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Focused Photonics Inc.

FPISB-LGA1401100 V2.0HZ

Focused Photonics Inc.

LGA series

PROCESS LASER GAS ANALYSIS SYSTEM

Focused Photonics Inc.

LGA series PROCESS LASER GAS ANALYSIS SYSTEM

Utilizing proprietary technologies of Tunable Diode Laser Absorption Spectroscopy (TDLAS), FPI delivers the LGA system to satisfy in-situ measurements with high accuracy, fast response, strong reliability and virtually maintenance free.

The LGA system is applicable to almost all industrial process, especially well proven in harsh conditions in combination of high temperature, pressure, dust, corrosives and contaminants.

Leveraging an installed base of over 8,000 units, the LGA system has been extensively used for combustion and safety control, process optimization, energy recovery, scientific research as well as environment monitoring. To date, these units have been employed in metallurgy, refinery, petrochemical, natural gas, power plant, waste incineration, cement and other situations where gas measurement is needed.

Gas	Detection Limit	Measurement Range
O_2	0.01%Vol	0-1%Vol , 0-100%Vol.
CO	0.6 ppm	(0-60)ppm, (0-100)%Vol.
CO_2	1.5 ppm	(0-150)ppm,(0-100)%Vol.
H_2O	0.3 ppm	(0-30)ppm, (0-100)%Vol.
H_2S	2 ppm	(0-200) ppm, (0-30)%Vol.
HF	0.02 ppm	(0-2)ppm, (0-10,000) ppmVol.
HCl	0.01 ppm	(0-7) ppm,(0-8000)ppmVol.
HCN	0.3 ppm	(0-30)ppm, (0-10,000)ppmVol.
NH_3	0.4 ppm	(0-40) ppm, (0-100)%Vol.
CH_4	10 ppm	(0-200)ppm, (0-100)%Vol.
C_2H_2	0.1 ppm	(0-10) ppm, (0-100)%Vol.
C_2H_4	0.6 ppm	(0-60)ppm, (0-100)%Vol.

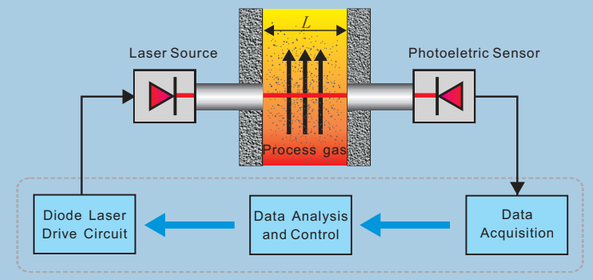
Notes: Listed are detection limits specified for 1m optical path at 20℃, 1 bar abs. Dual Gas CO+CO2, HCL+H2O are available for particular applications. Other gases and detailed measurement ranges may be available or customizable on request.

CONFIGURATION

The transmitter portion of the LGA system consists mainly of diode laser, laser driver and HMI modules, realizing diode laser driving, spectrum data processing and human-machine interface. The receiver unit of the analyzer is composed of a photoelectric sensor, signal processing and purge control modules, is capable of signal processing and anti-explosion control.

MEASURING PRINCIPLE

The laser beam from the transmitter unit passes across the stack or duct work and is absorbed by the measured gas. The attenuated light is then detected by the photoelectric sensor in the receiver unit, and the resulting signal is sent back to the transmitter unit and analyzed to yield gas concentration.



Measuring Principle Diagram

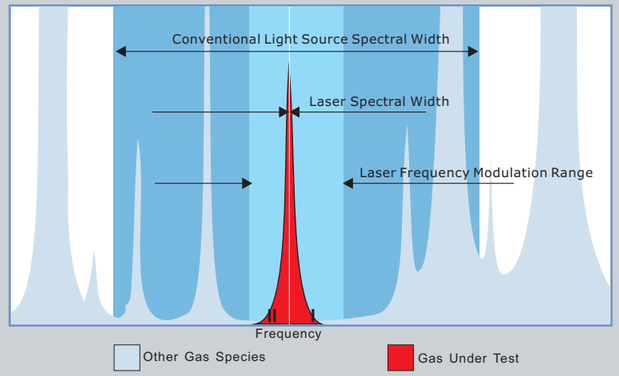
TECHNOLOGY COMPARISON

ITEM	LGA LASER SYSTEM	CONVENTIONAL ONLINE ANALYSIS
Adaptability	Applicable to high temperature, pressure, moisture, dust density and corrosion	Applicable to constant temperature, pressure and dust free
Measurement	In-situ, continuous/real-time measurement; sample gas evacuation free	With sample conditioning system, discontinuous measurement
Response Time	Fast, only limited by electronics response, less than 1sec	Slow, limited by gas sampling, transport, and instrument electronics response 20+sec
Accuracy	Average concentration along the optical path; no cross interference from other gas species, dust, and gas parameter fluctuations	Gas concentration at the tip of the sampling probe only, affected by gas influence and absorption, and leaked during gas sampling and transport; cross interference from other gas species, dust, and gas parameter fluctuations; gas information lost due to dissolution, absorption, and leakage
Reliability	No moving parts, highly reliable	Many moving parts, low reliability
Calibration& Maintenance	Calibration:<2times/year Maintenance:<2times/year	Calibration:2-3times/month Maintenance: frequent
Operation Costs	No spare parts, only cost of electricity	Lots of spare parts, around20% of the equipment cost per year

TECHNICAL PRINCIPLE

■ No Cross Interference

The laser spectrum features excellent monochromaticity with spectral width down to 0.001nm, which is much narrower than spectral width of other light sources. By utilizing the 'Single-line' spectroscopy, a well-targeted laser spectrum can be sorted out to cover only the measuring gas without overlapping spectrum of all background gases.

