On line Gas Analyser

CEM400

TETHYS Instruments
57, Chemin du vieux Chêne, 38240 MEYLAN -France-

Tel : +33 4 76 41 86 39 - **Fax** : +33 4 76 41 92 27
Mail : sales@tethys-instruments.com - **Web** : www.tethys-instruments.com

On line Gas Analyser

CEM400

The CEM400 is an extractive on-line gas analyser dedicated to continuous emission monitoring (CEM).

It is based on UV spectroscopy that brings a higher sensitivity than infra-red and gives the possibility to measure several gases simultaneously.

A high selectivity is achieved by a fast Fourier transform (FFT) on the absorbance spectrum for all the gases having a periodic structure like NH3, SO2, NO and some others.

All the internal gas circuit is heated at 190°C to admit directly hot and humid combustion gases.

the CEM400 stand in a watertight wall mounted enclosure.

This model may include a heated sampling pump as an option.

Advantages

CEM400

Optical Principle - Main Method : UV Spectroscopy

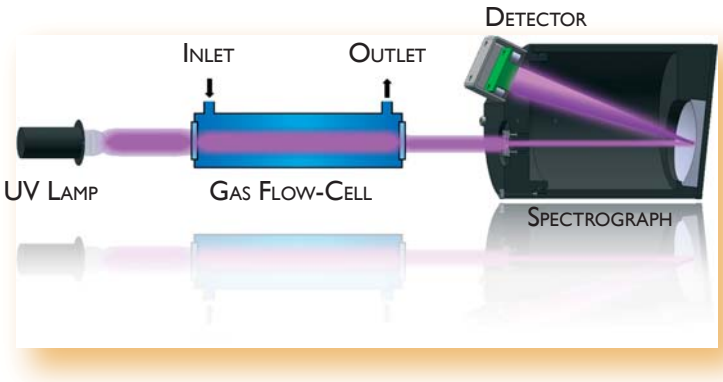
Several gases can be measured simultaneously thanks to the UV spectroscopy method by using different wavelengths and algorithms. For gases with a periodic absorption spectrum such as NH3, SO2, NO, CS2, formaldehyde or acetylene, an algorithm based on FFT (Fast Fourier Transform) guarantees a very good selectivity of measurement.
The solid-state design due to the UV spectroscopy gives a high reliability of the measuring system with quite no maintenance.

The UV lamp is a xenon flash lamp with a high lifetime and without thermal effect that may generate measurement drift.
The gas flow cell has two quartz windows to transmit the UV light throught the measured gas. The standard path length of the flow cell is 240 mm.

The spectrograph is based on a concave grating to minimize the optical parts and the spectrum is read on a 254 or 512 pixels diode array.

A zero is done automatically on zero air or nitrogen with an adjustable period (if possible every 2 or 4 hours but once per day remains acceptable).

The absorbance spectrum is calculated from the reference spectrum acquired during the zero step.



The measuring principle is based on the UV light absorption according to the Beer-Lambert Law:

$$[C] = K \log \frac{Iref}{Igas}$$

[C] : Concentration of the sample
K : Absorption coefficient at a specific wavelength for a specific gas
Iref : Light intensity on the zero air
Igas : Light intensity on the sample

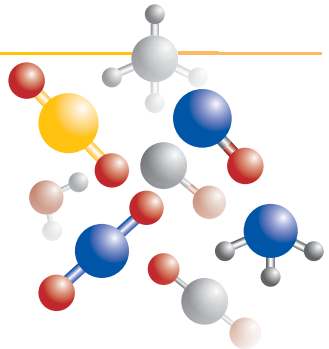
Heated Version

The analyser is provided with an heating system for the gas circuit. The heating temperature can be adjusted up to 190°C. The high temperature evaporates any deposits on the windows.

No Interference With CO, CO2 and CH4

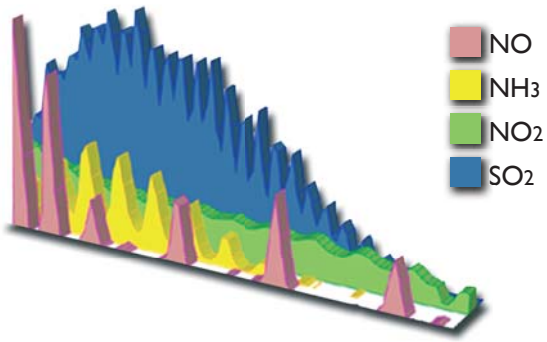
The major emission gases like CO, CO2, and CH4 have no UV absorption, therefore they don't interfere with the measured gases.

