LDS 3000
Product Information

Your eye in hell

Siemens Laser Analytics

Product information
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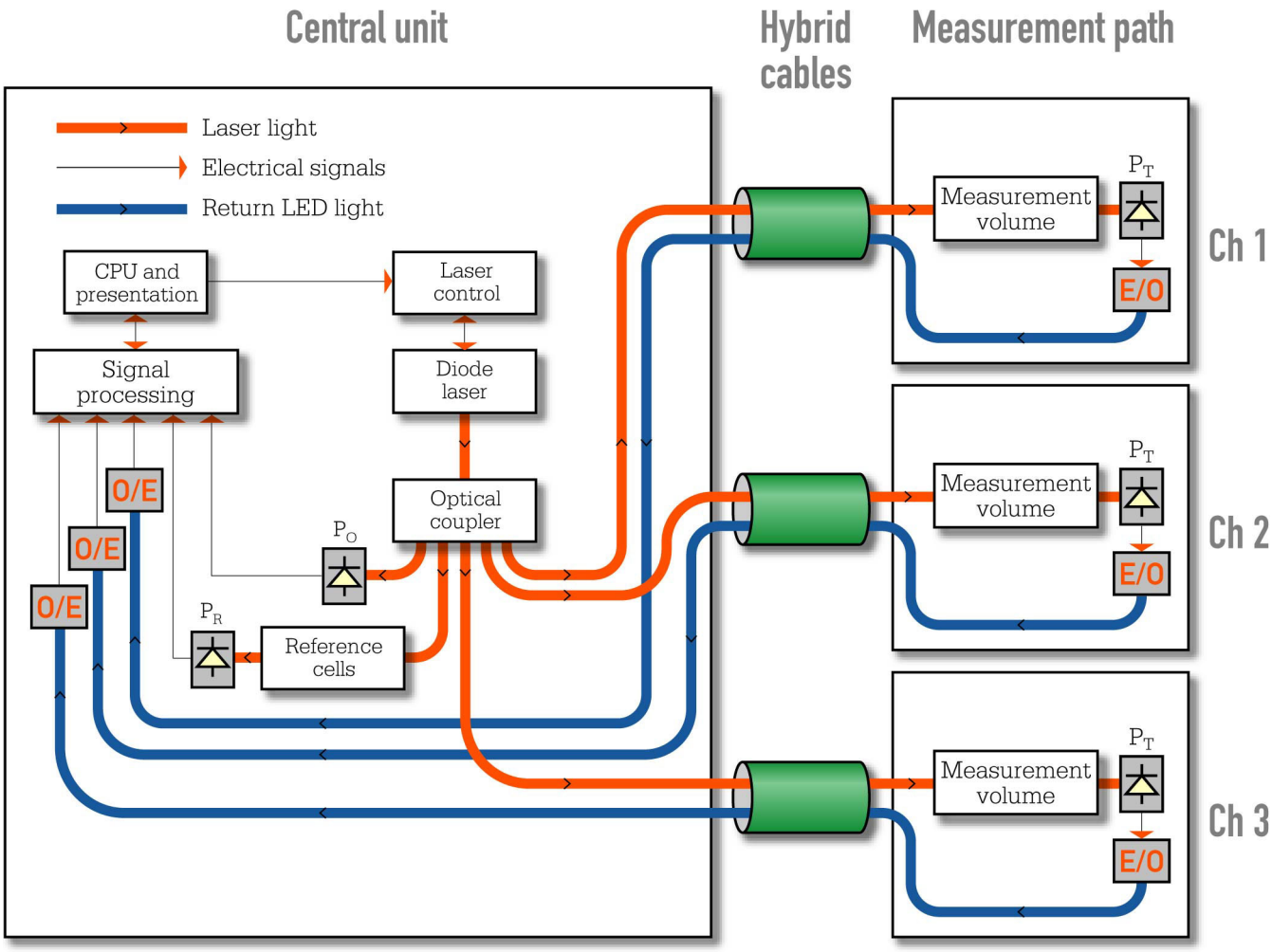
Product Information

LDS 3000 is a laser based gas sensor using absorption spectroscopy. The system can measure one gas (in some applications two gases) in three gas volumes simultaneously. These measurement points can be several hundred meters apart and is connected to the central unit using fibre optics. The sensors are designed to operate in very harsh environments and contain a minimum of electronics. LDS 3000 can also be configured to measure gas temperature. The block diagram below shows the main part in the system fully equipped (three channels).