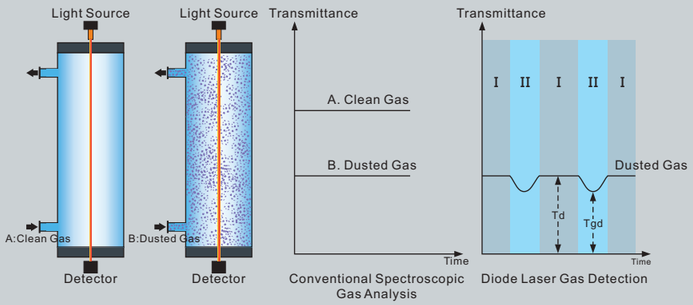


"Single-line spectrum" mearsurement

■ No Effects from Dust, Moisture and Window Contamination

TDLAS gas analyzers use a laser spectral scanning technique. The unit periodically scans the gas under test with a modulation frequency range larger than the gas absorption spectral line-width such that, within one scan period, there are two distinctive areas. Area I is uneffected by the gas absorption and gives Td, whereas Area II is effected and gives Tgd.

The transmittance of the gas under test is then calculated accurately by Tg=Tgd/Td. The interference from dust and optical window contamination is, therefore, automatically screened out.



■ Automatic Temperature & Pressure Compensation

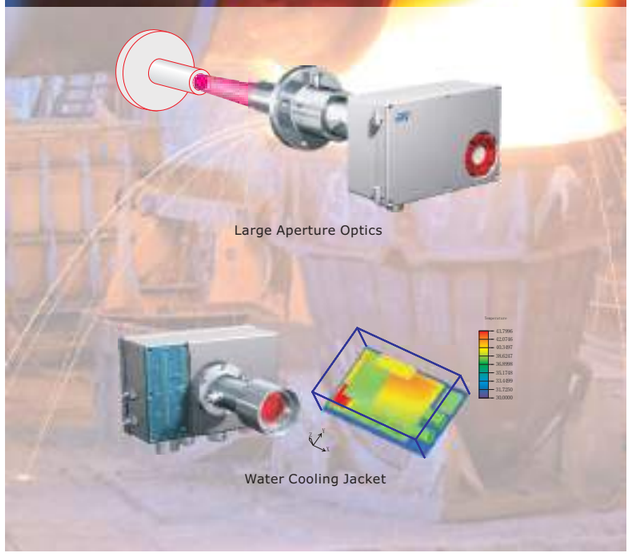
When gas temperature and pressure under measurement changes, the width and height of the absorption waveform change, which effects the accuracy of the measurement. By having 4-20mA process temperature and pressure input, the LGA system automatically compensates for them with a proprietary algorithm to ensure measurement accuracy.

LGA-4100 In-situ

Features and Benefits

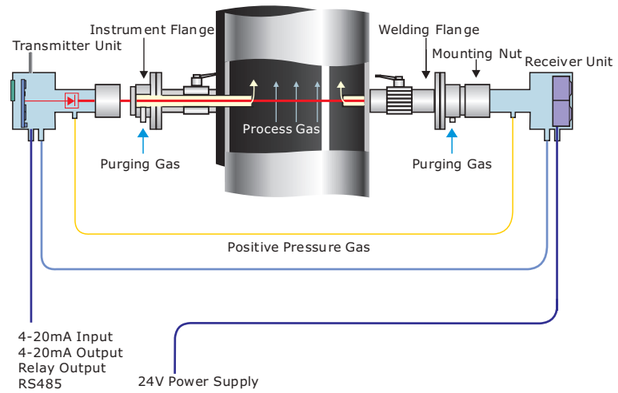
- In-situ, no gas sampling
- No cross interference
- Fast response less than one second
- Diverse optical length (0.5~20m)
- Reliable in all harsh conditions: high temperature & pressure, dust density, moisture and corrosion
- Online calibration, no zero drift
- Thousands of tailor-made solutions for various applications
- International ATEX certified

Large Aperture Optics



Water Cooling Jacket

LGA Composition



Technical Data

Specifications
Repeatability: ⩽ ± 1%F.S.
Linearity: ⩽ ± 1%F.S.
Span drift: ⩽ ± 1%F.S./6 months
Response time: ⩽ 1s(T90)
Warm-up time: ⩽ 15min
Optical path length: 0.5-20m
Process gas temperature: max. 1500°C
Process gas pressure: 0.8 to 4 bar abs.