H2O has a weak absorption in the UV range but at different wavelengths than combustion gases like NH3, NO, NO2 or SO2. Consequently, H2O, with an usual concentration between 5% and 20%, is not disturbing the measurements



Multi-Gas Configuration

Several gases can be measured in a same analyser if the sample gas composition is compatible with the selected algorithms and wavelengths.
The analyser gives high measurement selectivity thanks to the recognition of the specific UV absorption spectrum of gases by using proprietary algorithms.



ADVANTAGES

CEM400

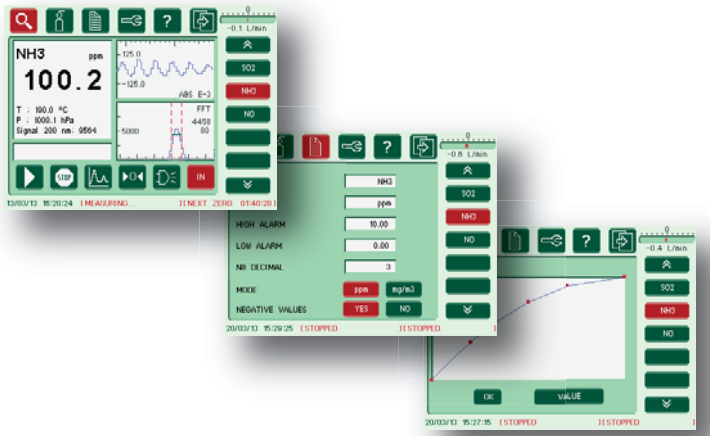
LOW MAINTENANCE AND HIGH RELIABILITY

THE DESIGN HAS BEEN SPECIALLY ORIENTED FOR LOW MAINTENANCE AND HIGH RELIABILITY ON THE MEASUREMENTS.

THE UV XENON LAMP IS SPECIFIED FOR A LIFETIME OF 10^9 FLASHES. THEREFORE, THE LIFETIME IS ABOUT 1 YEAR WITH CONTINUOUS MEASUREMENTS OR 10 YEARS WITH ONE MEASUREMENT PER MINUTE.
THIS REDUCES CONSIDERABLY THE MAINTENANCE AND THE RISK OF WRONG MEASUREMENT DUE TO AGED LAMPS OR ITS REPLACEMENT.

USER-FRIENDLY INTERFACE

A COLOUR TOUCH SCREEN DISPLAY INTERFACE ALLOWS THE USER TO EASILY NAVIGATE THROUGH
A NUMBER OF SCREENS THAT ARE USED TO SET AND CHECK ALL OF THE OPERATING CONDITIONS OF THE INSTRUMENT.
A PROTECTIVE FILM LIMITS THE RISK TO DAMAGE THE SURFACE OF THE TOUCH SCREEN,
ESPECIALLY AGAINST SOLVENT AND CORROSIVE LIQUID.



MEASURING TIME

FOR PROCESS THAT REQUIRES FAST MEASUREMENT LIKE MOTOR BENCH APPLICATION, THE ANALYSER IS ABLE TO MEASURE THE SAMPLE CONCENTRATION WITHIN 200 MILLISECONDS THANKS TO AN ULTRA FAST ELECTRONICS DESIGN BASED ON HIGH SPEED DSP (DIGITAL SIGNAL PROCESSOR). HOWEVER, USUAL MEASUREMENTS ON EMISSION GASES ARE PERFORMED WITHIN 5 SECONDS. A SPECIAL AUTO AVERAGING ALGORITHM CAN BE ACTIVATED TO IMPROVES THE STABILITY WITHOUT AFFECTING THE RESPONSE TIME.

GAS CIRCUIT

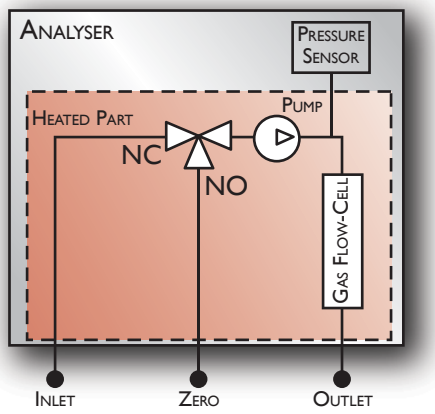
THREE GAS CONNECTIONS ARE AVAILABLE ON THE REAR PANEL OF THE ANALYSER :

- INLET FOR THE SAMPLE
- ZERO AIR OR NITROGEN
- OUTLET FOR SAMPLE OR ZERO

INLET AND ZERO ARE CONNECTED ON A 3 WAYS ELECTRIC VALVE. WHEN THE AUTOMATIC ZERO IS ACTIVATED, THE SOLENOID VALVE SWITCHES THE FLOW CELL ON ZERO AIR. A PRESSURE SENSOR TAKES THE PRESSURE OF MEASURED GAS TO COMPENSATE IT AND TO GIVE A FLOW INDICATION.