Block diagram of LDS 3000 configured for three simultaneous measuring pints

Below follows the general specifications for LDS 3000 including central unit CU 3000, standard sensor CD 3002, with options and hybrid cable FC 3000.

1 Measurements

Response time. From 0,1 s. The response time of the system depends on the conditions in the measurement volume. If there is a heavy dust load there is a need for low pass filtering because of the in-

duced transmission variations. Normally, this will increase the system response time to 1-10 seconds. Thus, there is a trade off between resolution and response time.

Linearity Better than 1%.

Accuracy Better than 2% of reading. The accuracy depends on the quality of the calibration gas used and its uncertainty must be added.

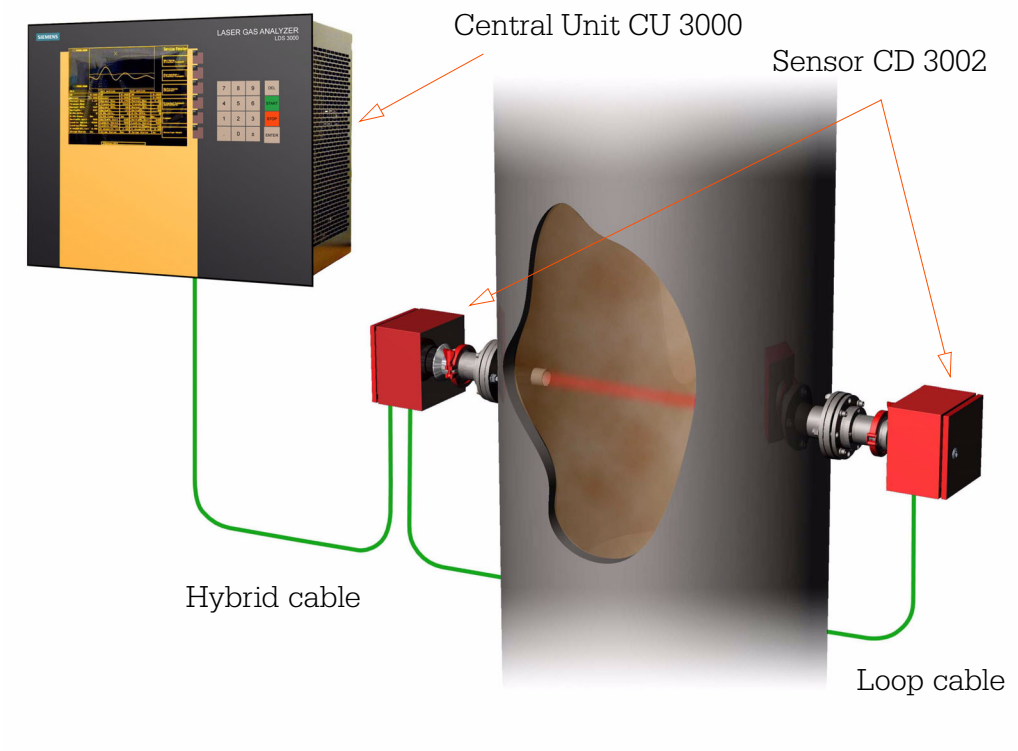
Resolution Depends on a number of parameters. LDS 3000 measures the strength of the absorption line and it depends on the number of molecules (which we want to measure) as well as pressure, temperature, line broadening due to presence of other gases. The table below lists the performance at a given application for a set of gases available. This performance will always be reduced compared to what is observed in a clean laboratory environment due to the factors mentioned above.

