



Electro Optical Components, Inc.

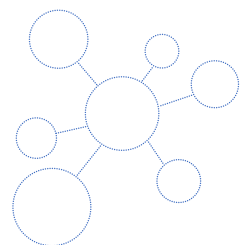
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CO₂ Capturing



What Is CO₂ Capturing?

CO₂ capturing involves separating carbon dioxide (CO₂) from the air or industrial processes, liquefied it and store it in the underground reservoirs or other storage media. This technology is crucial in the fight against global warming, as it helps reduce the CO₂ emissions and/or the current concentration to slow down and stop our Earth's temperature rise.



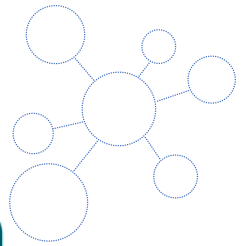
Why CO₂ Capturing ?

The Climate change stands as one of humanity's greatest challenges. At smartGAS, we're setting new standards in environmental protection with our innovative NDIR gas sensors.

FLOW^{EVO} (Plus), SILAREX WR (Plus) and BASIC^{EVO}

Let's have a look at two example processes

Processes of CO₂ Capturing

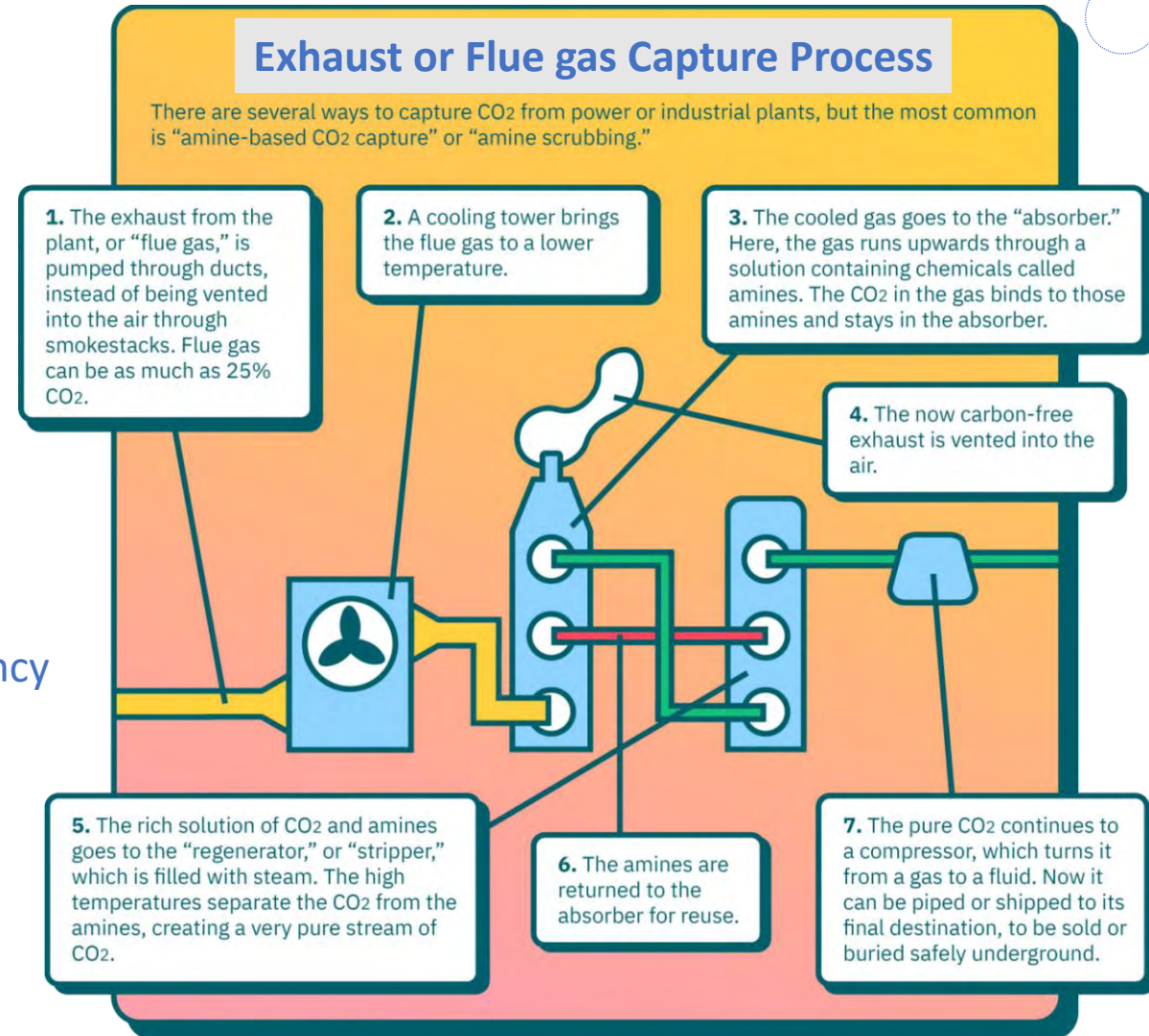


Exhaust or Flue Gas CO₂ Capturing

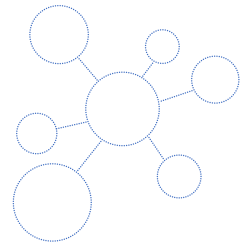
The process will capture CO₂ from industrial plants where this concentration is typical in the Range of Vol.%.

In these processes the smartGAS sensors can take over the measurement of a lot of critical parameters like

- Monitoring the CO₂ concentration at the inlet in the range of Vol.%
- Monitoring and Optimizing the process efficiency of the Stripper in the range of Vol.%
- Monitoring the CO₂ Purity after the release from the compressor in the range of Vol.%
- as well as Monitoring other gases CO, SO₂, NO to monitor and control the process input itself



Processes of CO₂ Capturing

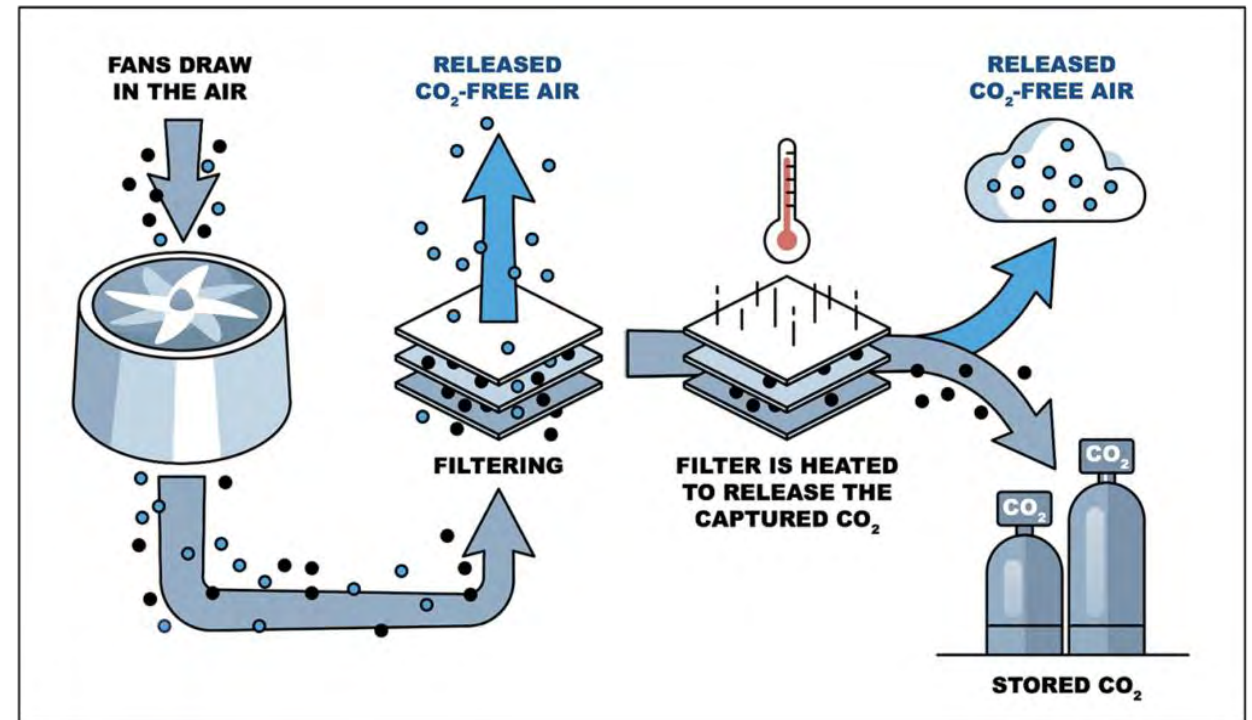


Direct Air CO₂ Capturing

The process will capture CO₂ directly from the environment Air where the concentration typical is below 1000ppm

