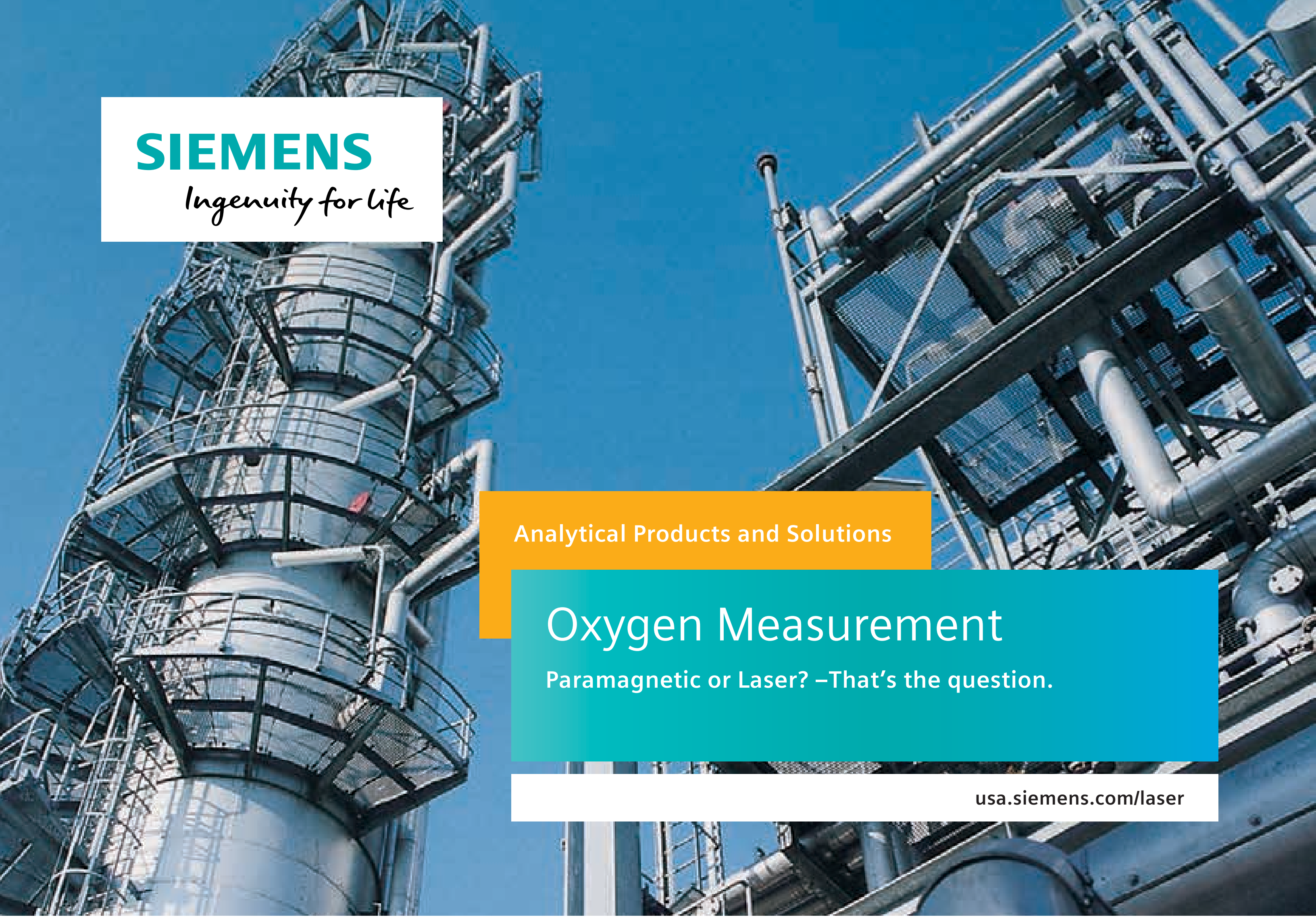

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Analytical Products and Solutions

Oxygen Measurement

Paramagnetic or Laser? –That's the question.

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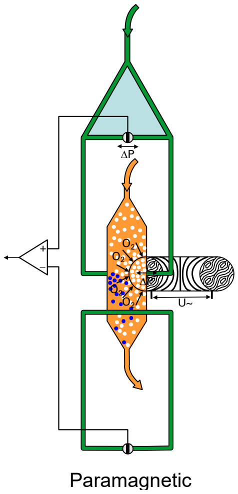
Oxygen is one of the components most often measured with online analytics. Various technologies have been developed and refined for automatic and continuous measurement of oxygen in process safety, process control and product quality control applications.