	Temp. [°C]	Dust load [mg/Nm^3]	Path length [m]	Range	Resolution	Response time [sec]
Combustion control						
O_2	700-1100	<10 000	4-12	0-10%	0.2%	1-2
H_2O	700-1100	<10 000	4-12	0-30%	0.2%	1-2
CO_2	700-1100	<10 000	4-12	0-20%	0.2%	1-2
HCl	700-1100	<10 000	4-12	0-1%	1 ppm	1-2
temperature	700-1100	<10 000	4-12	700-1100°C	20°C	1-2
DeNO$_x$						
NH_3 - SNCR	250-450	<10 000	3-12	0-50 ppm	0.5 ppm	1
NH_3 - SCR	250-450	<25 000	2-12	0-10 ppm	0.3 ppm	30
NH_3 - heavy vehicle	100-650	<2 000	1	0-100 ppm	1 ppm	1
Filter optimization						
HCl	120-170	<10 000	2-6	0-3000 ppm	0.5 ppm	1-3
HF	120-170	<10 000	2-6	0-1000 ppm	0.2 ppm	1-3
ESP						
CO	600	<80 000	1-5	0-10%	0.5%	<1
Emission						
NH_3	60-120	<20	1-3	0-50 ppm	0.5 ppm	<10
HCl	60-120	<20	1-3	0-10 ppm	0.3 ppm	<10
HF	60-120	<20	1-3	0-5 ppm	0.1 ppm	<10

Stability The stability is measured over 24 hours while the central unit is exposed to temperatures between 10°C and 30°C. The maximum instability is guaranteed to be less than 3 times the resolution.

Cross sensitivity Depending on temperature but always less than the resolution in each defined application.

System components	Central unit CU 3000, sensor CD 3002 and hybrid cable. The sensor pair is connected with a loop cable containing a multimode fibre and a twisted pair.



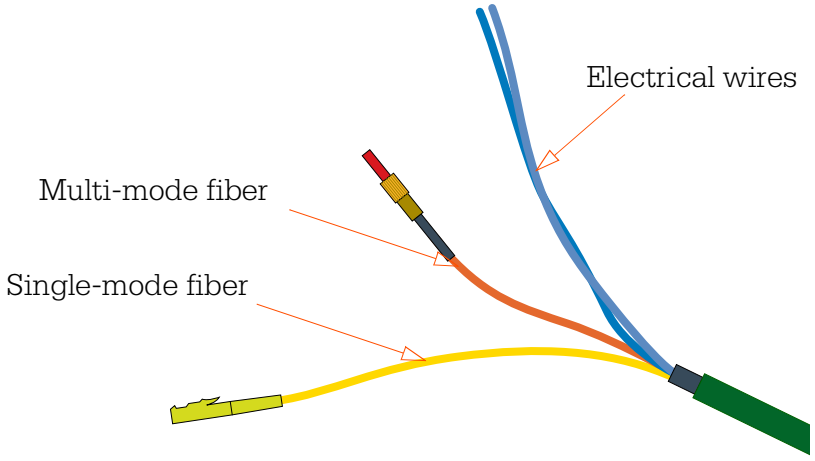
LDS 3000 setup

2 Central unit CU 3000

Dimensions.	H: 399 mm x W: 483 mm (19") x D: 390 mm.
Weight	30 kg (66 lb.)
Power consumption	150 W
Measurement principle	Single line absorption spectroscopy. Further information will be found in "Measurement principle in LDS 3000".
Light source	Semiconductor laser class 1. Maximum power into measurement volume is 0,5 mW.
Ambient temperature	+10 °C to +30 °C (+50 °F to +86 °F)
Dust and humidity	CU 3000 is constructed for an environment free from dust and a non condensing relative humidity of 0-80%.
Display	Graphic display for presentation of gas concentration, error messages and status signals.
Control	Menu driven key pad and numeric key pad.
Analog output	Isolated active 4-20 mA with gas concentration. Range can be set by user. Other parame-

	ters can optionally be accessible via 4-20 mA.
Analog inputs	Environmental parameters like gas temperature an gas pressure can be read by LDS 3000 through 4-20 mA inputs.
Alarm	4 relay outputs. Standard configuration is instrument alarm, transmission alarm and gas concentration level alarm.
Media	All necessary software and files are stored on a PC-card
Communication	CU 3000 is equipped with a RS232 serial port and communication can be done either directly to the port or using a modem. The communication software LDSCom must be used. Complete remote operation of LDS 3000 is then possible.
Power supply	85 - 264 VAC, 50/60 Hz, 200 VA.
CE	Certified
EMC	CU 3000 meets all regulations specified in the present EU regulations (LVD regulation 73/23/EEC and EMC regulation 89/366/EEC) as well as the regulations on the American and Canadian markets (UL- and CSA regulations).

