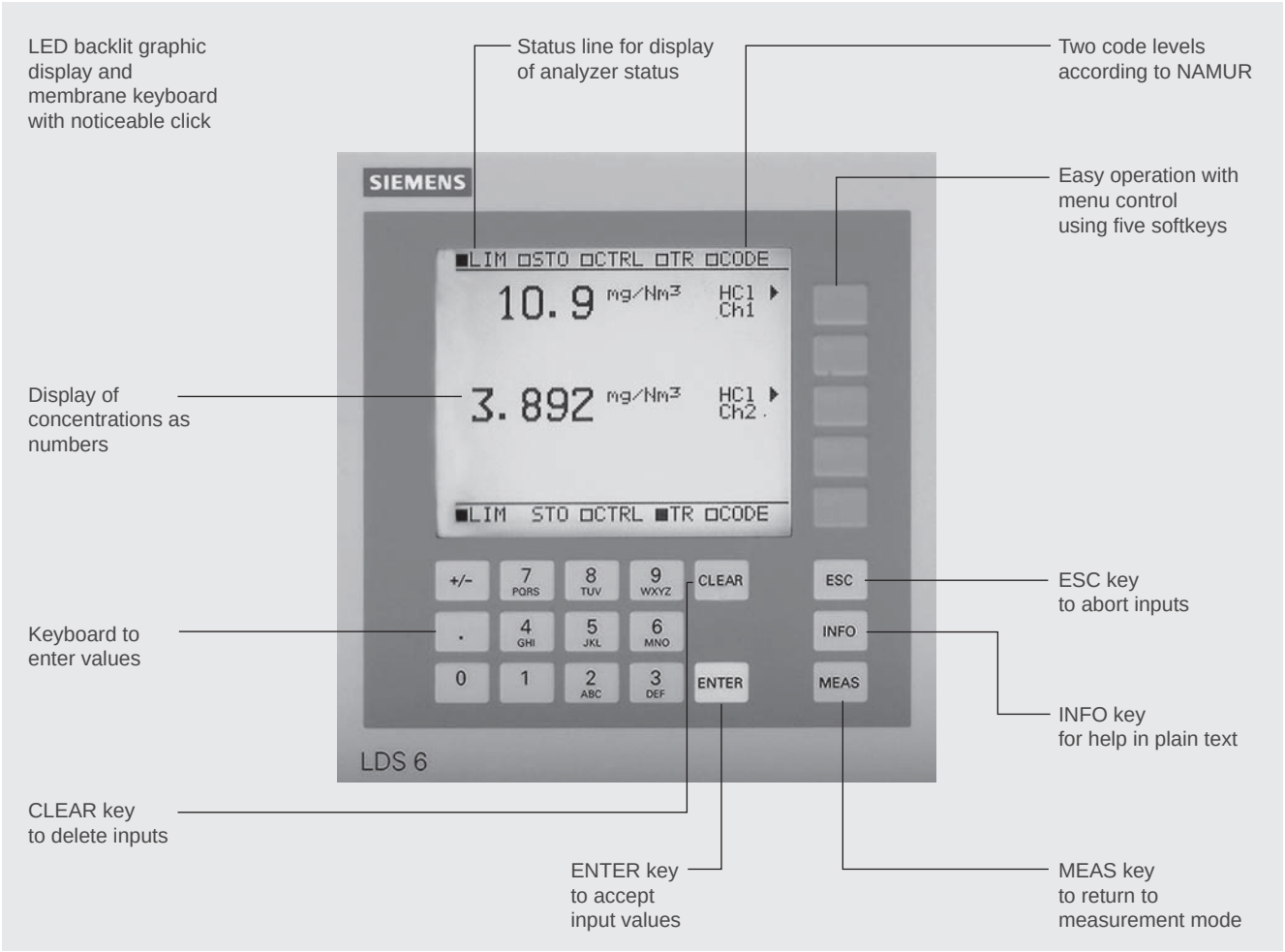
- Large LCD field for simultaneous display of measurement result and device status
- Contrast of the LCD field is adjustable via the menu
- LED illumination of the display
- Cleanable foil touch pad with soft-keys
- Menu-controlled operation for parameterization and diagnoses
- Operation help given in plain text.

Input and output connections

- One to three measurement channels with hybrid-connections for the sensors at the measuring points
- Per channel 2 analog inputs for process gas temperature and pressure
- Per channel 2 analog outputs for gas concentration(s) or gas temperature and concentration, respectively
- Per channel 6 freely configurable binary inputs for signalling of fault or maintenance request from external temperature or pressure transducers or purging failure.
- Per channel 6 freely configurable binary outputs (signalling of fault, maintenance request, function control, transmission limit alarm, concentration limit alarm, store analog output).

Communication

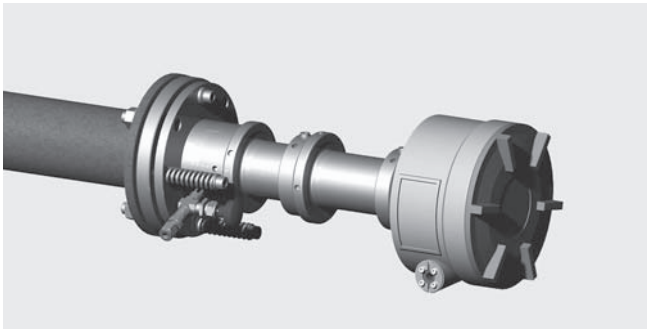
Network connection: Ethernet (T-Base-10) for remote diagnosis and maintenance.



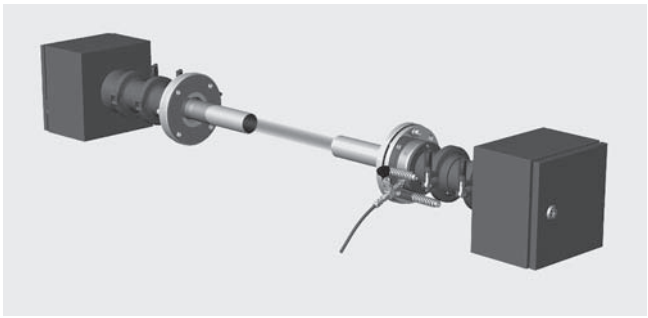
LDS 6 central unit, membrane keyboard and graphic display

General

Transmission sensors



Sensor CD 6 of the LDS 6 (non-EEx), transmitter or receiver unit



Sensor pair CD 3002 of the LDS 6 (EEx), transmitter and receiver unit

- In-situ cross duct sensors, configured as transmitter and receiver unit, connected via loop cable
- Sensor pair CD 6 for non-EEx environments, sensor pair CD 3002 for EEx environments
- Stainless steel, partially painted
- Protection class IP67 (non-EEx) sensor and IP65 (EEx)
- Adjustable window flanges with flange connection DN65/PN6, optional: ANSI 4“/150 lbs
- Purging facilities on the process and the sensor side, configurable application with purging gas connections for:
  - Instrument air
  - Air blower fan
  - Steam
  - Nitrogen
  - Any other suitable purging media
- Fast connectors for cleaning the measurement openings and the sensor window
- Optional Ex-protected version according to ATEX II 1GD EEx ia IIC T4.

Parts in contact with the process gases

The sensors normally do not come into contact with the process gas, since purging is applied at the process side. The material used for the tubes defining the purge volume in front of the sensor windows is selected according to the process conditions. Available tube materials are stainless steel (standard), Hastelloy, plastics (PP) and ceramics.

Hybrid- and loop cable

Combination of fiber optic cables and twisted copper wires to connect the sensors to the central unit. The hybrid cable connects the central unit with the transmitter unit of the sensor, the loop cable connects the transmitter and the receiver unit of the sensor.