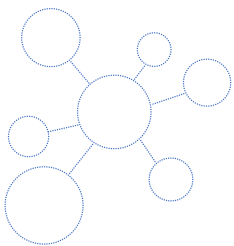
In these processe the smartGAS sensors can take over the measurement of a lot of important parameter like

- Monitoring the CO₂ concentration at the inlet in the range of ppm
- Monitoring and Optimizing the process efficiency (Inlet to Filter Outlet) in the range of ppm
- Monitoring the CO₂ Purity after the realease in the range of Vol.%
- as well as Monitoring other gases may cause filter damage like CO and SO₂ in the range of ppm



Direct Air Capture Process

smartGAS CO₂ Sensors for CO₂-Capturing



Here an Overview of the smartGAS CO₂ Sensors and examples of usage in CO₂ capturing
Other measured gases manly depends on the real situation of the gas source

	Range	Noise (LDL)	Temp. and Pressure Compensated	
BASIC ^{EVO}	0-1000ppm to 0-20Vol.%	low	T : compensated P : yes (with CONNECT)	Diffusion Sensor for Direct Air Capture - Air Channel Systems
FLOW ^{EVO}	One Range 0-100ppm up to 0-1000ppm	low		Direct Air Capture Inlet
FLOW ^{EVO} Plus		very low	T : highly stabilized ± 0,5K P : yes	High accuracy for Direct Air Capture Inlet
FLOW ^{EVO}	One Range 0-1000ppm up to 0-100Vol.%	low	T : compensated P : yes (with CONNECT)	Process efficiency and purity after compressor outlet
FLOW ^{EVO} Plus		very low	T : highly stabilized ± 0,5K P : yes	High accuracy Process efficiency and purity after compressor outlet
SILAREX WR (wide range)	Three Ranges one signal 0-100ppm 0-1000ppm 0-10000ppm up to 0-25000ppm	low in each range	T : stabilized ± 2K P : yes	Wide Range Sensor For system with high concentration changes
SILAREX WR Plus (wide range)		very low in each range	T : highly stabilized ± 0,5 K P : yes	High accuracy Wide Range Sensor For system with high concentration changes



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SILAREX NDIR Quad Gas Sensors

The SILAREX product line of smartGAS stands for precision and maximum performance. These are NDIR multi-gas sensors that can measure up to three gases or up to three ranges at the same time. The cross-sensitivity corrections can be calculated directly in the sensor.

The SILAREX gas sensors enable parallel concentration measurement of up to three sample gases or measuring ranges with one compact sensor. They are ideal for applications such as emission measurement of multiple gases such as CO₂, CO and SO₂, measurement of TOC (Total Organic Carbon), and also for measuring CO₂, N₂O and CH₄ in wastewater treatment plants.

The advantages of SILAREX compared to measuring with three individual sensors are obvious: only one sensor needs to be calibrated and maintained. Different sample preparations, differing of accuracy or life cycles of the sensors do not have to be taken into account.

	SILAREX	SILAREX TOC	SILAREX TOC PLUS	SILAREX WR PLUS
				
Gases	Up to Three	One/Three Ranges Merged	One/Three Ranges Merged	One/Three Ranges Merged
Applications	Multi Gas Measurement with cross compensation for Industry, Research and Environment Control	High Range Water Quality Analytic TOC/COD	High Range and high accurate Water Quality Analytic TOC/COD	Customized Wide Range SILAREX for High Range and high accurate Analytic Applications. Three calibrated Ranges Merged on one signal.
Reference Channel	Yes	Yes	Yes	Yes
Linearity Error	≤±1% (FS)	≤±1% (FS) Each Range	≤±1% (FS) Each Range	≤±1% (FS) Each Range
Ranges	0...50 ppm up to 0..100Vol.%	0..100/0..1000/0..10000ppm	0..100/0..1000/0..10000ppm	Upon Request
T90 Time vs Noise	≤14sec ≤±0.1%[FS] ≤3sec ≤±1.0%[FS]	≤14sec ≤±0.1%[FS] ≤3sec ≤±1.0%[FS] [FS] related to active range	≤3sec Noise : ≤±0.075%[FS] [FS] to active measured range e.g. 100/1000/10000 Value 56 Range = 100	
Detection Limit	≤±0.05%[FS] of smallest range			
Cycle Time (readout)	Max. 2.5Hz		Max. 10Hz	
Power Supply	24VDC+10%		10...26VDC	
Pressure Compensated	Optional Internal			
Digital Interface	TTL 1wire/RS485		RS232/RS485	