3 Hybrid Cable FC 3000



Hybrid cable FC 3000

Type	Two optical fibres and two electrical wires for 24 VDC in one cable. (The loop cable interconnecting the sensor pair does not contain the single mode fibre)
Connector single mode fibre	E2000 angle polished

Connector multimode fibre	SMA
Jacket material	Green, oil resistant polyurethane
Dimension	Diameter: <12 mm, Length: up to 1000 m.
Operating temperature	-25 °C to +80 °C (-13 °F to +176 °F)
Impact resistance	200 N/cm
Max tensile strength	500 N
Minimum bend radius	10 cm

4 Sensor CD 3002

This is the standard sensor and it consists of a transmitter and a receiver intended to work Cross Duct. The two units are optically and mechanically identical. In the transmitter there are provisions for connection of a fibre optic connector and in the receiver there are a photo detector and some electronics.

The sensor is also available in an EX-version.

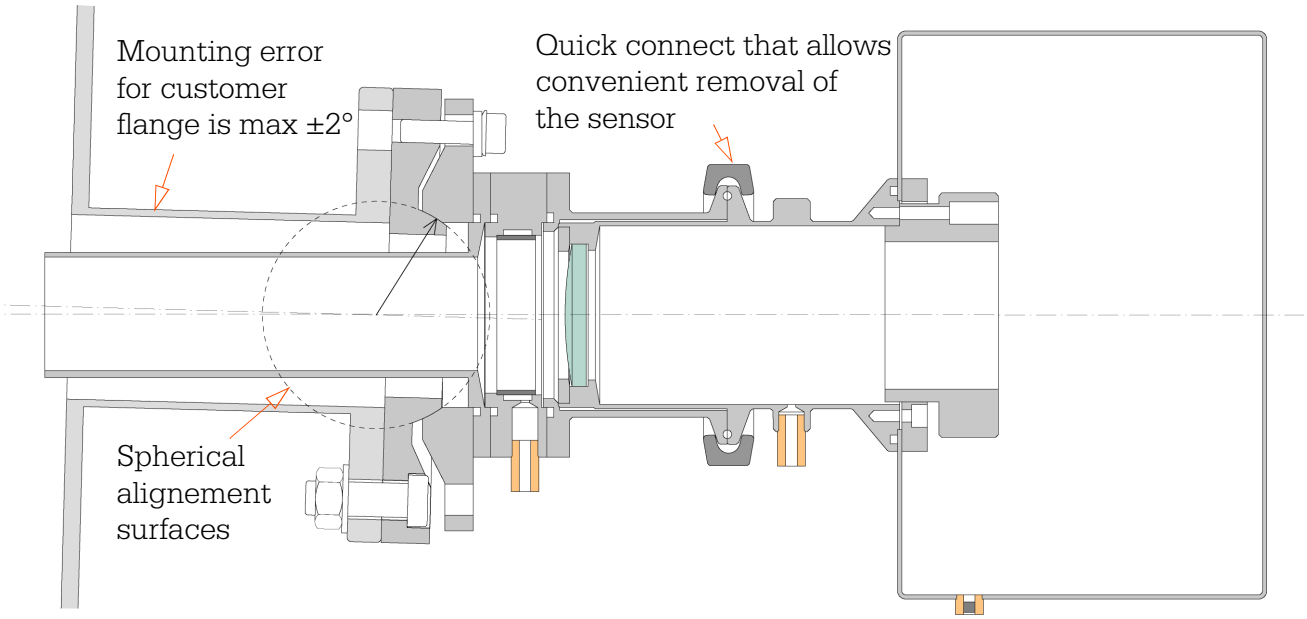
Normally the sensor optics needs to be protected from the measurement environment. There is a number of ways to accomplish this. The standard approach is to use pressurized instrument air at a flow of up to approximately 120 ltr/min. The sensor can be equipped with a number of options such as heater for the instrument air, in line calibration path, fan purging, steam purging, etc. If the sensor needs maintenance it is easily removed from its flange by means of a quick connect. The removal and relocation of the sensor does not require realignment. Thus the sensor optics can very easily be cleaned if needed.