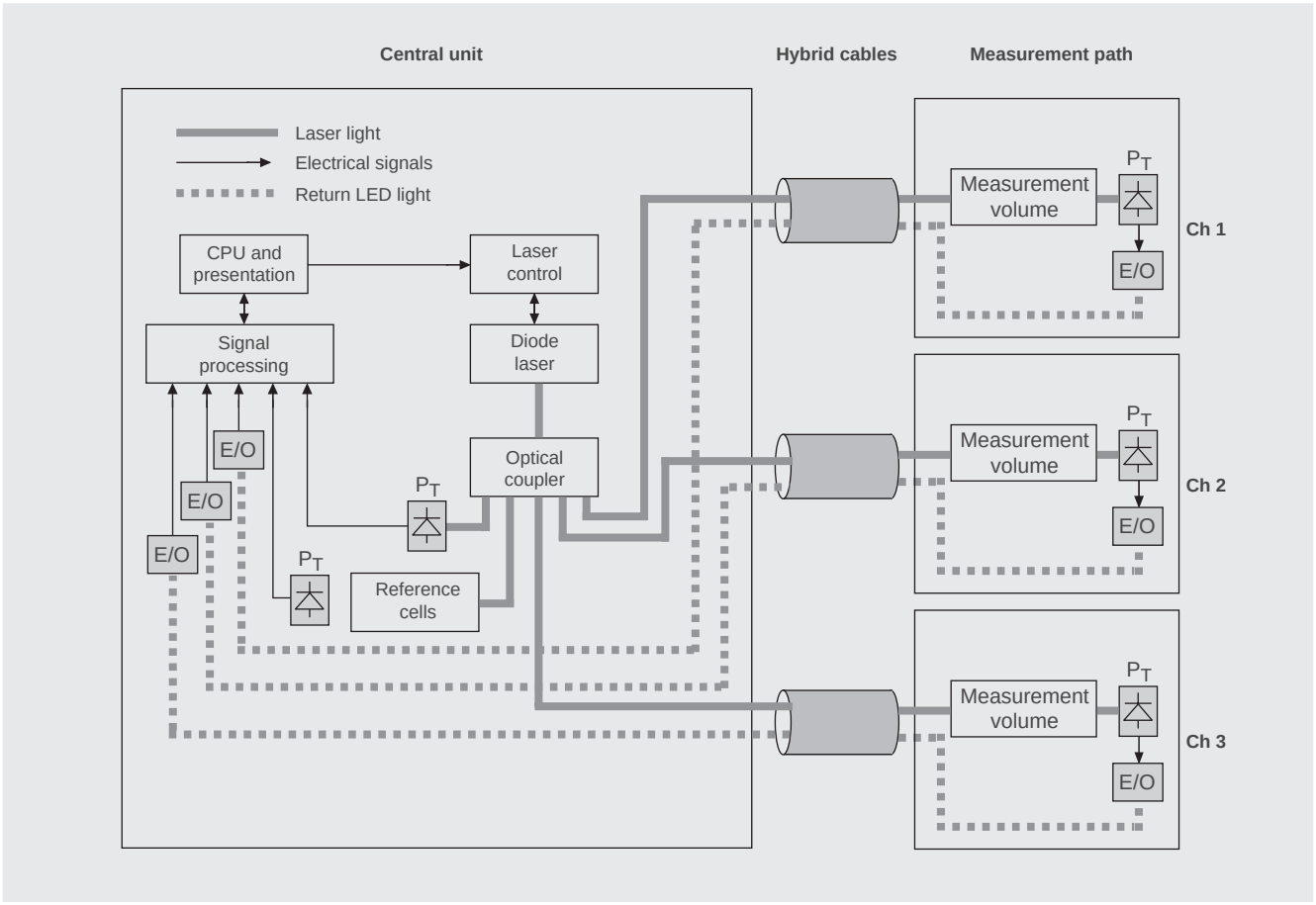
- Max. 1000 m distance between central unit and measuring point
- Hybrid and loop cable:
  - Multimode fiber-optic cable, provided with SMA connections for transmission of the measurement signal
  - Two-core copper cable, in twisted pair configuration, for +24 V supply of the receiver electronics
- Additionally for the hybrid cable:
  - Monomode fiber optic cable, configured double-sided with angle-polished E2000 connectors for the transmission of laser light
- Robust cable coating for mounting in open cable ducts or ductworks
- Oil-resistant polyurethane as jacket material.

Connections of the hybrid cable

Function

Working principle

LDS 6 is a gas analyzer employing single-line molecular absorption spectroscopy. A diode laser emits a beam of near-infrared light, which is sent through the process gas and detected by a receiver unit. The wavelength of the laser diode output is tuned to a gas specific absorption line. The laser is scanning continuously over this single absorption line with very high spectral resolution. The result is a fully resolved single molecular line which is analysed in terms of absorption strengths and line shape. The measurement is free of cross-interferences, since the quasi-monochromatic laser light is absorbed very selectively by only one specific molecular line in the scanned spectral range.

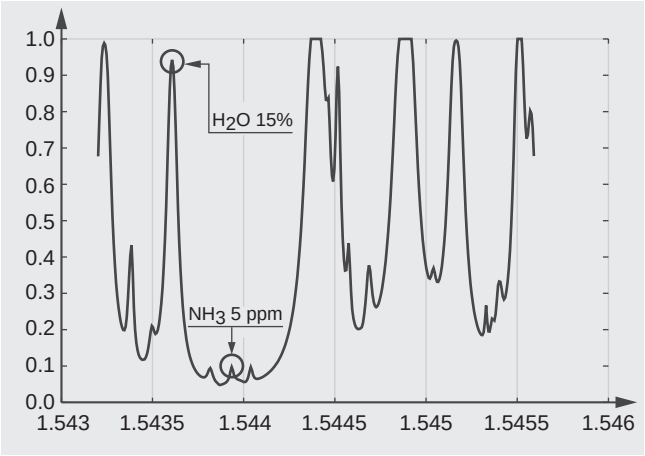


Basic design of the LDS 6

General

LDS 6 is connected to a measuring point by fiber optics. The laser light is guided by a single mode fibre from the central unit to the transmitter unit of the in-situ sensor. The sensor consists of a transmitter and a receiver; their distance defines the measurement path. In the receiver box, the light is focused onto a suitable detector. The detector signal is then transferred into an optical signal and is transmitted via a second optical fibre to the central unit, where the concentration of the gas component is determined from the detected absorption signal.

LDS 6 measures normally a single gas component. In some specific cases two components can be measured simultaneously, if their absorption lines are so close to each other that they can be detected within one laser scan (for example like water(H_2O) and ammonia (NH_3) in the spectrum shown.



Absorption spectra of water and ammonia

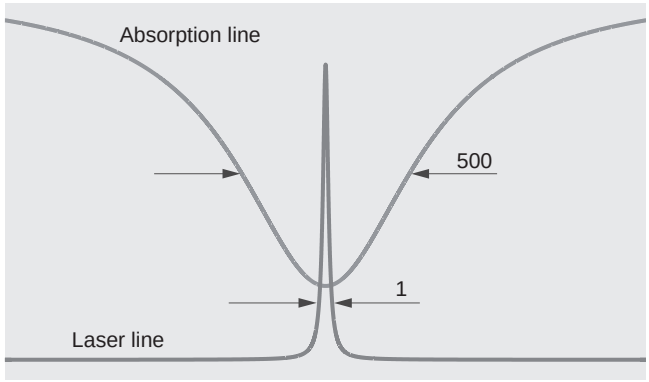
Moreover, in some applications it is possible to determine the gas temperature as a measurement value. In this case, the ratio of the absorbance of two characteristic lines of the same molecule measured at the same time in the same volume gives the actual temperature in the process gas.

Typical measurable gases for LDS 6 are:

- Oxygen / O2
- Hydro fluorine / HF
- Hydro chlorine / HCl
- Ammonia / NH_3
- Water vapour / H_2O
- Carbon monoxide / CO
- Carbon dioxide / CO_2.

By using an internal reference cell normally filled with the gas measured, the stability of the spectrometer is permanently checked in a reference channel.

By doing so, the continuous calibration of the instrument is guaranteed without the need of carrying out external re-calibrations by bottled test gases or reference cuvettes.



Typical spectral width of an absorption line compared to the width of the laser emission

Influences on the measurement

- **Dust load**: As long as the laser beam is able to give a suitable detector signal, the dust load of the process gases does not influence the analytical result. By applying a dynamic background correction, measurements can be carried out without any negative impact. Typical particle densities from below 1 mg/Nm^3 to 100 g/Nm^3 can be handled by the LDS 6. The varying dust loads are compensated by scanning the laser over the gas absorption line and the inherent background. At a scan position next to the absorption line, the instrument can "see" only absorption caused by the dust load where at the line center the signal is composed of the molecular absorption and the continuous, unspecific background absorption. While using a wavelength modulation technique, the actual measured transmission is always compared with the baseline. In the signal processing, a lock-in detection scheme delivers a signal only from the molecular line free of background.
  Dust load and path length are competing: the higher the dust load in the process, the shorter the max. path length possible.
- **Temperature**: The temperature influence on the absorption line strength is compensated by a correction factor determined during calibration. A temperature signal can be fed into the instrument from an external temperature sensor. The signal is then used for a mathematical correction of the influence of the temperature on the observed line strength.
  At high temperatures where thermal radiation of the gas and the dust is present or flames can occur in the measurement path, the detector is shielded with an optical band pass filter in front in order not to saturate it with the strong background radiation.
- **Pressure**: The gas pressure can affect the line shape of the molecular absorption line. LDS 6 uses a curve fitting algorithm to adapt to the resulting line shape. Additionally, an external pressure signal can be fed to the instrument to give a complete mathematical compensation for the pressure influence incl. the density effect.
- **Cross interferences**: Since LDS 6 derives its signal from a single fully resolved molecular absorption, cross interferences with other gases are quite unlikely. LDS 6 is therefore able to measure the desired gas components very selectively. In special cases, the composition of the process gas might have an influence on the shape of the absorption line features. This influence is compensated by analysing the full shape of the detected signal curve by customized algorithms.

- **Optical path length**: The absorption values analyzed by the LDS 6 are typically small. As a result of Lampert-Beer's law, the signal strength of the absorption lines can be approximated as being linear dependent on the optical path length within the gas. Therefore, the precision in determine the effective optical path length in the process might limit the overall precision of the measurement.
  As the sensor openings towards the process normally need to be purged to keep them clean over a long period of time, the thickness of the mixing zone between the purging media and the process gas and its concentration distribution need to be considered. In a typical cross duct installation with some meters of path, the influence of the purging gas on the effective path length can be neglected.
  Path length and load are competing: the higher the dust load in the process, the shorter the max. path length possible.

Maintenance and failure alarms

LDS 6 delivers warnings by relays:

- Need for maintenance (measurement value is not influenced)
- Operational fault (measurement value can be influenced).