Input & Outputs
Analog outputs: 2 outputs 4-20mA, max. load 750Ω, electrically isolated
Relay outputs: 3 outputs 24V DC/1A
Analog inputs: 2 inputs 4-20mA, for gas temperature & pressure compensation
Communications: RS485(or Bluetooth, RS232 or GPRS)

Operating conditions
Power supply: 24V DC(21-36V DC), or 90-240V AC
Power consumption: max. 20W
Operating temperature: -30°C to +60°C
Storage temperature: -40°C to +80°C
Purge gas: 0.3 to 0.8MPa nitrogen gas or instrument air
Protection class: IP65

Approvals
Laser class: class 1 conformant with IEC60825-1
CE certified: conformant with 2004/108/EC
ATEX(IECEx) certified: Ex d op is pxIIC T5 Gb

Application Areas

Refinery & Petrochemical

- FCC Catalyst Regeneration
- SCR NH3 Injection
- Desulfurization Efficiency
- Explosive Process Gas
- Reactant Ratio Optimization
- Product Purity
- HCL, HF Emission
- Flue Gas Measurement Outlet of Process Heaters, Fractionators, Thermal Crackers, Utility Boilers and Incinerators
- Sulfur Recovery

Metallurgy

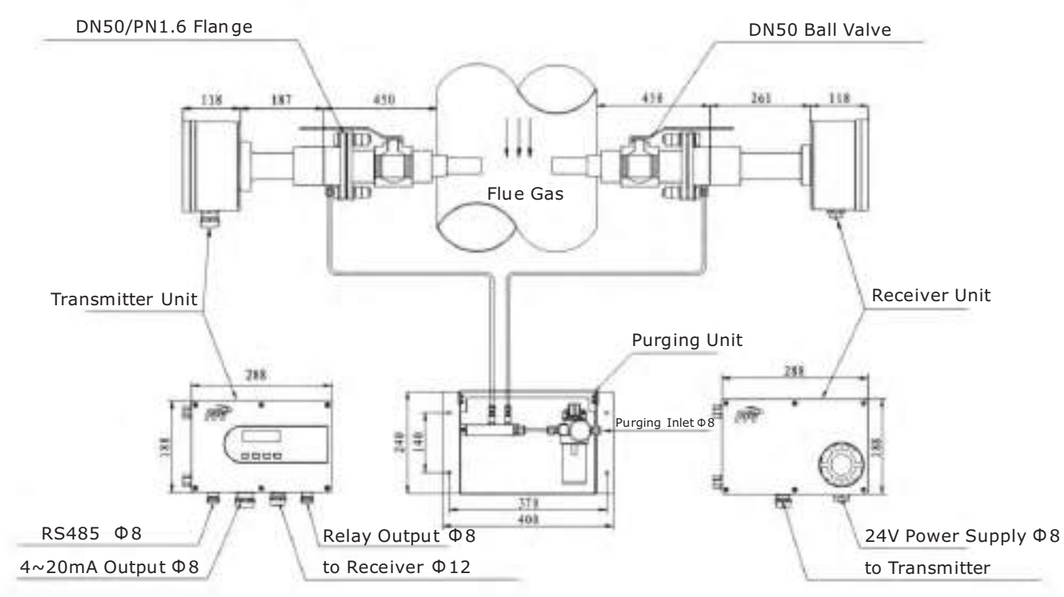
- Combustion Control for Reheating Furnace, Heat treatment Furnace, Forging Furnace
- Converter Gas Recycle
- Blast Furnace Gas
- Coke Oven Gas
- Flue Gas of Sintering, Pelletizing
- Coal Injection Safety Control
- Electric Tar Precipitator (ETP) Safety Control
- CDQ Circulating Gas
- Gas Tank Safety Control
- Calorific Value Analysis
- Sulfur Recovery

Thermal Power

- SCR NH3 Injection
- Desulfurization Efficiency
- Coal Injection Safety Control
- HCL, HF Emission

LGA Dimension

Unit:mm



LGA-4500 Bypass

Corrosion resistant/high temperature proof gas cell

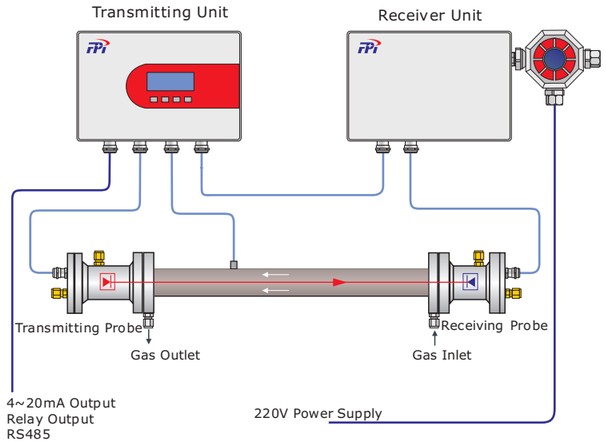
Features and Benefits

- Fast response
- High accuracy, ppm level resolution
- No cross interference
- Reliable in all harsh conditions: high temperature & pressure, dust density, moisture and corrosion
- Online calibration, no zero drift
- International ATEX certified

Application Areas

- Trace H_2O in VCM Production
- Coal Injection Safety Control
- SCR NH_3 Injection in Coal-fueled Plants
- All other applications where in-situ doesn't fit due to high pressure or dust density, limitation of stack diameter or position.