4.1 General

Dimension of housing	H: 200 x W: 200 x D: 150.
Dimension of flange	DN65/PN6 (DIN), 4"/150 lbf. (ANSI)
Material in housing	Painted stainless steel
Material in sensor	Stainless steel
Ambient temperature	“above dew point” to +50 °C (+112 °F)
Weight	10 kg (22 lb.)
Protection class	IP65
CE	Certified
EMC	CD 3002 meets all regulations specified in the present EU regulations (LVD regulation 73/23/EEC and EMC regulation 89/366/EEC) as well as the regulations on the american and canadian markets (UL- and CSA regulations)

4.2 Alignement

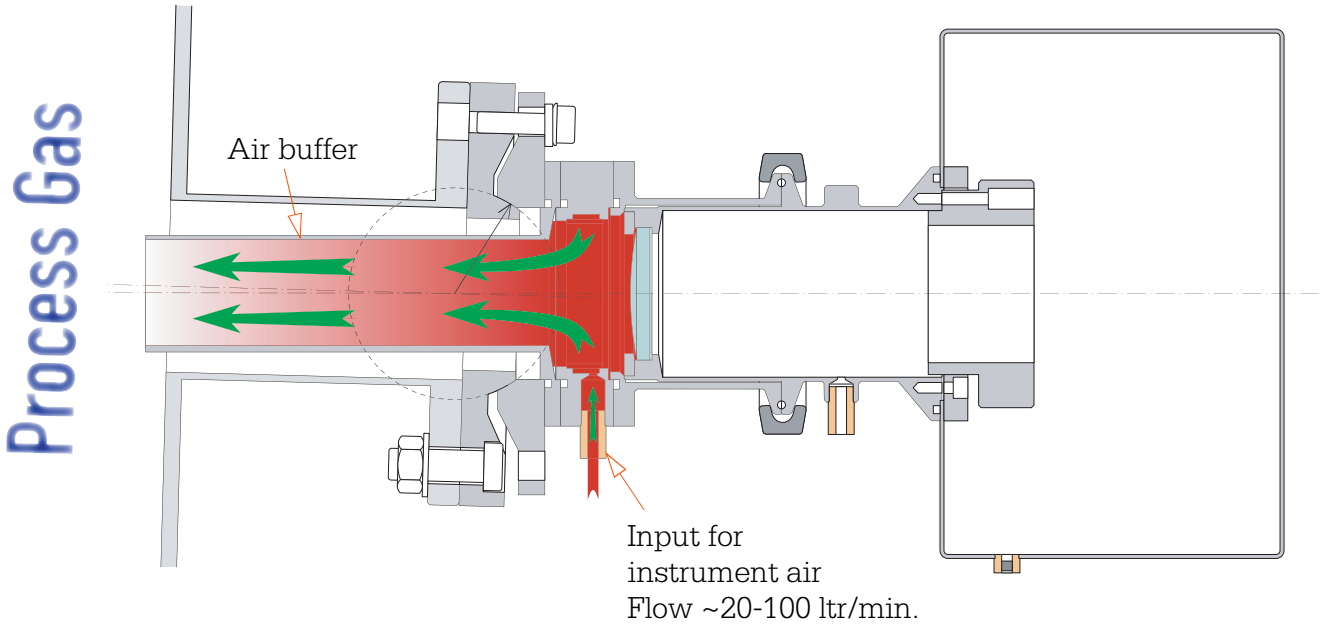
The customer flanges must be co aligned so that their axes of symmetry are within 2° of mismatch with their mutual axis of symmetry. The remaining error must be removed by means of an alignment step, which is described in the sensor manual. The figure below illustrates this.



Alignement of CD 3002

4.3 Purging with instrument air

Pressure	4-8 bars
Quality	Oil free
Dew point	Application dependent. Normally <-10°C is sufficient. Condensation on the optics must be prevented.