Analog Interfaces	None		Option Internal	
Heat Stabalization	Internal Heat Controller ±1.0K or Optional high performance external Heat Controller ±0.5K			
Cuvette Material	AL(Standard) Stainless / Peek (Depends on gas type and application)			
Cuvette Length	Up to 300mm	Up to 300mm	Up to 300mm	Up to 300mm
Gas In/Outlet	3/5mm Rubber Tube Fitting (Standard) Optional : 4/6mm Rubber Tube/Quick Connector/PTFE/Stainless Steel			
Custom Software	No	No	Possible	
External Casing	AL Casing with thermal Insolation(Customized on Request)			
Standard Gasses	CO2 CO CH4 SO2 N2O NO Other gases request		CO2	Gas Type on request
Additional Options	Interface Converter / Power Supplies / Cabling / Gas Pumps / Filter / Tubing / Integration / Customized Gases and Ranges / Calibration Service			



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FLOW^{EVO} NDIR Dual Channel Gas Sensors

The FLOW^{EVO} is a high-performance NDIR gas sensor product line specifically designed for the analysis of gases in process analysis. The sensors are "ready to use", low-maintenance and have low detection limits. They are highly selective against interfering gases and have flexible interfaces. In addition, they are temperature and drift compensated and have a compact design. The FLOW^{EVO} product line from smartGAS is characterized by measuring accuracy, compact design and easy handling. The sensors can detect a wide range of measurable gases and are particularly useful where extreme precision and reliability are required. They are ideal for various applications, including process metrology, high voltage technology with SF₆, emission measurement, pest control, biogas analysis, and fruit storage & ripening gas control, CO₂ capturing ... and much much more

	FLOW ^{EVO}	FLOW ^{EVO} PLUS	FLOW ^{EVO} PRO
			
Gases	One	One	One/Selectable
Applications	Standard Gas measurement in Industry, Research and Environment Control	Applications. Very low Noise and LDL Low T90 time and high output frequency	Universal usage for control Applications
Reference Channel	Yes	Yes	Yes
Linearity Error	≤±1% (FS)	≤±1% (FS)	≤±3% (FS)
Ranges	0...50 ppm up to 0..100Vol.%	0...50 ppm up to 0..100Vol.%	0...50 ppm up to 0..100Vol.%
T90 Time vs Noise	≤14sec ≤±0.1%[FS] ≤3sec ≤±1.0%[FS]	≤3sec ≤±0.075%FS	≤14sec ≤±0.1%[FS] ≤3sec ≤±1.0%[FS]
Detection Limit	≤±0.6%[FS]	≤±0.05%[FS]	≤±0.05%[FS] of smallest range
Cycle Time (readout)	Max. 2.5Hz	Max. 10Hz	Max. 2.5Hz
Power Supply	3.3..6VDC	10...26VDC	3.3..6VDC
Pressure Compensated	Optional w External Coontroler	Optional Internal	Optional w External Coontroler
Digital Interface	TTL 1 wire	RS232/RS485	TTL 1 wire
Analog Interfaces	Optional w External Coontroler	Optional Internal	Optional w External Coontroler

Heat Stabilization	Optional w External Coontroler ±1.0K	Internal w High Performance Controller ±0.5K	Optional w External Coontroler ±1.0K
Cuvette Material	AL(Standard) Stainless / Peek (Depends on gas type and application)		
Cuvette Length	Up to 300mm	Up to 300mm	Up to 300mm
Gas In/Outlet	3/5mm Rubber Tube Fitting (Standard) Optional : 4/6mm Rubber Tube/Quick Connector/PTFE/Stainless Steel		
Custom Software	No	Possible	No
External Casing	AL Casing with thermal Insolation(Customized on Request)		
Options	External Interface Pressure Compensation RS232/RS485 Analog Interface		External Interface Pressure Compensation RS232/RS485 Analog Interface
Standard Gasses	CO2 CO CH4 C2H4 SO2 N2O CH3Br SO2F2 SF6 NH3 CnHm; Other gases request		Up to 20 Freon; Up to 20 CnHm
Additional Options	Interface Converter / Power Supplies / Cabling / Gas Pumps / Filter / Tubing / Integration / Customized Gases and Ranges / Calibration Service		