Note

Individual requirements for the measuring point can make the utilization of special sensor equipment necessary. The possibilities for adapting the sensors are:

- Different purging media available like instrument air, ambient air, nitrogen or steam
- Different purging modes on process and sensor side
- Special materials of purging tubes and/or the sensor flanges
- Cooling or heating of the sensors
- EEx-proof sensor configurations

Essential characteristics

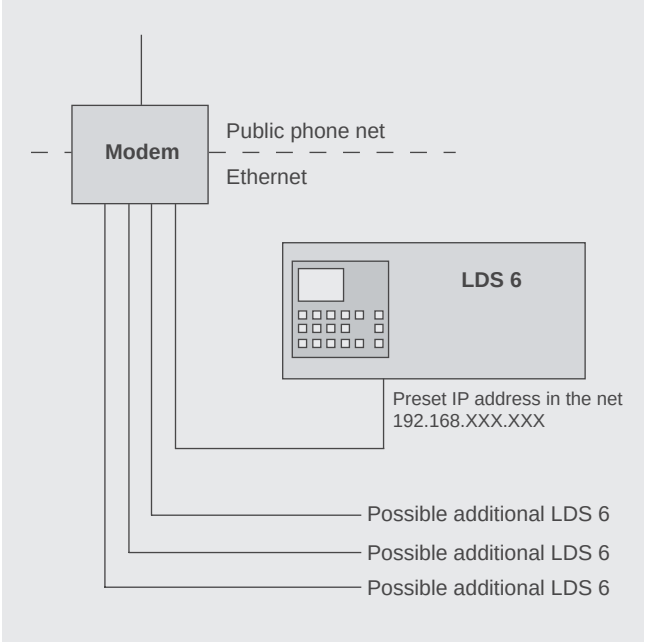
- Integrated self-calibration with an internal reference cell
- Negligible long-term drifts of zero and span
- Dynamic background correction for varying dust loads
- Galvanically isolated signal outputs of 4-20 mA (also inverted)
- Easy-to-handle with menu-driven operation
- Selectable time constants (response time)
- Two user levels with individual access codes for prevention of unwanted and unauthorised operations
- Operation conformity with NAMUR recommendations
- Monitoring of overall optical transmission
- Remote preventive maintenance, and service operations accessible via Ethernet
- Straightforward replacement of the central units, since connectors can easily be removed
- Deterioration- and corrosion-free sensor and central unit housing
- Easy operation with a numerical keypad and menu prompt
- Modular design, allows exchange of components in the field.

Integration

Communication

LDS 6 is capable to transmit and receive data via Ethernet connection by using the software LDScom. This installation and service tool is capable to check and adjust remotely instrument status and calibration parameters. If desired, almost a full system check can be done remotely. In case of service, information can be addressed via modem to Siemens service personnel, who take care of appropriate measures remotely.

This remote control capability is established by using a standard LAN modem.



External connection of LDS 6 via modem to establish remote maintenance capabilities

19" central unit

Technical specifications

Analytical performance	
Measuring range	internally adjustable
Minimum detection limits (20 °C, 1000 hPa, 1 m path length)	gas-depending: HF: 0.05 ppm HCl: 0.2 ppm NH_3: 0.3 ppm H_2O: 1 ppm
in combination with HF, HCl, NH_3	1000 ppm O_2: 200 ppm CO: 200 ppm CO_2: 200 ppm
Smallest recommended measuring range (20 °C, 1000 hPa, 1 m path length)	gas-depending: HF: 0 ... 2 ppm HCl: 0 ... 10 ppm NH_3: 0 ... 10 ppm H_2O: 0 ... 50 ppm
in combination with HF, HCl, NH_3	0 ... 5 Vol% O_2: 0 ... 1 Vol% CO: 0 ... 1 Vol% CO_2: 0 ... 1 Vol%
Largest recommended measuring range (20°C, 1 bar, 1 m path length or smaller)	gas-depending: HF: 0 ... 10 Vol% HCl: 0 ... 25 Vol% NH_3: 0 ... 100 Vol% H_2O: 0 ... 100 Vol%
in combination with HF, HCl, NH_3	0 ... 30 Vol% O_2: 0 ... 100 Vol% CO: 0 ... 100 Vol% CO_2: 0 ... 100 Vol%

The max. ranges possible with an analyser might be dependent on the measurement conditions and its individual configuration. In case, a required range is larger than 200 times the smallest range given above, please, contact Siemens to discuss your application.

General	
Concentration units	ppm, Vol%, mg/Nm^3 (EU/US)
Display	Digital concentration display (5 digits with floating decimal point)
Mounting orientation	Front plate vertical
Laser protection class	Class 1, safe to the eye
Laser power	varies with application
Certificates	CE mark, ATEX
Linearity	better than 1%
Accuracy	better than 2% of reading above the minimum detection limit
Configuration, housing	
Protection class	IP20 according to EN 60529
Dimensions	177x440x380 mm
Weight	approx 13 kg
Electrical properties	
Power supply	100 bis 240 VAC 50-60 Hz, automatically adjusted to the system
Power consumption	50 W
EMC-compatibility	According to EN 61326 and standard classification of NAMUR NE21
Electrical safety	According to EN 61010-1, overvoltage classification II
Fuse specifications	100 ... 240 V: 2.5T/250

Time parameters	
Warm-up temperature at 20 °C ambient	approx 15 min
Delay of display (T_{90})	< 1 s
Electrical time constant	0.3 (adjustable), typically 1 ... 3 s
Dead time	< 1 s
Response time	better than 3 s, application dependent
Electrical damping	1 bis100 s, selectable
Measurement behaviour	
Output signal fluctuation	2% of measurement value
Precision	< 2% ... < 5% of measurement value, application dependent
Zero point drift	negligible
Drift of measurement value	negligible
Deviation of linearity	< 1% of measurement value
Parameters of influence	
Ambient temperature	< 1%/10 K of measurement value
Ambient pressure	< 1%/50 hPa
Measurement gas pressure	< 2% change of reading upon change in pressure of 50 hPa
Power supply	< 1% at change of output signal range of ± 10%
Tilting	< 1% for non-horizontal mounting of the sensors below 15°
Electrical in- and outputs	
Number of measurement channels	1 ... 3, optional
Analog output	2, 4 ... 20 mA, potential-free, ohmic resistance max. 750 Ω
Analog inputs	2, designed for 4 ... 20 mA
Binary outputs	6, with changeover contacts, configurable, AC/DC 24 V/1 A, potential-free
Binary inputs	6, designed for 24 V, potential-free, configurable
Communication Interface	Ethernet 10BaseT (RJ-45)
Ambient conditions	
Temperature range	+5 ... +45 °C during operation, -40 ... +70 °C during transportation and storage
Humidity	< 85% RH, above dew-point
Ambient pressure	700 ... 1200 hPa

Ordering data

Order No. 7MB6021-0 ■■ 00-0 ■■

In-situ LDS 6 gas analyzer
19“ unit for installation in cabinets

Measured component	Application channel 1	
O_2 [1])	CEM	AA
	Combustion control	AB
	Safety-relevant areas	AC
	Process control	AD
O_2/temp [1])	Combustion control	BB
NH_3	CEM	CA
	SNCR-DeNOx	CE
	SCR-DeNOx	CF
	SCR-DeNOx / Automotive	CG
NH_3/H_2O	CEM	DA
	SNCR-DeNOx	DE
	SCR-DeNOx	DF
	SCR-DeNOx / Automotive	DG
HCl	CEM	EA
	Filter optimization	EH
	Trace gas detection (VCM, ...)	EJ
HCl/H_2O	CEM	FA
	Filter optimization	FH
HF [1])	CEM	GA
	Filter optimization	GH
HF/H_2O [1])	CEM	HA
	Filter optimization	HH
CO [1])	Combustion control	JB
	Safety-relevant areas	JC
	Process control (steel, ...)	JD
see channel 1 for the allowed combination	Application channel 2	
	CEM	A
	Combustion control	B
	Safety-relevant areas	C
	Process control (defined process)	D
	SNCR-DeNOx	E
	SCR-DeNOx	F
	SCR-DeNOx / Automotive	G
	Filter optimization	H
	Trace gas detection	J
	Channel 2 not equipped	X
see channel 1 for the allowed combination	Application channel 3 [1])	
	CEM	A
	Combustion control	B
	Safety-relevant areas	C
	Process control (defined process)	D
	SNCR-DeNOx	E
	SCR-DeNOx	F
	SCR-DeNOx / Automotive	G
	Filter optimization	H
	Trace gas detection	J
	Channel 3 not equipped	X
Language (supplied documentation, software)		
German		0
English		1
French		2
Spanish		3
Italian		4

1) To be released soon.

19" central unit

Further versions	Order code
Please add „-**Z**“ to Order No. and specify Order code	
Telescopic rails (2 off)	**A31**
Set of Torx tools, socket spanner	**A32**
Communication software (LDS6Com)	**K01**
LAN modem incl. cable	**K10**
D-sub to standard terminal connection, 15 pins (converter)	**K20**
D-sub to standard terminal connection, 25 pins (converter)	**K21**
Cable, D-sub 15 pins (1,5 m pin to pin)	**K22**
Cable, D-sub 25 pins (1,5 m pin to pin)	**K23**
TAG labels (customer-defined inscriptions)	**Y30**
FAT	**Y40**