Flow of purging gas using instrument air

4.4 Heater for instrument air

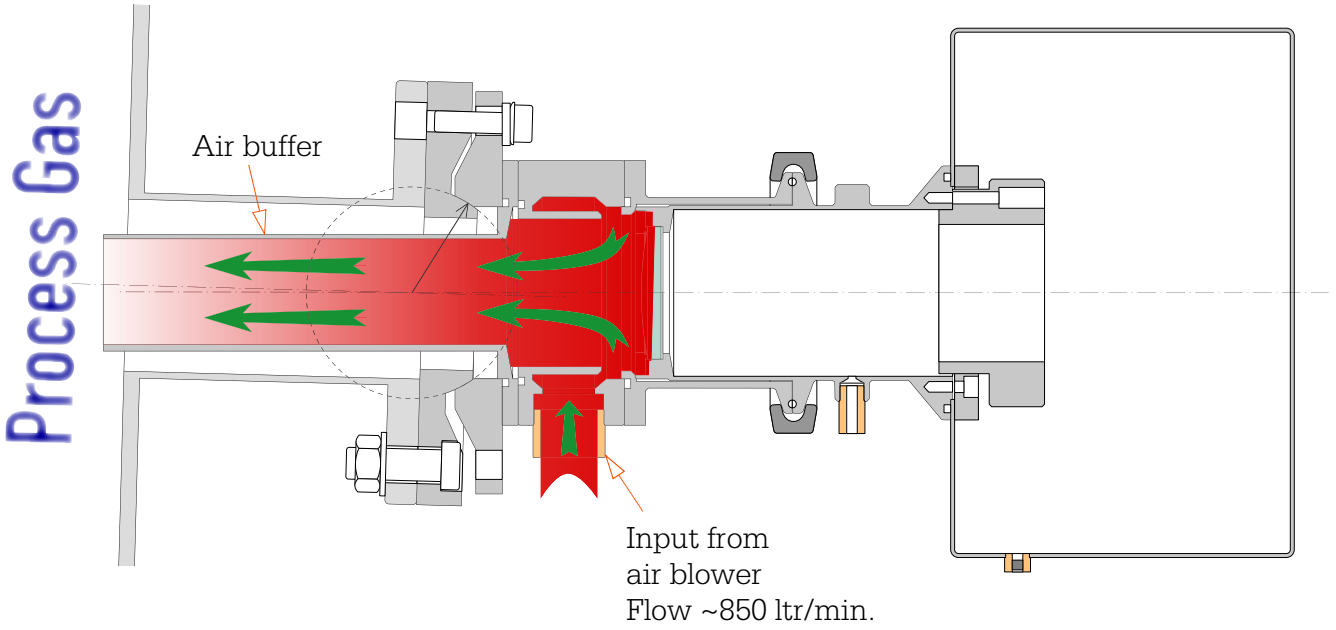
In some processes like in waste combustion condensation of different salts on the lenses will occur if they are cold. Heating of the instrument air is then necessary.

Max air temperature	250 °C
Max flow rate	500 ltr/min.
Connected power	2 kW
Size of housing for heater	H: 400 x W: 300 x D: 160

4.5 Purging with air blower

In applications with high dust load air blower purging must be considered. The air speed when using standard purging can be too low to prevent build-up of dust in the flange tubes. Our standard air blower solution will provide up to 850 ltr/min.

Power consumption of fan	250 W, 1 phase
Max counter pressure	40 mbar
Air flow at 20 mbar counter pressure	850 ltr/min.
Protection class of fan	IP54



