DEFOR
Extractive UV Gas Analyzer

Individual or Simultaneous Measurement of SO_2, NO, NO_2, Cl_2 as well as NH_3, CS_2, COS and H_2S

SICK
Sensor Intelligence.

DEFOR –
Extractive measurement of gases by UV absorption

DEFOR is an extractive UV gas analyzer that can simultaneously measure up to three measuring components. It is a specialist for extremely selective NO measurement with small measuring ranges and an allrounder for many other UV-active gases, e.g. SO_2, NO_2, Cl_2, NH_3, CS_2, H_2S and COS. Cross-sensitivities to CO_2 and H_2O do not exist because of the spectral range used.

Innovative signal processing as well as highly stable detectors provide excellent long-term stability and compensation of drifts and influencing effects. DEFOR with state-of-the-art electronics and software has the interfaces required for remote monitoring from a network as well as to the connection to process control systems.

AREAS OF APPLICATION

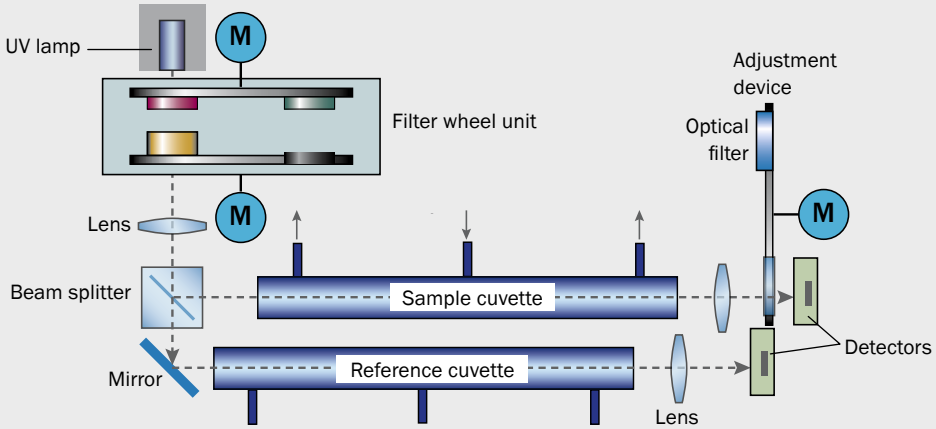
- Emission measurement
  - Measurement of low NO concentrations in power stations and gas turbines
  - Monitoring of NO_x in denitrification plants by direct measurement of NO and NO_2 as well as a combined NO_x value
  - Efficient measurement in denitrification plants
  - Registering of lowest SO_2 and NO concentrations
  - Emission measurement in the pulp and paper industry
- Process monitoring
  - Cl_2 measurement also in combination with O_2
  - H_2 in Cl_2, or Cl_2 in H_2
  - Measurement of sulfur compounds in process gas in the paper and petrochemical industry
  - NO, NO_2, and NH_3 measurement in applications in nitric acid production
  - Optimization of NO_x emissions in the exhaust gas of the automotive industry
  - H_2S and SO_2 measurement in residual gas purification of sulfur recovery units (SRU)
  - Measurement of sulfur components in Claus plants
  - High H_2S concentrations in reactive or sour gases

KEY FEATURES

- Simultaneous measurement of NO and NO_2 with subsequent compilation. NO_2 converters or CLD analyzers are thus not required. Therefore:
  - Lower maintenance effort (no converter function check)
  - Reduced operating costs because no additional equipment required, e.g. ozone generator, etc.
- Measurement in the UV range
  - Measurement not affected by H_2O and CO_2
  - Very low SO_2 and NO measuring ranges possible
- **UV R**esonance **A**bsorption **S**pectrometry (UVRAS)
  - Measurement of very low NO concentrations: Measuring range 10 ppm
  - Very low cross-sensitivity to other gases
- Very long service life of UV lamp (typically 2 years)
- Low drifts and high stability by
  - four-channel measuring method and double quotient calculation
- True reference measurement for drift-free, stable measurement
- Combinable in a housing with OXOR-P or THERMOR and/or gas module
- All modules “temperature controlled”; thereby independent of ambient temperature fluctuations
- Optional adjustment device
  - Filter wheel with test cells which are swiveled into the optical path for calibration; no test gases are required
  - Adjustment: manual or automatic
- Options
  - Wall mounting case (IP 65) with separate, purgeable electronic and analysis sections
  - Wall mounting case in Ex versions for Zone 2 or Zone 1
  - Cuvette and gas lines in stainless steel or hastelloy
  - Process cuvette with purgeable windows
  - Heated gas lines and cuvette up to 80 °C (175 °F)

MEASURING PRINCIPLE

The DEFOR process photometer operates according to the principle of absorption in the ultraviolet radiation range. NO-specific as well as other wideband radiation fractions are emitted from an electrode-less discharge lamp in the ultraviolet spectral range. The radiation spectrum, required for measurement and reference of the respective gas component, is generated in the filter wheel unit by one or two revolving filter wheels. For NO measurement, DEFOR uses the gas filter correlation where the radiation spectrum for measurement and reference is separated by a cyclic swiveling in of an NO gas filter. For all other gases, interference filter correlation is used. Here, two interference filters with different transmission characteristics are swiveled into the beam path in succession. The beam splitter directs the filtered radiation to both reference and sample cuvettes. The detectors positioned behind the cuvettes, receive the radiation for the measurement and reference that arrive with a time offset. A quotient is calculated using the signal values received by each detector. Both detectors are then related to each other. This calculation of double quotients compensates not only for proportional signal drifts but also symmetric drifts. The gas concentration is derived from the double quotient.