				Standard application	Typical values	Resolution	Typical values	Resolution
Gas 1	**Gas 2**	**Code**	**Code**	**Comment**	**for range gas 1**	**Gas 1**	**for range gas 2**	**Gas 2**
O_2 [1])		A	A	CEM	0 ... 21 Vol%	0.1 Vol%	n.a.	n.a.
NH_3		C		flue gas, high accuracy	0 ... 25 ppm	0.3 ppm	n.a.	n.a.
NH_3	H_2O	D			0 ... 25 ppm	0.3 ppm	0 ... 30 Vol%	0.1 Vol%
HCl		E			0 ... 10 ppm	0.2 ppm	n.a.	n.a.
HCl	H_2O	F			0 ... 10 ppm	0.2 ppm	0 ... 30 Vol%	0.1 Vol%
HF [1])		G			0 ... 5 ppm	0.1 ppm	n.a.	n.a.
HF [1])	H_2O	H			0 ... 5 ppm	0.1 ppm	0 ... 30 Vol%	0.1 Vol%
O_2 [1])		A	B	Combustion control	0 ... 21 Vol%	0.1 Vol%	n.a.	n.a.
O_2 [1])	Temp.	B		high temperature calibration	0 ... 21 Vol%	0.1 Vol%	650°C ... 1200°C	± 30 K
CO [1])		J			0 ... 5 Vol%	0.1 Vol%	n.a.	n.a.
O_2 [1])		A	C	Safety relevant areas	0 ... 10 Vol%	0.1 Vol%	n.a.	n.a.
CO [1])		J		short response time	0 ... 10 Vol%	0.1 Vol%	n.a.	n.a.
O_2 [1])		A	D	Process control	0 ... 21 Vol%	0.1 Vol%	n.a.	n.a.
CO [1])		J		customized algorithm	0 ... 60 Vol%	0.1 Vol%	n.a.	n.a.
NH_3		C	E	SNCR-DeNOx	0 ... 50 ppm	1 ppm	n.a.	n.a.
NH_3	H_2O	D		high dynamics (e.g. municipal waste incinerator)	0 ... 50 ppm	1 ppm	0 ... 30 Vol%	0.1 Vol%
NH_3		C	F	SCR-DeNOx	0 ... 10 ppm	0.3 ppm	n.a.	n.a.
NH_3	H_2O	D		power plants, highest accuracy	0 ... 10 ppm	0.3 ppm	0 ... 30 Vol%	0.1 Vol%
NH_3		C	G	SCR-DeNOx / Automotive	0 ... 100 ppm	1 ... 2 ppm	n.a.	n.a.
NH_3	H_2O	D		engine lab	0 ... 100 ppm	1 ... 2 ppm	0 ... 30 Vol%	0.1 Vol%
HCl		E	H	Filter optimization	0 ... 2000 ppm at 1 m	2 ppm	n.a.	n.a.
HCl	H_2O	F		high dynamics (e.g. municipal waste incinerator)	0 ... 2000 ppm at 1 m	0.2 ppm	0 ... 30 Vol%	0.1 Vol%
HF [1])		G			0 ... 2000 ppm at 1 m	2 ppm	n.a.	n.a.
HF [1])	H_2O	H			0 ... 2000 ppm at 1 m	2 ppm	0 ... 30 Vol%	0.1 Vol%

Standard combination reference table

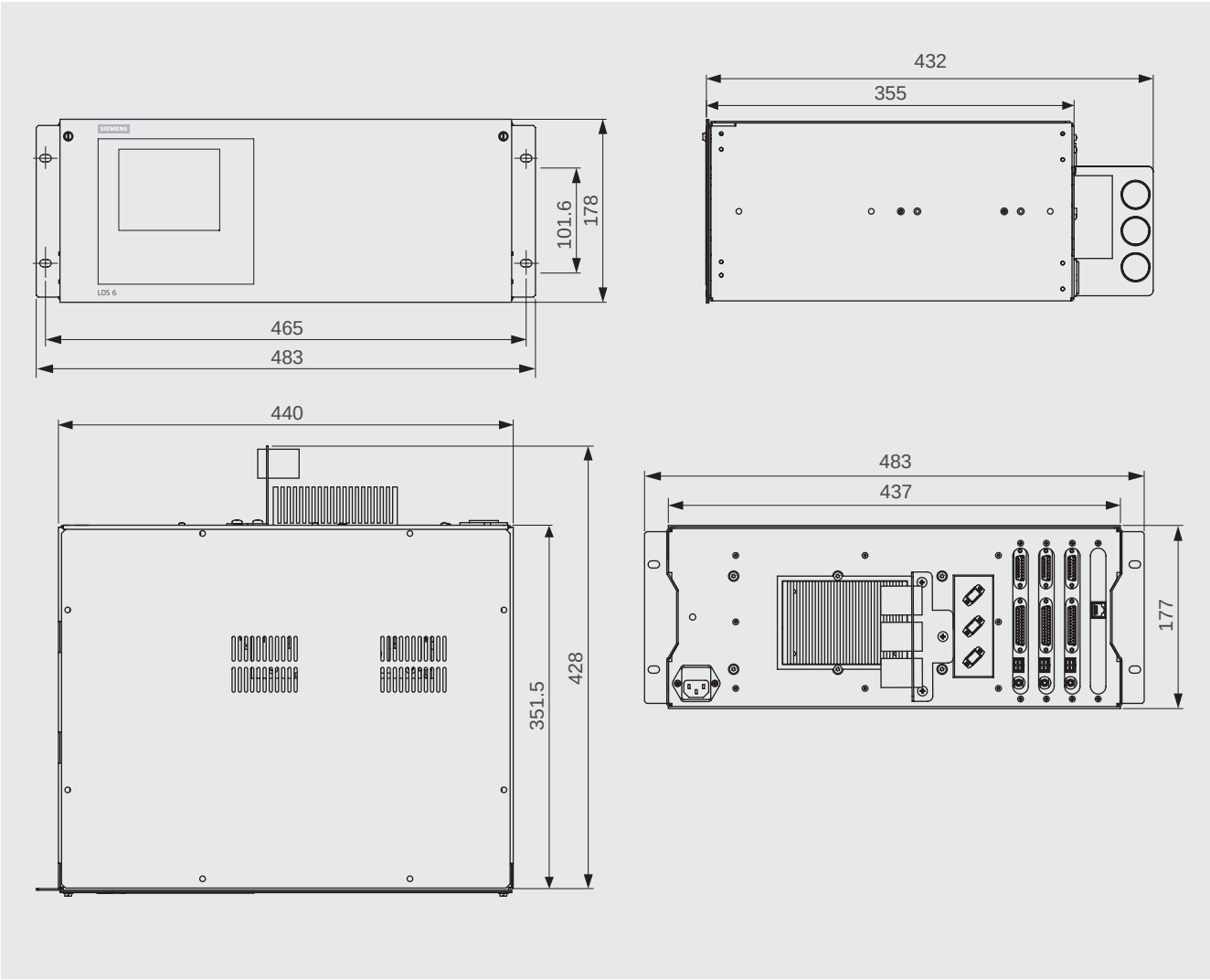
1) To be released soon.

				Typical values for		Typical values for		Typical	Purging mode		Purging media
Gas 1	**Gas 2**	**Code**	**Code**	**Temperature**	**Pressure**	**Path length**	**Dust load**	**integr. time**	**Default**	**Optional**	
O_2		A	A	< 150 °C	1000 hPa	1 ... 6 m	< 100 mg/Nm^3	30 s	D	B	N_2
NH_3		C		< 150 °C	1000 hPa	1 ... 6 m	< 100 mg/Nm^3	30 s	C	G	air
NH_3	H_2O	D		< 150 °C	1000 hPa	1 ... 6 m	< 100 mg/Nm^3	30 s	C	G	air
HCl		E		< 150 °C	1000 hPa	1 ... 6 m	< 100 mg/Nm^3	30 s	C	G	air
HCl	H_2O	F		< 150 °C	1000 hPa	1 ... 6 m	< 100 mg/Nm^3	30 s	C	G	air
HF		G		< 150 °C	1000 hPa	1 ... 6 m	< 100 mg/Nm^3	30 s	C	G	air
HF	H_2O	H		< 150 °C	1000 hPa	1 ... 6 m	< 100 mg/Nm^3	30 s	C	G	air
O_2		A	B	600 ... 1200 °C	1000 hPa	2 ... 6 m	< 20 g/Nm^3	10 s	E , F	G, H	steam + air, N_2
O_2	Temp.	B		600 ... 1200 °C	1000 hPa	2 ... 6 m	< 20 g/Nm^3	10 s	F	H	steam + N_2
CO		J		< 600 °C	1000 hPa	1 ... 6 m	< 20 g/Nm^3	10 s	E	G	air
O_2		A	C	< 150 °C	1000 hPa	1 ... 6 m	< 100 mg/Nm^3	2 s	D	B	N_2
CO		J		< 150 °C	1000 hPa	1 ... 4 m	< 20 g/Nm^3	2 s	E	G	air or N_2
O_2		A	D	< 150 °C	1000 hPa	1 ... 6 m	< 100 mg/Nm^3	10 s	D	B	N_2
CO		J		< 600 °C	1000 hPa	1 ... 4 m	< 20 g/Nm^3	2 s	E	G	air or N_2
NH_3		C	E	250 ... 350 °C	1000 hPa	2 ... 6 m	< 20 g/Nm^3	30 s	E	G	air
NH_3	H_2O	D		250 ... 350 °C	1000 hPa	2 ... 6 m	< 20 g/Nm^3	30 s	E	G	air
NH_3		C	F	300 ... 400 °C	1000 hPa	4 ... 8 m	< 20 g/Nm^3	30 s	E	G	air
NH_3	H_2O	D		300 ... 400 °C	1000 hPa	4 ... 8 m	< 20 g/Nm^3	30 s	E	G	air
NH_3		C	G	20 ... 650 °C	1000 hPa	1 m	< 2 g/Nm^3	2 s	C	A	air
NH_3	H_2O	D		20 ... 650 °C	1000 hPa	1 m	< 2 g/Nm^3	2 s	C	A	air
HCl		E	H	150 ... 250 °C	1000 hPa	1 ... 6 m	< 20 g/Nm^3	10 s	E	G	air
HCl	H_2O	F		150 ... 250 °C	1000 hPa	1 ... 6 m	< 20 g/Nm^3	10 s	E	G	air
HF		G		150 ... 250 °C	1000 hPa	1 ... 6 m	< 20 g/Nm^3	10 s	E	G	air
HF	H_2O	H		150 ... 250 °C	1000 hPa	1 ... 2 m	< 20 g/Nm^3	10 s	E	G	air