Flow of purging gas using air blower

4.6 Steam purging

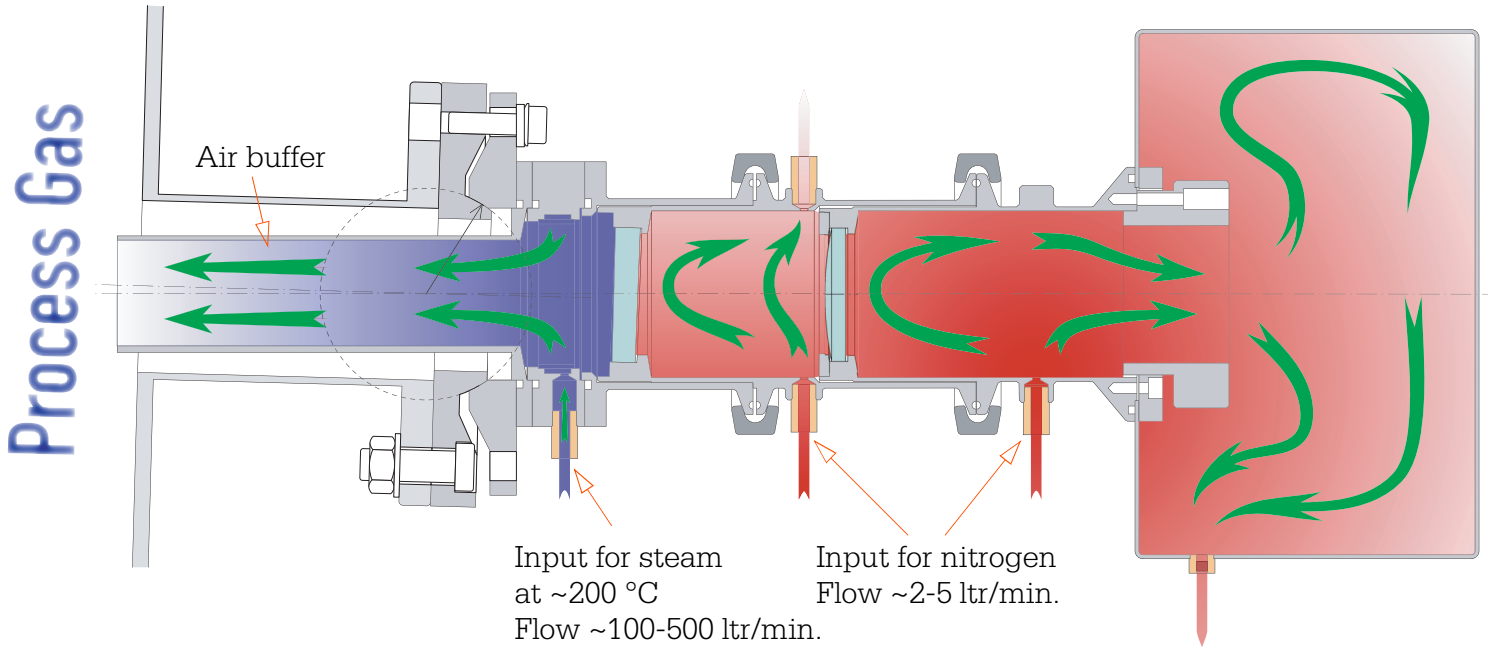
If overheated steam is available it is a candidate for purging of the lenses. It has some advantages like high temperature (to prevent salt condensation) and low maintenance. An additional advantage when oxygen is measured is that steam is free of oxygen and will not interfere with the measurements. In this case N2 purging of the sensor housing might also be necessary to obtain maximum performance. Instruction for installation of steam will be found in “Installation of steam purging system for CD 3002". Below are the maximum values at the input of the sensor - i.e. before the pressure drop in the steel filter.

Max steam temperature	240 °C (464 °F)
Steam pressure	The pressure should be at least 4 bars and overheated. Lower pressures can work but the risk

of dust build-up in the purging tube is increased because of the low flow. The maximum pressure on the steel filter in the sensor is 16 bar which will generate a steam flow of ~1100 Nltr/min.

4.7 Oxygen measurements

When oxygen is measured it is very important that other sources of oxygen is eliminated. The purging of the lens should be done using nitrogen or steam. The volume inside the sensor housing must also be flushed with nitrogen to remove the oxygen always present to 21% in regular air.



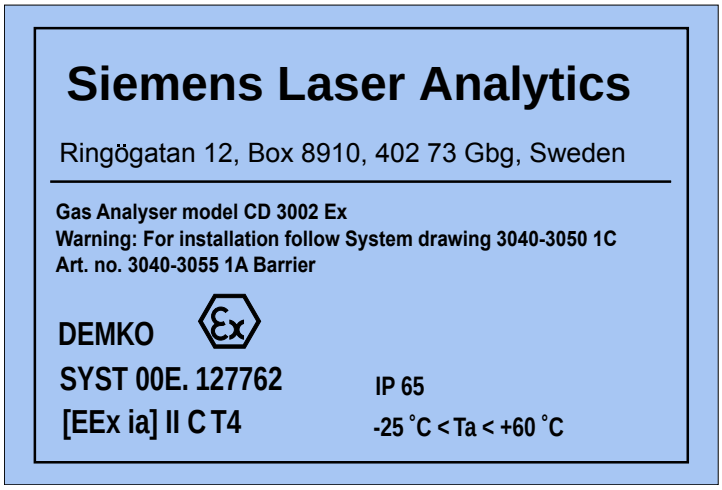
Flow of purging gas when oxygen is measured