LGA Composition



Technical Data

Specifications
Repeatability: ⩽ ± 1%F.S.
Linearity: ⩽ ± 1%F.S.
Span drift: ⩽ ± 1%F.S./6 months
Instrument response time: ⩽1s*
Warm-up time: ⩽15min
Gas cell temperature: -30°C to +250°C
Gas cell pressure: 0.5 to 3 bar abs.
*Gas flow>1L/min, system response time: T90⩽20s.

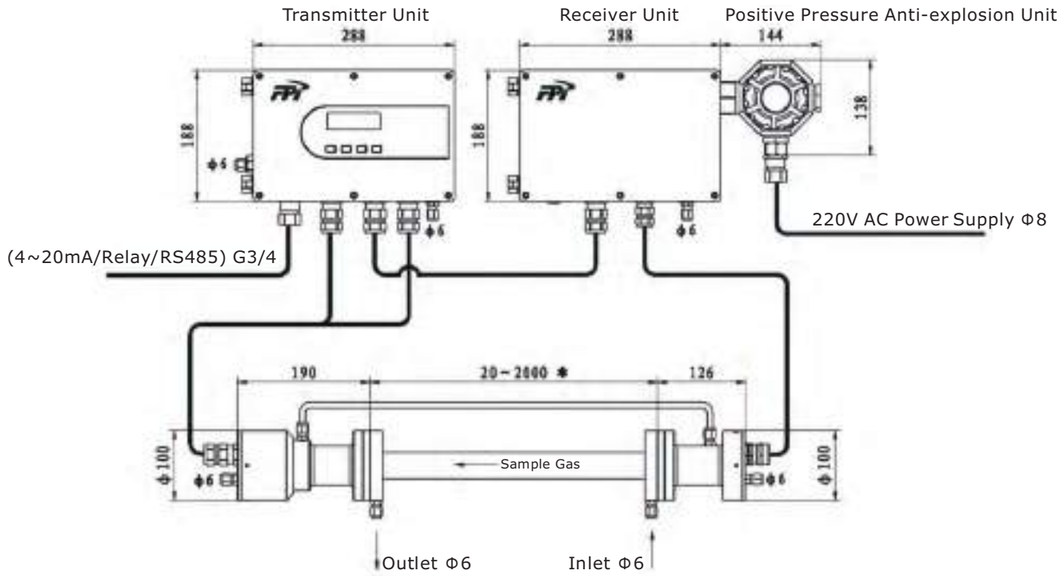
Input & Outputs
Analog outputs: 2 outputs 4-20mA, max. load 750Ω, electrically isolated
Relay outputs: 3 outputs 24V DC/1A
Communications: RS485(or Bluetooth, RS232 or GPRS)

Operating Conditions
Power supply: 200-240V AC/48-63Hz
Power consumption: ⩽30W (no heat tracing)
Operating temperature: -30°C to +60°C
Storage temperature: -40°C to +80°C
Purge gas: 0.3MPa nitrogen gas or instrument air
Protection class: IP65

Approvals
Laser class: class 1 conformant with IEC60825-1
CE certified: conformant with 2004/108/EC
ATEX(IECEx) certified: Ex d op is pxIIC T5 Gb

LGA Dimension

Unit:mm



LGA-4500IC Trace Level

Features and Benefits

- Drift free, Maintenance free
- Accurate, real-time measurement
- No tape, No carrier gas, No light source or probe replacement
- No interference from glycol, methanol or amine
- Reliable in harsh conditions
- ATEX certified

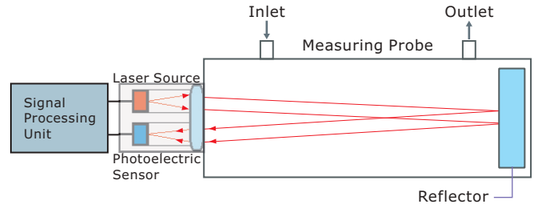
Application Areas

- H_2O, H_2S in natural gas
- Trace level H_2O, H_2S in chemicals

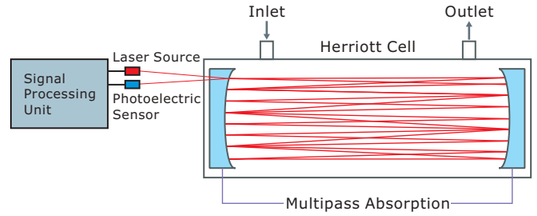
Gas	Detection Limit	Measurement Range
H_2O in natural gas	2ppm	0-100ppm
H_2S in natural gas	2ppm	0-50ppm,0-200ppm

LGA Composition

For H_2O



For H_2S



Technical Data

Specifications (H_2O)
Repeatability: ⩽±1%F.S.
Linearity: ⩽±1%F.S.
Span drift: ⩽±1%F.S./6 months
Instrument response time: ⩽1s*
Warm-up time: ⩽15min
Suggested gas flow: 1-5L/min
*Gas flow > 1L/min,system response time (short OPL 46cm): T90⩽11s,
system response time (long OPL 112cm): T90⩽21s.