Standard combination reference table (continued)

19" central unit

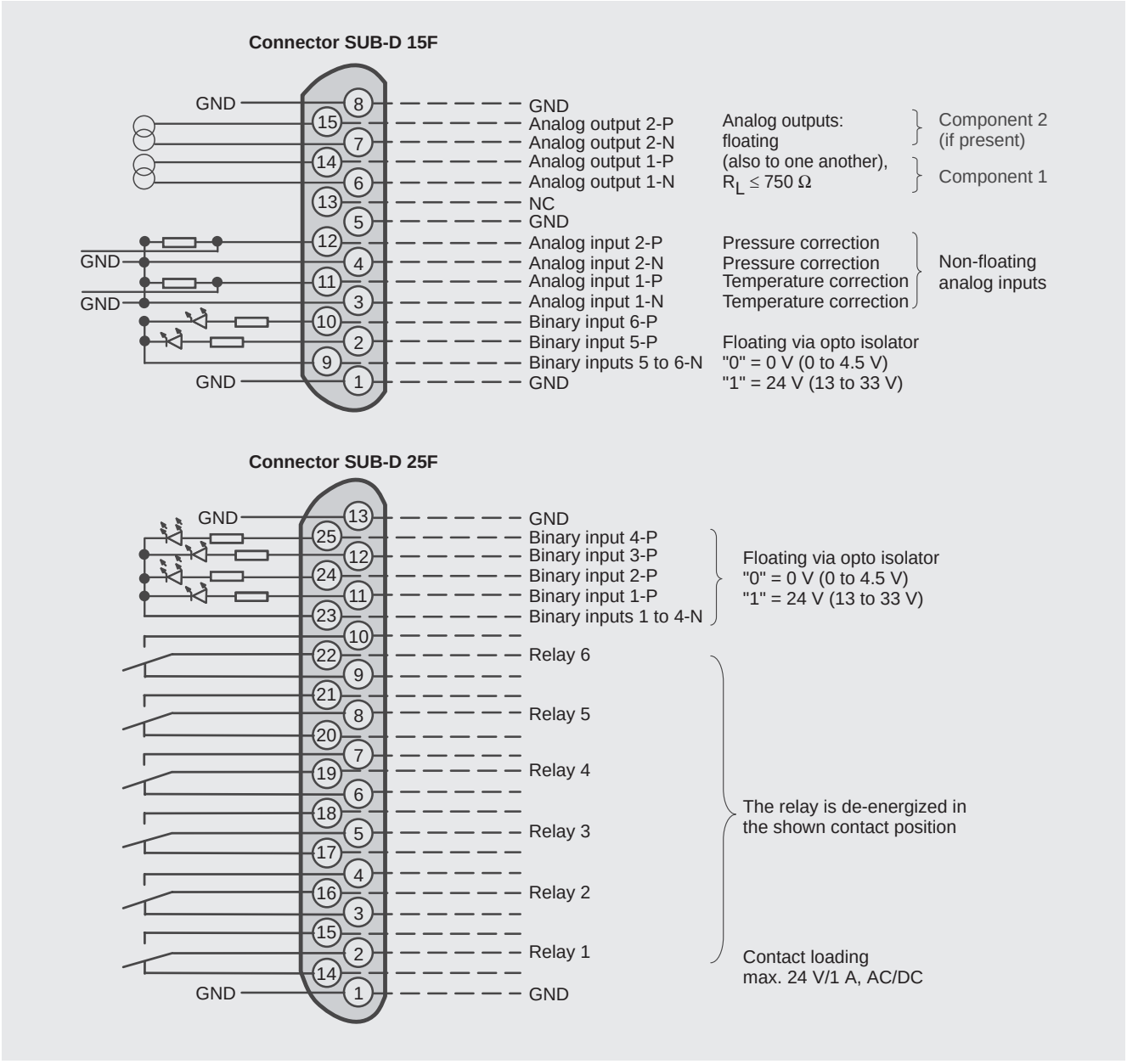
Dimensional drawings



LDS 6, 19“ central unit, dimensions in mm

Schematics

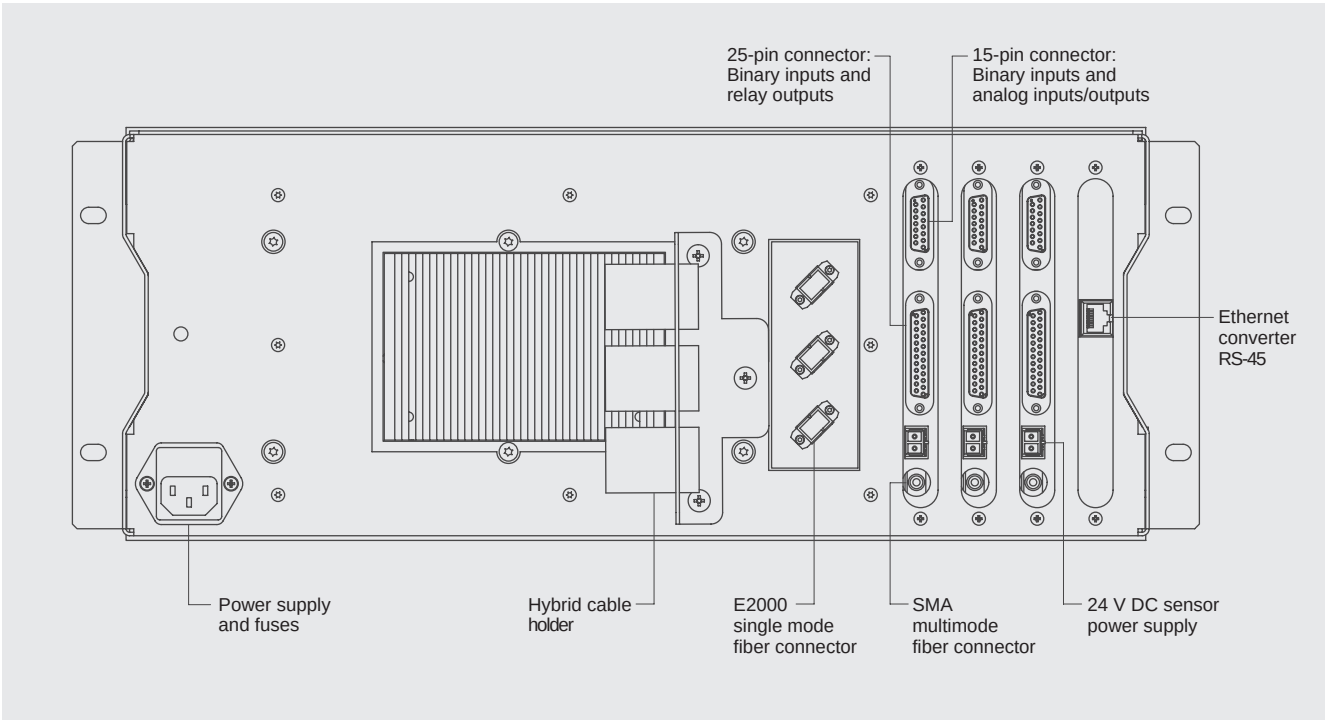
Pin assignment



LDS 6, 19“ central unit, pin assignment

19" central unit

Optical and electrical connections

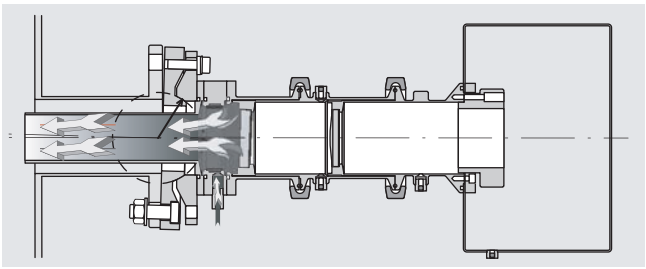


LDS 6, 19“ central unit, optical and electrical connections

Overview

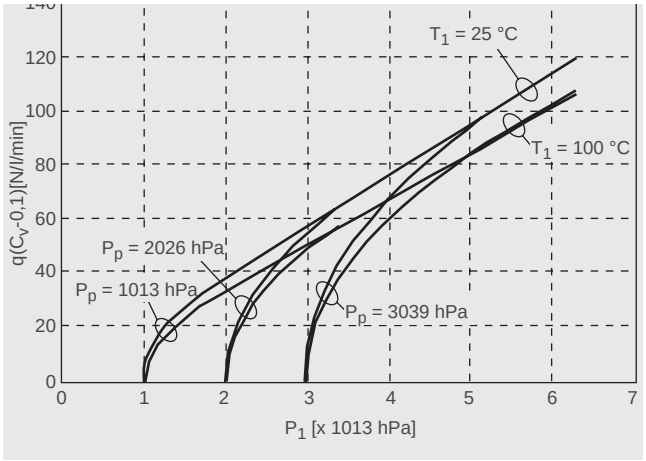
Sensors and cables for non-Ex applications

The standard sensor head consists of a transmitter and a receiver unit, which share the same mechanical dimensions. The transmitter unit provides a connector for the fiber optical cable. The receiver unit contains a photo detector and some basic electronic parts. The sensors are mounted onto flanges. Purging tubes that directly aim into the process stream are flushed with a purging media. The easiest possibility to avoid condensations on the optical surfaces and to keep them free of dust is the purging with instrument air or N_2, if inert purging is required. This standard purging method is suitable for low and medium dust loads in the process.