5 Explosion protection

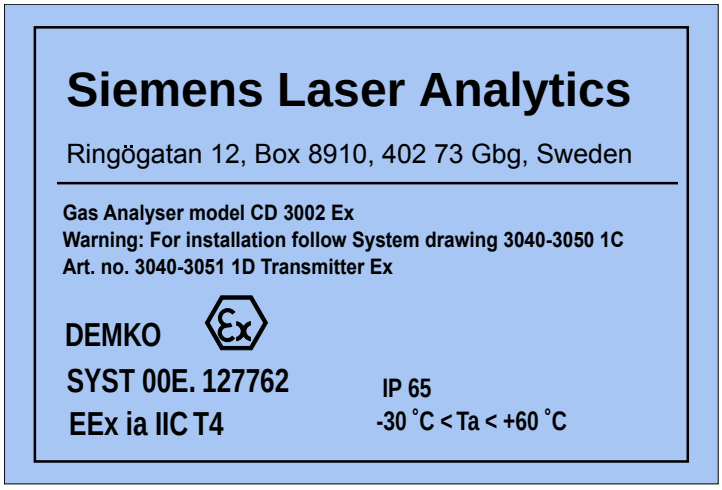
CD 3002 can be delivered with an explosion protection and this option is labelled CD 3002 Ex. The EEx certificate is a system certificate and is only valid if the installation is done according to the instruction stated in the certificate.

Area classification	Zone 0 - Flammable material present continously or for long periods
Type of protection	Ex ia - intrinsic safety
Explosion group	IIC - Acetylene and Hydrogen
Temperature class	T4 - <135°C

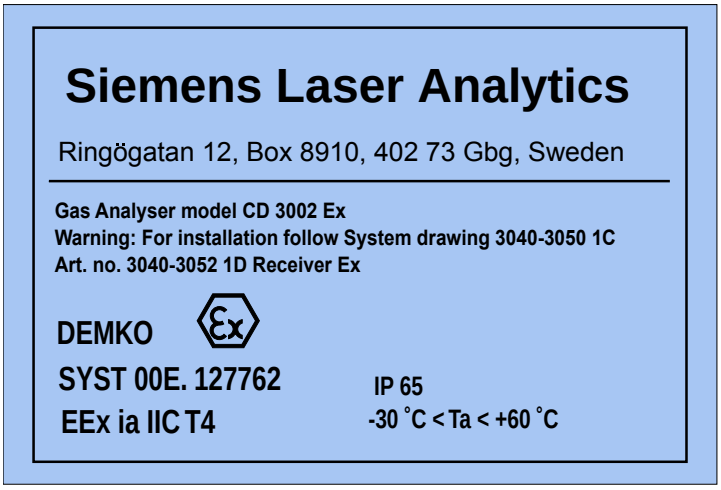
Labelling Barrier



Labelling Transmitter



Labelling receiver



6 Security

Laser power

All lasers used by LDS 3000 are of class 1. The emitted laser light is in most cases invisible (near infrared) and the intensity is low enough that the unprotected eye is not damaged. However, if you look directly into the beam with focusing optics (like a binocular) there is a risk for the eye. LDS 3000 has warning labels at appropriate positions according to SSI FS 1980:2 chapter 5.

High temperatures

Some metal parts and piping in the vicinity of the sensors are at elevated temperatures. The reason is high temperature purging - either from steam or from air. These parts are either isolated or equipped with protective metal sheets. There is also a label

Electrical	CD 3002 meets all regulations specified in the present EU regulations (LVD regulation 73/23/EEC and EMC regulation 89/366/EEC) as well as the regulations on the American and Canadian markets (UL- and CSA regulations)
High Pressure	The purging of the sensors will in the case of steam and instrument air be through a steel filter. This filter will in extreme cases be subject to a pressure drop of up to 40 bars. The high pressure volume in the sensor is less than 10 cm^3 which puts the sensor outside demands of certification in most countries. This should be verified with the local regulations. The sensor is tested at 50 bar.