Specifications (H2S)
Repeatability: ⩽±1%F.S.
Linearity: ⩽±1%F.S.
Span drift: ⩽±2%F.S./6 months
Instrument response time: ⩽3s*
Warm-up time: ⩽60min
Sample gas: dust/moisture/oil free (filtration⩽0.5um)
Suggested gas flow: 1-5L/min
* Gas flow > 1L/min, system response time: T90⩽30s.

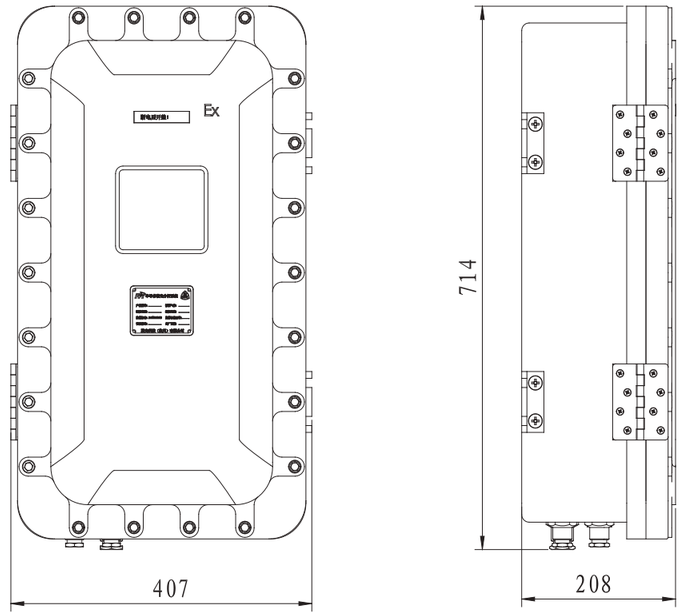
Input & Outputs
Analog outputs: 2 outputs 4-20mA, max. load 500Ω,
electrically isolated
Relay outputs: 3 outputs 24V DC/1A
Communications: RS485(or RS232/Modbus)

Operating Conditions
Power supply:100-240V AC(H_2O), 200-240V AC(H_2S)/48-63Hz
Power consumption: ⩽12W(H_2O); ⩽450W(H_2S)
Operating temperature: -20°C to +50°C
Protection class: IP65

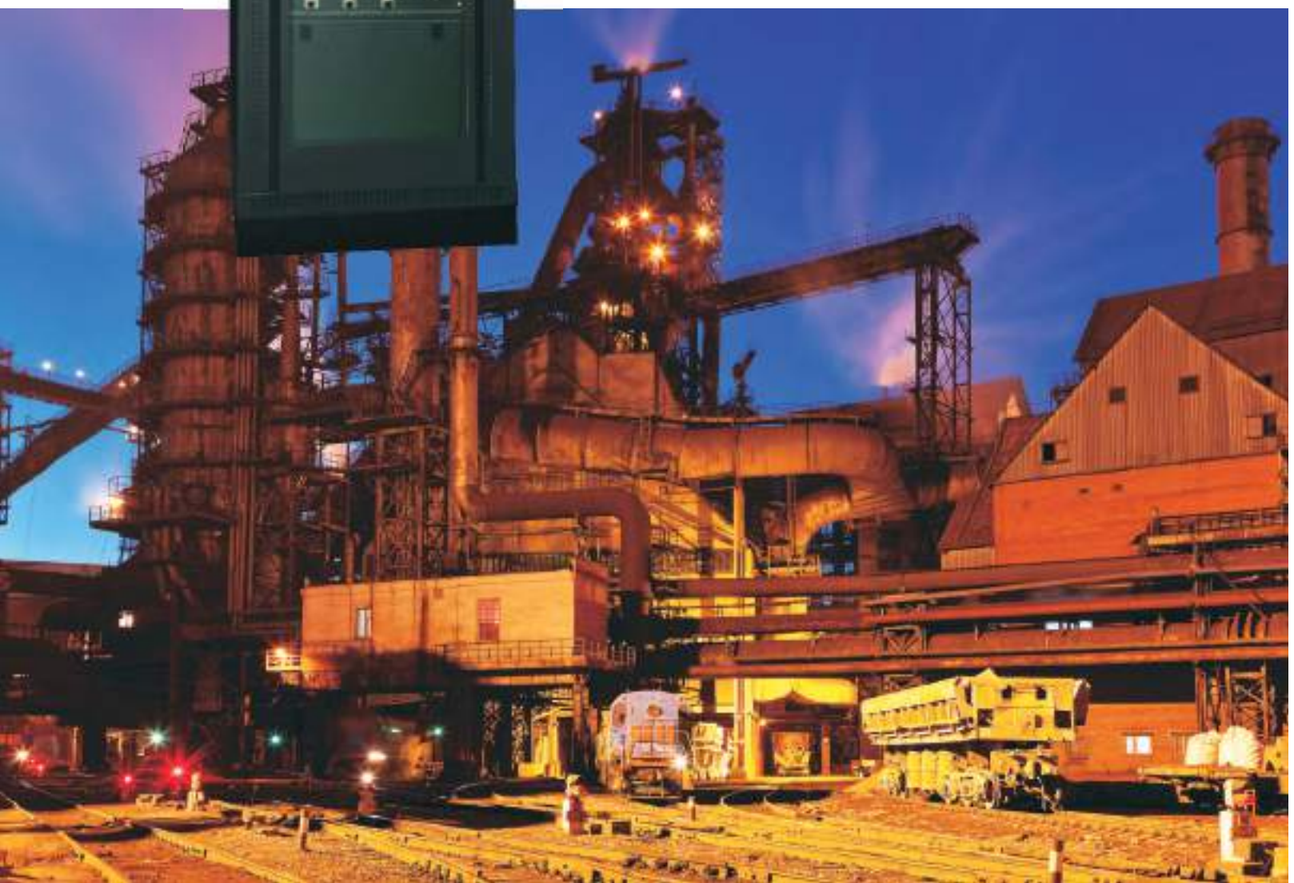
Approvals
Laser class: class 1 conformant with IEC60825-1
CE certified: conformant with 2004/108/EC