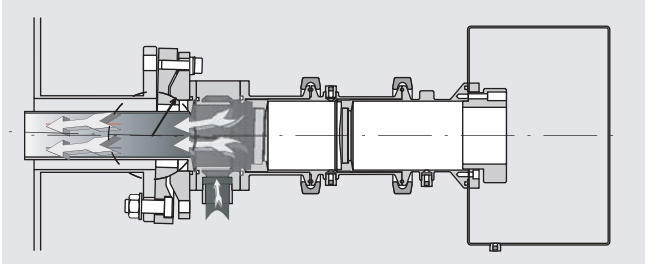
Purging of the mounting flange with instrument air

The following diagram can be used to derive the purging air flow as a function of the upstream pressure (P_1). There are two parameters in the diagram, i.e. the process pressure (P_p) and the temperature of the purge gas which is assumed to be air. The diagram shows the flow through a standard sensor head configured with a needle valve for non elevate purging flows.
In the case of elevated flows (without the needle valve) the resulting purge gas will be approx. 4 times higher.



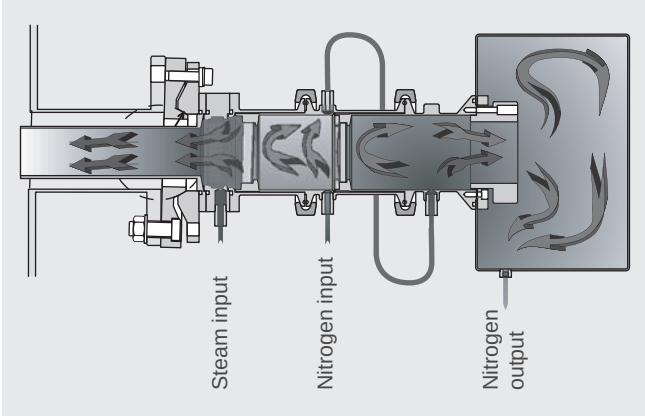
Purge air flow rate

For heavy dust loads in the process stream, the purging can be performed with forced air by an air blower. In this configuration, the sintered air inlet filter is replaced by a ring slit.



Mounting flange with forced-air purging

For the analyses of oxygen at low gas temperatures (< 600 °C) all ambient air has to be removed from of the measuring path. For this purpose, an inert gas like nitrogen or steam is used for purging on the process side in combination with a suitable inert gas purging of the sensor housing and wedge window module.



Purging example of an oxygen analyzer

The sensor can be removed easily from the flange for cleaning. Removing and re-mounting of the sensor does not require re-alignment.

The sensors are also available in an intrinsically safe EEx-version (EEx ia).

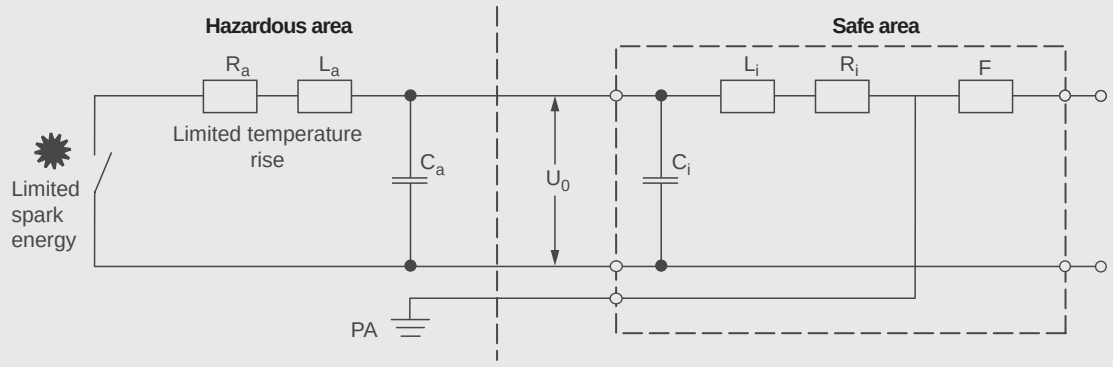
Sensors and cables

Sensors and cables for Ex applications

Intrinsic safety and intrinsically-safe circuit

Principles

The physical principle for the type of protection "Intrinsic safety" is that a certain minimum ignition energy is required to ignite an explosive atmosphere. In an intrinsically safe circuit, this minimum ignition energy is not present in the hazardous area, neither during normal operation nor in the event of a fault. The intrinsic safety of a circuit is achieved by limiting the current, voltage, power and temperature. Therefore the type of protection "Intrinsic safety" is limited to circuits with relatively small powers. To prevent sparks during closing or opening, the capacitance and inductance of an intrinsically-safe circuit are also limited depending on the maximum current and voltage values. No sparks or thermal effects which could lead to ignition of an explosive atmosphere occur either in normal operation or in the event of a fault. Therefore intrinsically-safe circuits may also be connected or disconnected during operation when live since the safety is also guaranteed in the event of a short-circuit or interruption. The following figure shows the block diagram of the type of protection "Intrinsic safety".



U_0	Max. output voltage	PA	Equipotential bonding
R_i	Internal resistance	R_a	External resistance
L_i	Internal inductance	L_a	External inductance
C_i	Internal capacitance	C_a	External capacitance
F	Fuse		

Block diagram for voltage/current limiting with type of protection "Intrinsic safety"

Intrinsically-safe electrical equipment and intrinsically-safe components of associated equipment are divided into categories ("Protection level"). A differentiation is made between the protection levels "ia" and "ib", where protection level "ib" also provides protection should one protective measure fail (fault redundancy 1) and protective level "ia" also provides protection should two protective measures fail (fault redundancy 2). The standard refers to so-called "countable faults" instead of protective measures. These refer to protective measures such as current limiting resistors, Zener diodes for voltage limiting, fuses, safe distances etc., i.e. all components or measures which handle an exactly defined safety function for the associated equipment.

Protection level	Description according to EN 50020	Installation
ia	The intrinsically-safe electrical equipment must not cause an ignition • During normal operation or with the existence of those non-countable faults which result in the most unfavorable condition. • During normal operation or with the existence of a countable fault plus those non-countable faults which result in the most unfavorable condition. • During normal operation or with the existence of two countable faults plus those non-countable faults which result in the most unfavorable condition.	Up to zone 0
ib	The intrinsically-safe electrical equipment must not cause an ignition • During normal operation or with the existence of those non-countable faults which result in the most unfavorable condition. • During normal operation or with the existence of a countable fault plus those non-countable faults which result in the most unfavorable condition.	Zone 2 Zone 1

Protection levels of electrical equipment and intrinsically-safe components

Minimum ignition curves

The so-called minimum ignition curves are used to assess an intrinsically-safe circuit and to determine the maximum capacitance and inductance values. They are included in the valid intrinsically-safe standards (EN 50020 or DIN EN 50020, and IEC 60079-11 or EN 60079-11). Minimum ignition curves exist for the resistive, capacitive and inductive circuits. Different minimum ignition curves are applied depending on the gas group for which an intrinsically-safe circuit is to be designed and take into account the minimum ignition energies of the gas groups.

Associated electrical equipment

Associated electrical equipment is a reference to equipment which contains one or more intrinsically-safe circuits but in which not all circuits are intrinsically-safe Associated electrical equipment usually has an isolating function, i.e. separating intrinsically-safe equipment from non-intrinsically-safe equipment within a signal circuit. Such devices include e.g.: safety barriers, isolating switching amplifiers, power supply units etc.

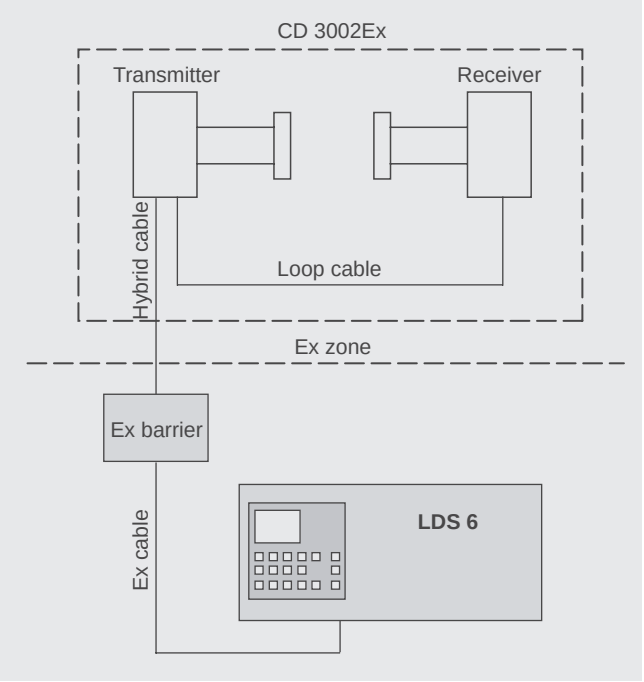
Associated electrical equipment is not explosion-proof and must therefore not be installed in the hazardous area. It only contains intrinsically-safe circuits which may be routed into the hazardous area. Associated electrical equipment is identified by a square bracket enclosing the "EEx" and the symbol for the type of protection, as well as absence of the temperature class, e.g. [EEx ia] IIC.

Cables

DIN / EN 60 079-14 (VDE 165, Part 1) must be observed when selecting and routing the cables. Particular attention must be paid to the characteristic values such as electric strength and minimum cross-section. In the case of intrinsically-safe circuits, the cable capacitance and inductance must be observed in addition, and must not exceed the values specified for the intrinsically-safe or associated equipment used (Co, Lo). The connection points and cables of intrinsically-safe circuits must be identified, e.g. in light blue, and be separated from the other connection points and cables of non-intrinsically-safe circuits.