DEVICE LAYOUT

Basic equipment

- 19″ rack housing with power supply unit, 4 rack units
- I/O module
- SCU operating unit
- Gas connections: Bulkhead fitting 6 mm PVDF

Options

- Automatic adjustment for 1, 2 or 3 UV measuring components
- Paramagnetic oxygen sensor module OXOR-P
- Conductivity sensor module THERMOR
- Gas module
- Connection via SOPAS-ET (software for installation on external PC)
- Optional gas connections: 6 mm Swagelok, 1/4″ Swagelok
- Gas paths with stainless steel tubes

Module OXOR-P

Oxygen sensor OXOR-P operates according to the precise paramagnetic principle. The distinct paramagnetic behavior of O_2 in the sample gas applies a torque on the diamagnetic dumbbell that is pivot mounted in a non-uniform magnetic field.

Module THERMOR

THERMOR is based on thermal conductivity in different gas mixtures. H_2, He, CO_2, Ar and other gases are measured with high precision in binary or quasi-binary mixtures.

Gas module

The gas module contains the sample gas monitoring sensors as well as the sample gas pump. Gas pump, flow sensor, humidity sensor as well as a pressure sensor for sample gas pressure or barometric compensation can be optionally integrated.

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Technical data				
Measuring Parameters				
Available measuring ranges DEFOR	Measuring components	Min.		Max.
	Chlorine Cl_2	125 ppm /400 mg/m³		100 vol %
	Nitrogen monoxide NO	10 ppm / 15 mg/m³		100 vol %
	Nitrogen dioxide NO_2	50 ppm / 105 mg/m³ 10 ppm / 20 mg/m³ [1]		100 vol %
	Sulfur dioxide SO_2	25 ppm / 75 mg/m³ 10 ppm / 30 mg/m³ [1]		100 vol %
	Ammonia NH_3	50 ppm / 40 mg/m³		100 vol %
	Carbon disulfide CS_2	50 ppm / 170 mg/m³		30 vol %
	carbonyl sulfide COS	250 ppm / 670 mg/m³		100 vol %
	hydrogen sulfide H_2S	25 ppm / 40 mg/m³		100 vol %
Available measuring ranges THERMOR	Measuring components	Min.		Max.
	Ar in O_2/N_2	5 vol %		100 vol %
	NH_3 in CO_2	15 vol %		100 vol %
	NH_3 in air	75 vol %		100 vol %
	He in N_2	2 vol %		100 vol %
	CO_2 in air	10 vol %		100 vol %
	H_2 in Ar/CO/air/CH_4/O_2/N_2	1 vol %		100 vol %
Available measuring ranges OXOR-P	Measuring components	Min.	Max.	Surpressed measuring range
	O_2	1 vol % [2]	100 vol %	up to 95 ... 100 vol % [2]
Measuring Conditions				
Sample gas temperature	0 ... +45 °C (32 ... 110 °F)			
Process pressure	–200 ... +300 hPa (–80 ... 120 inch H_2O); relative to atmospheric pressure			
Ambient Conditions	**19″ rack**		**Wall mounting case**	
Ambient temperature	+5 ... +45 °C (40 ... 110 °F)		+5 ... +45 °C (40 ... 110 °F)	
Approvals	**19″ rack**		**Wall mounting case**	
Protection class	IP 40		IP 65	
explosion protection			Zone 2: II 3 G Ex nR IICT6 II 3 G Ex pZ IICT6 Zone 1: II 2 G Ex pX IICT6	
Electrical safety	• CE, EMC Directive 2004/108/EC • Low Voltage Directive 2006/95/EC			
Inputs/Outputs, Interfaces	**Modules freely selectable and upgradeable according to customer requirement**			
Analog outputs	4 outputs, electrically isolated: 4 ... 20 mA, max. load 500 Ω			
Analog inputs	2 inputs, not electrically isolated, 4 ... 20 mA			
Digital outputs	8 outputs, contact load: max. 0.5 A, max 48 V DC /34 V AC			
Digital inputs	8 inputs: 14 ... 42 V, all inputs with shared reference potential			
Interfaces	Ethernet; extendable via SCU control unit			
Bus protocol	OPC (option) via SOPAS-ET			
General Information				
Design	• 19″ rack (4 RU) • Wall mounting case			
Operation	Via display (SCU) and/or PC software SOPAS-ET			
Power supply	90 ... 264 V AC / 47 ... 63 Hz or 125 ... 370 V DC			

[1] When calibrated daily and in temperature controlled environment ±2 °C (35.6 °F)
[2] Option

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