LGA Dimension

Unit:mm



LGA-C300 Calorific Value



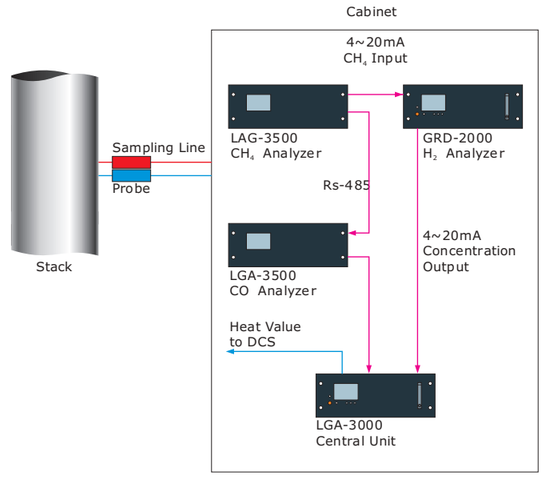
Features and Benefits

- Integrated and compact
- Simultaneous and continuous multiple fuel compositions (CO, CH_4, H_2) analysis
- Low cost ownership and operation
- Reliable in harsh conditions

Application Areas

- Calorific value analysis in iron&steel

LGA Composition



Technical Data

CO: 0-100%*
CH_4: 0-100%*
H_2: 0-100%*
*** Measurement ranges (percentage) customizable on request.**

Specifications
Repeatability: ⩽±1% F.S.
Span drift: ⩽±2% F.S./3 months
Instrument response time: ⩽1s*
* Gas flow>1L/min, system response time: T90⩽21s.

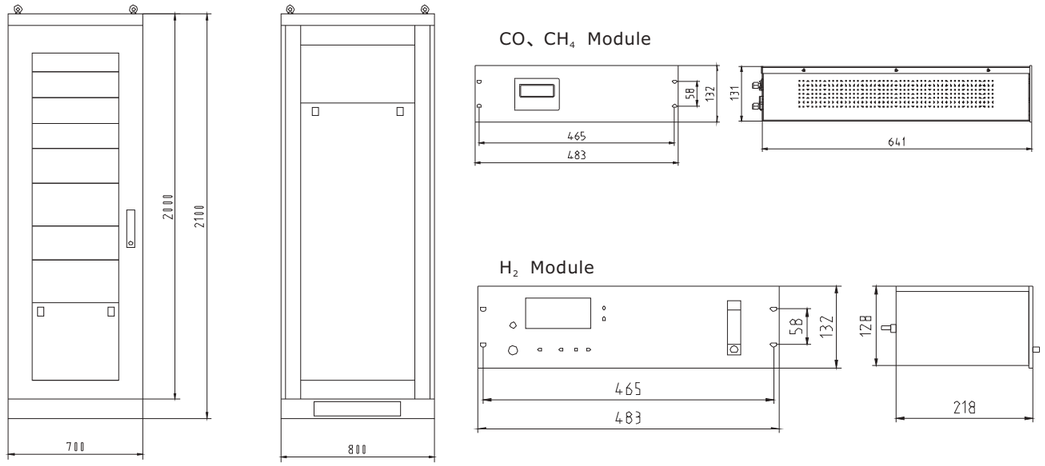
Input & Outputs
Analog outputs: 2 outputs 4-20mA, max. load 750Ω, electrically isolated
Communications: RS485/RS232

Operating conditions
Power supply: 100-240V AC/ 48-63Hz
Operating temperature: 0°C to +45°C