Typical LDS 6 system set-up in explosion endangered zones

LDS 6 is capable to measure gases in EEx environment, provided that special care is taken about safety concerns. The central unit of LDS 6 always has to be located out of hazardous areas. Special EEx -type sensors (s. explosion protection tag), certified according to Ex II 1GD EEx ia IIC T4, allow the operation inside almost any EEx classified area. In between the connection of sensors and central unit an EEx barrier has to be applied. A typical sensor setup is given in the following figure.



Typical setup of LDS 6 in an explosion endangered area

Sensors and cables

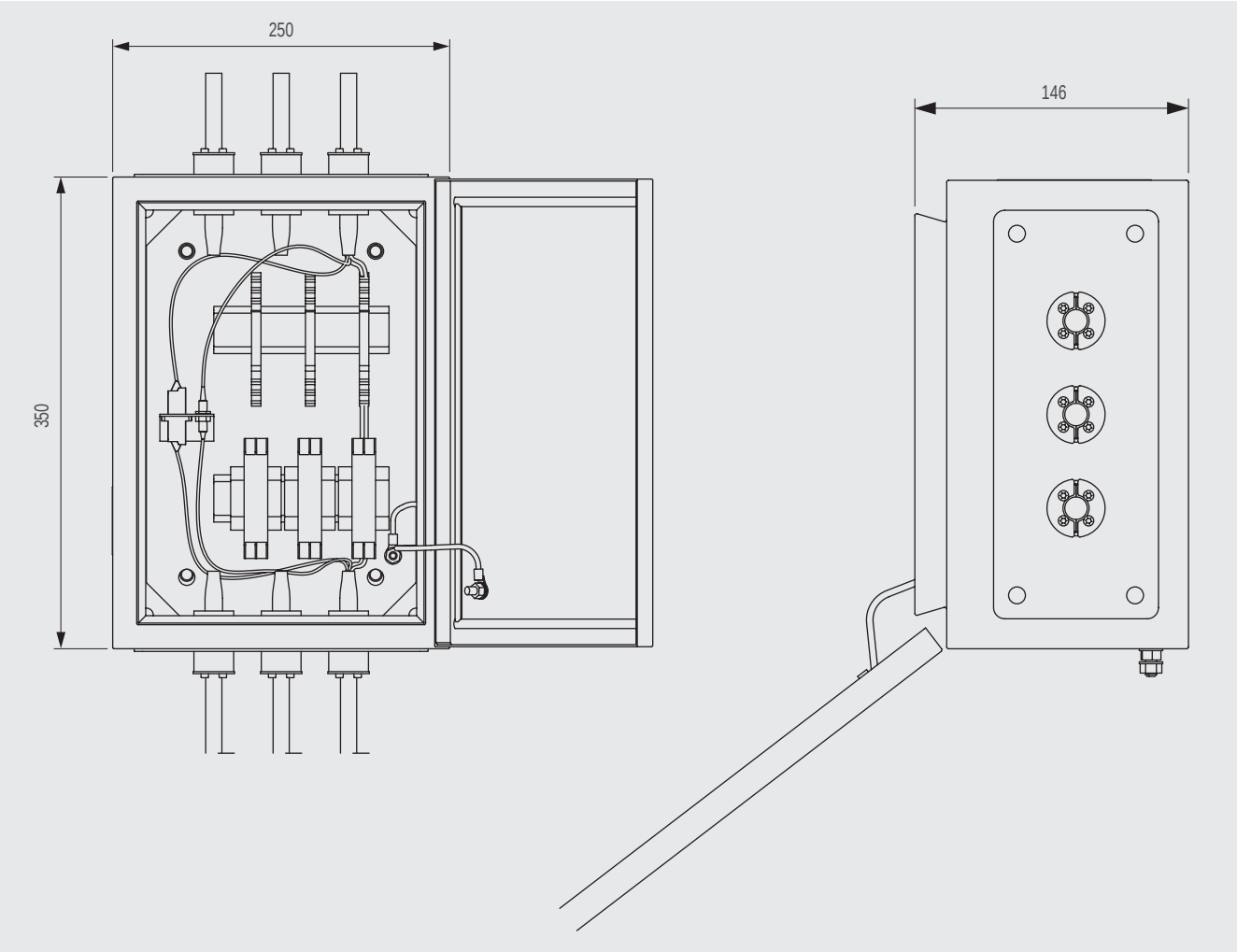
EEx barrier

The EEx barrier is part of the delivery of the EEx sensor CD 3002 Ex. It is meant for wall mounting close to the location of the LDS 6 central unit within an EEx safe environment. The EEx barrier defines the interface between the analyzer central unit and the intrinsically safe sensor heads and ensures under any circumstances that the total electrical energy transferred via the hybrid cable to the sensors is always less than needed to ignite combustible gas mixtures.

Technical specifications

Hazardous area output	
• Minimum output voltage	12.85 V at 45 mA
• Maximum output voltage	24 V from 170 Ω
• Current limit	45 mA
Max. current consumption (45 mA output)	90 mA at 24 V, 110 mA at 20 ... 35 V DC
Safety description	25 V, 170 Ω, 147 mA, U_m = 250 V_{rms} or DC

Dimensional drawings



LDS 6, sensors CD 3002 Ex, EEx barrier, dimensions in mm

Technical specifications

Sensors

General	
Setup	Transmitter and receiver unit, connected by a loop-cable
Interior material	stainless steel
Installation	horizontally to the optical axis, perpendicular or parallel to the gas flow
Laser protection class	Class 1, safe to the eye
Options	Inline-calibration path, air blower purging, steam purging
Ex-protection	optionally, according to ATEX II 1GD EEx ia IIC T4
Configuration, housing	
Protection classes	
• Sensors	
- non EEx sensor CD 6	IP67
- EEx sensor CD 3002	IP65
Dimensions	
• non EEx sensor CD 6	Diameter 163, D: 395 mm
• EEx sensor CD 3002	195x195x450 mm
• Purging tube	400 (370 net) x 44 x 40 mm 800 (770 net) x 44 x 40 mm 1200 (1170 net) x 44 x 40 mm
Weight	2 x ca 11 kg
Mounting	DN 65/PN 6 or ANSI 4"/150 lb
Electrical properties	
Power supply	24 V DC, supply from central unit via hybrid cable
Power consumption	approx 2 W during operation
Ambient environment	
Ambient temperature	
• Non EEx sensor CD 6	-30 ... +70 °C during operation, -40 ... +70 °C during storage and transportation
• EEx sensor CD 3002	-30 ... +60 °C during operation, -40 ... +70 °C during storage and transportation
Humidity	< 95% relative humidity, above dew point
Pressure	700 ... 1200 hPa
Measurement conditions	
Measurement path	1 m ... 12 m, longer or shorter paths lengths need to be confirmed by Siemens
Gas temperatures	-5 ... +1300 °C, application-dependent
Gas pressure	Ambient pressure +/- 50 hPa, higher or lower pressures need to be confirmed by Siemens
Dust load	up to 100 g/Nm^3, depending on particle size and measurement path length

Options	
Purging with instrument air	
• Pressure	2000 ... 8000 hPa
• Quality	instrument air, free of oil and water
• Maximum flow rate	500 l/min
• Dew point	benchmark: < -10 °C, application-dependent, condensation of the optics has to be avoided
Air blower fan (230 V: A5E00253147, 115 V: A5E00253148)	
• Maximum counter pressure	40 hPa
• Maximum flow rate	850 l/min
• Power consumption	370 W
Protection class (ventilator)	IP54
Steam purging	
• Steam conditioning	Overheated
• Maximum temperature	240 °C
• Minimum pressure	> 4000 hPa
• Maximum pressure	16000 hPa, refers to a volume flow of approx. 1100 l/min

Hybrid and loop cable

General	
Configuration hybrid cable	Two optical fibers and two twisted copper wires for 24 V DC in one cable. Mono mode light wave guide configured on both sides with angle polished E2000 connectors, multimode light wave guides configured on both sides with SMA connectors.
Coating	Oil-resistant polyurethane
Dimension	Diameter < 8 mm, length: up to 1000 m
Impact resistance	200 N/cm
Maximum tensile strength	500 N
Minimum bend radius	10 cm
Ambient conditions	
Ambient temperature	-40 ... +80 °C during operation
Humidity	< 95% relative humidity, above dew point

1) Please observe partial release for sale.

Sensors and cables

Ordering data

Order No. **7MB6022-** ■■■■■-■■■■

In-situ LDS 6 gas analyzer
Sensor pair (cross duct)

Ex protection	Sensor type	
Without	CD 6	0
According to ATEX II 1 GD	CD 3002	1
According to ATEX II 3 GD	CD 3002	2
Sensor type	Component	
Standard cross duct	O_2 [1]	A
	O_2/temp [1]	B
	NH_3	C
	NH_3/H_2O	D
	HCl	E
	HCl/H_2O	F
	HF [1]	G
	HF/H_2O [1]	H
	CO [1]	J
Purging mode, process side	Sensor side	
No purging	No purging	A
	Air or N_2, 1 ... 2 l/min	B
Instrument air or N_2 moderate flow: 300 ... 120 l/min	No purging	C
	Air or N_2, 1 ... 2 l/min	D
Air, N_2 or steam elevated flow: 300 ... 500 l/min	No purging	E
	Air or N_2, 1 ... 2 l/min	F
Air, blower fan or steam high flow: > 500 l/min	No purging	G
	Air or N_2, 1 ... 2 l/min	H
Purging tubes, material		
No purging tubes		0
Stainless steel		1
Hastelloy		2
Plastic (PP)		3
Ceramics		4
Purging tubes, length		
No purging tubes		0
400 mm (370 mm net)		1
800 mm (770 mm net)		2
1200 mm (1170 mm net)		3
Engine lab version		4
Flange type		
DN 65/PN 6		0
ANSI 4“ /150 lbs		1
Engine lab version		2
Hybrid cable	Length [m]	
Standard length	5	A
	10	B
	15	C
	20	D
	25	E
	30	F
	40	G
	50	H
	75	J
	100	K
	150	L
	200	M
Customized length		Z
No loop cable		X

1) To be released soon.