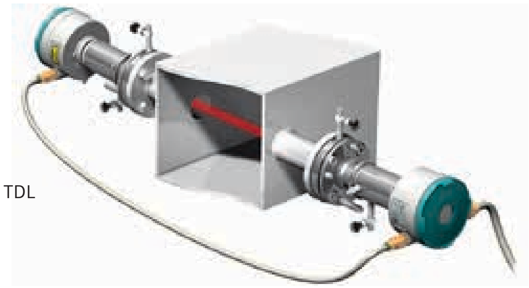
Paramagnetic

An oxygen analyzer exploits the paramagnetic properties of oxygen as a basis of measurement. Because the analyzer's design separates the sample and the measurement flow path so that the sample does not come in contact with the measurement sensor, it is widely used not only for simple O_2 measurement but also for process streams that need heating or are highly corrosive. Specifically, this separation of the sample and the measurement sensor gives the analyzer long-term stability and makes it very reliable in an extractive system solution design.

A new technology, tunable diode laser spectroscopy (TDL), recently has been making fast in-roads into the market as an option for continuous, online and automatic oxygen measurement. By using a specific wavelength laser beam across or along a straight-run pipe, the oxygen concentration can be determined. Laser measurement, such as found in the SITRANS SL and LDS product family, is very precise with virtually no cross interference of other components and can be applied as an in-situ system or as part of an extractive measurement system.

When a new measurement technology enters a field, the question is often whether it is better for a specific measurement task than existing solutions in terms of performance, maintainability, installation requirements or cost of installation and operation. Following are a few basic considerations and guidelines for determining which type of analyzer might be most appropriate for your specific application requirements.

TDL



There are many technical, product, solution and operational sample stream details and objectives to consider when deciding which technology should be applied for online and automatic oxygen measurement. The following table provides a few highlights to consider.

	Paramagnetic	TDL Spectroscopy
System configuration	Extractive	In-situ or extractive
Sample conditioning	Always needs sample conditioning, filtering, pressure/flow control, heating and drying. For sample, if streams require heating or contain particulates, high boiling components or inorganic material, sample extraction can result in high maintenance. Sample extraction and conditioning is especially demanding when the measurement involves chemically reactive or instable constituent.	If in-situ measurement is possible, TDL helps prevent the maintenance associated with preparing an extractive sample. The analyzer "window" has to be purged to prevent window fouling. Suitability depends on analyzer suitability regarding sample temperature, pressure and path length properties. Extractive measurement configuration (that is, with sample slip stream) often requires temperature and flow control only.
Response time	Measurement response time depends mainly on sample lag time due to sample transport and conditioning. It can range from seconds to minutes.	Response time mainly depends on measurement "averaging" to reduce noise and increase sensitivity. It can range from a few to several dozen seconds.
Cross interference	Although oxygen has very high paramagnetic properties, other components can contribute to the measurement. Wide concentration swings of such interferences can impact oxygen measurement precision.	This approach exhibits high selectivity towards oxygen measurement with typical cross interference below minimum detectability.
Calibration/ validation	You can calibrate the analyzer or entire analytical system by introducing reference standards.	In-situ calibration is possible by using a cal cell filled with O_{18} isotope and permanently located in laser path. For calibration with O_{16}, an in-situ analyzer has to be removed. TDL is mounted on extractive flow path, validated and calibrated using a reference standard. However, typically a higher flow rate is needed compared with an O_2 CGA. O_2 measurement following environmental regulations may have to be mounted extractively to ensure calibration as specified by regulations.

	Siemens Oxymat 6	Siemens LDS 6	Siemens SITRANS SL
	Key technical data		
Sample pressure	ambient pressure	up to 70 psi	up to 195 psi
Sample temperature	up to 145°C / 290°F	up to 1300°C / 2370°F	up to 600°C / 1110°F
Explosive mixtures	No	Yes	Yes
Suitability	IP20 / IP65; Class I, Div.2, Group	IP 65; Class I, Div.1, Group A	IP 65, Class I, Div.1, Group A
	Ambient conditions		
Drift	<1/2% of span / month	none	<4% of span / year
Calibration	monthly	none	yearly
Measuring ranges	0-0.5 to 0-100%	0-5% / 0-100%	0-1% / 0-100%
Detectability	+/- 50 ppm	+/- 0.1%	+/- 200 ppm
Purge	reference gas	N_2 purge	N_2 purge

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