Approvals
Laser class: class 1 conformant with IEC60825-1

LGA Dimension

Unit:mm



Iron & Steel

FPI Process Gas measurement in Iron & Steel					
Process	Measuring Position	Gas Measured	Typical Range	Measuring Purpose	Instruments
Iron Making	**Sintering, Pelletizing**				
	Sintering Flue Gas	O_2	0~21%	Combustion Optimizing, Energy Saving	LGA-4100
		CO	0~5%	Safety Control	LGA-4100
		CO_2	0~15%	Combustion End-point Monitoring	LGA-4100
		H_2O	0~15%	Process Optimizing, Energy Saving	LGA-4100
		Fuel Calorific Value		See 'Calorific Value Analysis' Forth Below	
	Pelletizing Flue Gas	O_2	0~15%	Combustion Optimizing, Energy Saving	LGA-4100
		CO	0~15%	Safety Control	LGA-4100
		CO_2	0~15%	Combustion End-point Monitoring	LGA-4100
		H_2O	0~15%	Process Optimizing, Energy Saving	LGA-4100
		Fuel Calorific Value		See 'Calorific Value Analysis' Forth Below	
	Coal Injection Safety Control				
	Inlet of Coal Mill	O_2	0~21%	Safety Control	LGA-4100
		CO	0~5000ppm		LGA-4100
	Outlet of Coal Mill	O_2	0~21%		LGA-4500
		CO	0~5000ppm		LGA-4500
	Outlet of Bag Filter	O_2	0~21%		LGA-4100
		CO	0~5000ppm		LGA-4100
	Coal Bunk	O_2	0~21%		LGA-4500
		CO	(0~5000/0~2000)ppm		LGA-4500
	Blast Furnace Gas				
	Flue Gas after Bag Filter	O_2	0~3%	Combustion Efficiency Control, Furnace Leakage Monitoring	LGA-4100
		CH_4	0~5%		LGA-4100
		CO	0~30%/0~50%		LGA-4100
		CO_2	0~30%/0~50%		LGA-4100
		H_2	0~10%		GRD-2000
	Hot Blast Stove Flue Gas				
	Hot Blast Stove Flue Gas	O_2	0~21%	Process Optimizing, Energy Saving, Safety Control	LGA-4100
		CO	(0~2000/0~5000)ppm /0~5%		LGA-4100
Steel Making	**Converter Gas Recycle**				
	Inlet or Outlet of Induced Draft Fan	CO	0~100%	Gas Recycle Control	LGA-4100
	Inlet or Outlet of Induced Draft Fan	O_2	0~5%/0~21%		LGA-4100
	Inlet or Outlet of Induced Draft Fan	H_2	0~10%	Condenser Operation Monitoring	GRD-2000
	Gas Tank Safety Control				
	Inlet & Outlet of Gas Tank	CO	0~100%	Safety Control	LGA-4100
	Inlet & Outlet of Gas Tank	O_2	0~5%		LGA-4100
	Flue Gas Before Electrostatic Precipitator(ESP)	CO	0~100%		LGA-4100
	Flue Gas Before Electrostatic Precipitator(ESP)	O_2	0~5%		LGA-4100
Coking	**Electric Tar Precipitator (ETP) Safety Control**				
	ETP Outlet	O_2	0~5%/0~1%	Safety Control	LGA-4100
	Coke Oven Exhaust Gas	O_2	0~10%/0~5%/0~1%	Combustion Optimizing, Energy Saving	LGA-4100
	Coke Oven Gas				
	Inlet of Desulfurization	H_2S	0~2000ppm	Desulfurization Efficiency Control	LGA-4100
	Outlet of Desulfurization	H_2S	0-500mg/Nm^3		LGA-4500IC
	CDQ Circulating Gas				
	CDQ	O_2	0~5%	Process Optimizing, Safety Control	LGA-4100
	CDQ	CO	0~20%		LGA-4100
	CDQ	Co_2	0~30%		LGA-4100
	CDQ	CO/CO_2	0~20%/0~30%		LGA-4100
	CDQ	H_2	0~10%/0~20%		GRD-2000
	Claus Sulfur Recovery				
	Acid Gas	H_2S	0-100%	H2S:Air Proportioning, Reaction Optimizing	LGA-4100
	Outlet of Catalytic Reactor	H_2S/SO_2	0-1%/0-2%	H2S:SO2 Ratio, Reaction Optimizing	OMA-2000
	Claus Exhaust Gas Cleaning				
	Outlet of Sulfur Condenser	H_2	0~5%	Oxidization Control	GRD-2000
	Outlet of Tail Gas Scrubber	H_2S	0~1%	Scrubbing Efficiency Monitoring	LGA-4100
	Outlet of Incinerator	O_2	0~5%	Combustion Optimizing, Energy Saving	LGA-4100
	Chimney	SO_2	(0~2000/0~1000)ppm	Emission Monitoring	CEMS-2000
Hot Rolling	**Reheating Furnace**				
	in-situ on Furnace	O_2	0~21%	Burning Loss Control	LGA-4100
	in-situ on Furnace	CO	0~2%/0~5%	Process Optimizing, Energy Saving	LGA-4100
Calorific Value	**Calorific Value Analysis**				
	Converter Gas/Blast Furnace Gas	CO	0~60%	Fuel Gas Proportioning, Cost Accounting	LGA-4100
	Coke Oven Gas	CO	0~20%		LGA-C300
		CH_4	0~60%		
		H_2	0~60%		
	Mixed Gas	CO	0~40%		LGA-C300
		CH_4	0~60%		
		H_2	0~40%		
	Blast Furnace Gas	CO	0~50%		LGA-C300
		H_2	0~10%		
Others	Industrial boilers/calciners	O_2	0~5%/0~1%	Process Optimizing, Safety Control	Specifications
		CO	0~5%/0~1% /(0~5000/0~2000)ppm		