Ordering data

Order No.

In-situ LDS 6 gas analyzer
Sensor pair (cross duct)

7MB6022 - ■■■■■ - ■■■

Loop cable	Length [m]	
Standard length	5	A
	10	B
	15	C
	20	D
	25	E
	30	F
	40	G
	50	H
Customized length		Z
No loop cable		X

Language (supplied documentation)	
German	0
English	1
French	2
Spanish	3
Italian	4

Further versions

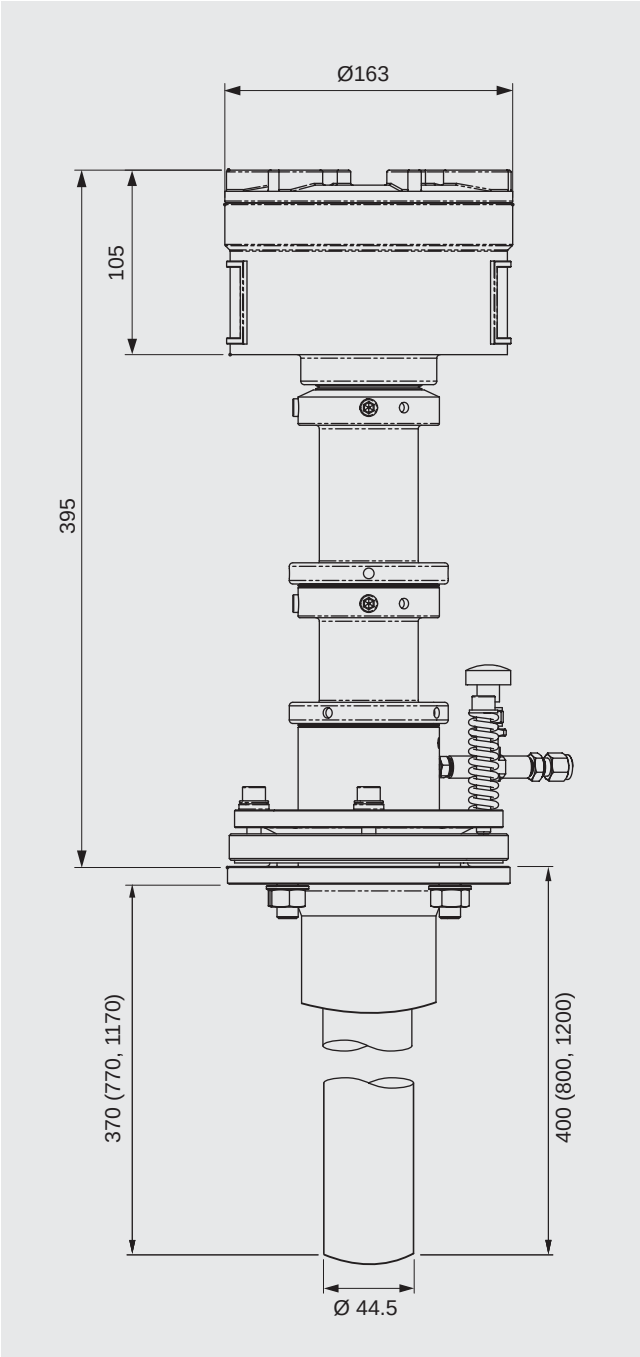
Order code

Please add „-**Z**“ to Order No. and specify Order code

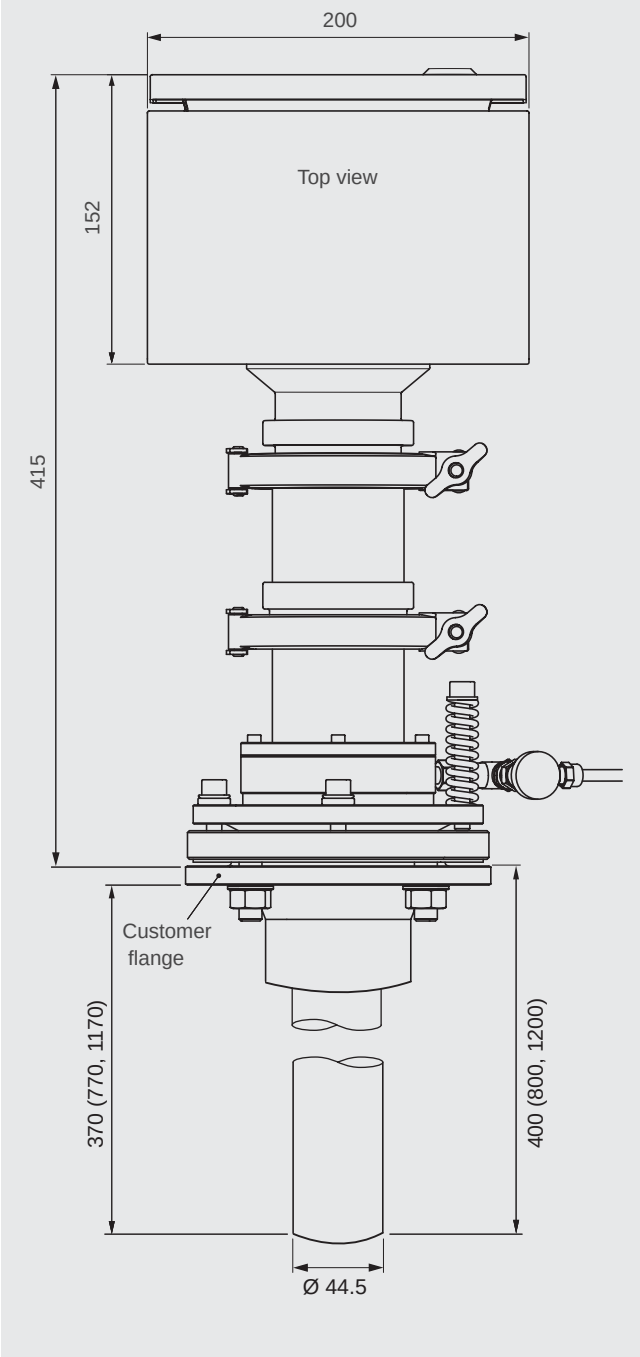
High pressure window flanges	
• Borosilicate glass, SS (1 pair)	**F01**
• Borosilicate glass, Hastelloy (1 pair)	**F02**
• Quartz glass, SS (1 pair)	**F03**
• Quartz glass, Hastelloy (1 pair)	**F04**
Hook spanner	**F10**
Alignment kit (additional)	**F11**
Process flanges, 1 pair (only for application code CG, DG)	**F20**
Air blower fan 230 V (only for purging mode G, H)	**L01**
Air blower fan 115 V (only for purging mode G, H)	**L02**
Needle valve, purging flows < 120 l/min, 1 pair	**L10**
External flow cell, SS, PTFE coated, 1 m path length, 1.2 l inner volume	**L20**
External heated flow cell, max. 200 °C, 1 m path length, 1.2 l inner volume	**L21**
External heated flow cell, max. 200 °C, 1 m path length, 1.2 l inner volume, mounted on rack with wheels	**L22**
Calibration verification kit (not available for gas code H. F)	**L23**
Weather shield, 1 pair	**L30**
Optical filter to reduce IR background	**L40**
Hybrid cable, customized length	**P1Y**
Loop cable, customized length	**Q1Y**
TAG labels (customized inscriptions)	**Y31**

Sensors and cables

Dimensional drawings



Non EEx sensor CD 6, dimensions in mm



EEx sensor CD 3002, dimensions in mm

Documentation

Manual	Order No.
Betriebsanleitung LDS 6 (German)	**A5E00295893**
LDS 6 Operating instructions (English)	**A5E00295894**
Instructions LDS 6 (French)	**A5E00295895**
Istruzioni operative LDS 6 (Italian)	**A5E00295896**
LDS 6 instrucciones de operación (spanish)	**A5E00362720**
Wartungsanleitung LDS 6 (German)	**A5E00295897**
LDS 6 Service instructions (English)	**A5E00295898**

Proposition of spare parts for a 2-year and a 5-year service

LDS 6 does not contain expandable parts, but some parts of the sensors might be stressed in the sensors. For this reason it is recommended for demanding applications to keep window modules and detector electronics on stock (piece counts given per measuring point, i.e. per sensor pair).

Description	Qty for 2 years	Qty for 5 years	Order No.
Non EEx sensors			
• Window module (quartz), for CD 6	1	2	**A5E00338490**
• Window module (engine), for CD 6	1	2	**A5E00338490**
• Sensor electronics (only O_2), for CD 6	1	1	**A5E00338533**
• Sensor electronics (most gases), for CD 6	1	1	**A5E00338540**
• Sensor electronics (most gases, high gain), for CD 6	1	1	**A5E00338541**
• Sensor electronics (only HCl), for CD 6	1	1	**A5E00338552**
EEx sensors			
• Window module (quartz), for CD 3002 (EEx)	1	2	**A5E00338594**
• Sensor electronics (only O_2), for CD 3002 (EEx)	1	1	**A5E00338563**
• Sensor electronics (most gases), for CD 3002 (EEx)	1	1	**A5E00338572**

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Export regulations

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