Oil&Gas

FPI Process Gas measurement in Oil & Gas				
Industry	Application	Measuring Position	Objects to measure	Instruments
Oil Refining	FCC	Outlet of Regenerator	CO,CO_2, O_2	LGA-4100
	Hydrogen Production	Process gases	CO, CO_2, C_2H_4	LGA-4500
	Sulfur recovery	Feedstock gas	H_2S	OMA-3120/LGA-4500
		Outlet of Claus Reactor	H_2S/SO_2	OMA-3510
		Outlet of Condenser	H_2	TAI-2020
		Exhaust gas incineration	SO_2	OMA-3110
		Emission gas	SO_2,H_2S,O_2,particulate, velocity	CEMS-2000,LGA-4100
Petrochemical	Ethylene Cracking	Outlet of cracking furnace	CO, Co_2, C_2H_2	LGA-4100/4500, PGC
	PTA	Process gases	O_2, CO, Co_2, H_2O, CH_3COOH	LGA-4100/4500, SUPNIR
	EO/EG	Process gases	O_2, Co_2, CH_4, C_2H_4, C_2H_6, EO, Ar, N_2	MGA, LGA-4500
	PE	Process gases	CO, CO_2,C_2H_4, C_2H_6, O_2, trace H_2O	LGA-4500, TAI-2000/8800
	PP	Process gases	CO, CO_2, C_3H_6, C_3H_8, H_2, C_4H_8, C_4H_6CL, Trace H_2O, O_2	LGA-4500, TAI-2000/8800/3020T
	PS	Process gases	O_2, CO/CO_2, Trace H_2O in Benzene	LGA-4500
Chemical	PVC (VCM)	Feedstock C2H4	H_2O, O_2 in C_2H_4	LGA-4500
		Feedstock Cl2	O_2, trace H_2O in Cl_2	LGA-4500
		EDC gas	Cl_2, Trace H_2O in EDC	OMA-3010, LGA-4500
		Recycle gas	O_2, CO, CO_2, C_2H_4	LGA4500/4100
		HCL stripping	O_2 in HCL	LGA-4500
	Methanol Ammonia Synthesis Urea Synthesis	Process gases	O_2, CO, CO_2, NH_3	LGA-4500/4100
			NH_3, Co_2	LGA-4500
	Hydrogen Peroxide	Oxidation	O_2	LGA-4100
	Sulfuric Acid	Feedstock gas	SO_2	OMA-3110
DeNOx	SCR outlet		NH_3 slip	LGA-4500/4100
	Emission stack		NOx, SO_2, O_2, CO, CO_2	CEMS-2000
Natural Gas	Extraction	Raw gas	High H_2S, CO_2	LGA-4500PA (portable)
	Purification	Acid gas removing	High H_2S	LGA-4500
		Sulfur recovery exhaust gas	H_2S/SO_2	OMA-3510
		Exhaust gas treatment	SO_2	OMA-3110
		Purified gas	Trace H_2S, H_2O	LGA-4500IC
	Transportation	Pipelines and stations	Trace H_2S, H_2O	LGA-4500IC
	Compression	CNG	Trace H_2S, H_2O	LGA-4500IC

Other Applications

FPI Process Gas measurement in Various Applications				
Industry	Measuring Position	Gas Measured	Measuring Purpose	Instruments
Waste Incineration	Incinerator	O_2, CO	Incinerator Combustion Control	LGA-4100
	Outlet of Acid Scrubber	HCL, HF	Input Control of Calcium Hydroxide	LGA-4100
	Outlet of Bag House Filter	HCL, HF	Filter Efficiency Control	LGA-4100
	Outlet of SCR Reactor	NH_3	NH_3 Injection Control and NH_3 Slip Detection	LGA-4100
	Stack Inlet	HCL+H_2O	Dry HCL Exhaust	LGA-4100
		SO_2, NOx, O_2, CO, Co_2, Dust, TPF	Emission Monitoring	CEMS-2000B
Thermal Power	Inlet of SCR Reactor	NOx, O_2	Flue gas Monitoring	CEMS-2000B
	Outlet of SCR Reactor	NOx, O_2, Dust, TPF, Humidity		CEMS-2000B
	Outlet of SCR Reactor	NH_3	NH_3 Injection Control and NH_3 Slip Detection	LGA-4100
	Inlet of Desulfurization Reactor	SO_2, O_2, Velocity, Humidity	Desulfurization Efficiency Control	CEMS-2000B
	Outlet of Desulfurization Reactor	SO_2, NOx, O_2, Dust, TPF, Humidity		CEMS-2000B
	Chimney	SO_2, NOx, O_2, Dust, TPF, Humidity	Emission Monitoring	CEMS-2000B
	Inlet of Coal Mill	O_2, CO	Safety Control	LGA-4100
	Outlet of Coal Mill	O_2, CO		LGA-4500
	Outlet of Bag Filter	O_2, CO		LGA-4100
	Coal Bunk	O_2, CO		LGA-4500
Cement	Kiln Outlet	O_2, CO, CO_2	Combustion Optimizing	LGA-4100
	Outlet of Preheater Tower	O_2, CO, CO_2	Process Optimizing	LGA-4100
	Inlet of Coal Mill	O_2, CO	Safety Control	LGA-4100
	Outlet of Coal Mill	O_2, CO		LGA-4500
	Outlet of Bag Filter	O_2, CO		LGA-4100
	Coal Bunk	O_2, CO		LGA-4500