ALL THE GAS CIRCUIT IS IN A HEATED COMPARTMENT CONTROLLED WITHIN +/- 0.5 °C AT AN ADJUSTABLE TEMPERATURE BETWEEN 60°C AND 190°C.

AN OPTIONAL PUMP MAY BE INCLUDED BEFORE THE GAS FLOW CELL IN ORDER TO PUMP THE SAMPLE AS WELL AS THE ZERO GAS THAT MAY BE AMBIANT AIR FOR MOST OF THE APPLICATIONS.



AUTOMATIC COMPENSATION

AN INTERNAL MEASUREMENT OF TEMPERATURE AND PRESSURE OF THE SAMPLE IS PERFORMED. A RATIO RELATED TO THE IDEAL GAS LAW IS APPLIED ON THE MEASURED VALUE TO COMPENSATE THE EFFECTS OF TEMPERATURE AND PRESSURE.

COMMUNICATION

RECORDED DATA AND DIAGNOSTIC FILES FOR EACH PARAMETER CAN BE DOWNLOADED TO MEMORY STICK THANKS TO A USB PORT.
THIS ALLOWS TO COLLECT EASILY THESE FILES ON SITE WITHOUT USING A COMPUTER. THE FILES ARE IN TEXT FORMAT AND CAN BE DIRECTLY IMPORTED TO EXCEL® FOR GRAPHIC CHARTS.

Technical Documentation

CEM400

Parameters	Range*(ppm)	Range*(mg/m3)	Detection limit**	Repeatability***
NH3 Ammonia	0 - 10 ppm 0 - 100 ppm 0 - 1000 ppm	0 - 7 mg/m3 0 - 70 mg/m3 0 - 700 mg/m3	0.1 ppm 0.1 ppm 0.1 ppm	0.05 ppm at 10 ppm 0.1 ppm at 100 ppm 0.5 ppm at 1000 ppm
NO Nitrogen oxide	0 - 2000 ppm	0 - 2500 mg/m3	3 ppm	1 ppm at 1000 ppm
SO2 Sulfur dioxide	0 - 1000 ppm	0 - 3000 mg/m3	0.5 ppm	2ppm at 1000 ppm
H2S Hydrogen sulfide	0 - 500 ppm	0 - 750 mg/m3	0.5 ppm	0.5 ppm at 500 ppm
NO2 Nitrogen dioxide	0 - 2000 ppm	0 - 4000 mg/m3		
CS2 Carbon disulfide	0 - 100 ppm	0 - 300 mg/m3		
C6H6 Benzene	0 - 100 ppm	0 - 300 mg/m3		
C7H8 Toluene	0 - 30 ppm	0 - 100 mg/m3		
C8H10 Xylene	0 - 30 ppm	0 - 150 mg/m3		
NCL3 Nitrogen trichloride	0 - 100 ppm	0 - 500 mg/m3		

*Higher range available on request

**Typical Detection limit as 3x sigma on zero gas, 10 sec response time, Pressure of 1000hPa (May be increased by gases mixing)

***Typical Repeatability as1x sigma on standard gas, 10 sec response time, Pressure of 1000 hPa (may be increased by gases mixing)

The measurement range is given for an optical path of 240 mm

Specifications

CEM400

Data storage	5000 measurements for all parameters
Interfaces	Interface RS232 (MODBUS, AK and http / html5 protocol) USB Port (for memory stick) External WIFI interface IEEE 802.11 b (option) External Ethernet 10 Base-T interface IEEE 802.3 (option)
Signals	1 to 8 analog outputs 4-20 mA opto-isolated (option) 1 to 4 relay contacts programmable (option)
Display	LCD colour screen (TFT) with LED backlight 320x240 pixels
Power supply	90-264 VAC / 1000 VA / 50-60Hz
Operatings limits	0 to 40 °C, less than 90% as relative humidity
CE standards	Electromagnetic compatibility and safety *EN 61010-1, IEC 61010-1 / EN 61326, IEC 61326*
Enclosure	Wall mounting enclosure (IP65), Coated steel
Dimensions	410 x 571 x 255 mm (H x W x D)
Weight	35 kg
Sampling gas	Pressure : 0 – 2 Bar Absolute (0 – 2000 hPa Absolute) Flow : 0.1 to 10 l/min Temperature : ambiant to 400 C Fittings : Swagelok, stainless steel 316 for tube OD ¼" (6.4 mm)
Zero gas	Pressure : 0 – 2 Bar Absolute (0 – 2000 hPa Absolute) Flow : 0.1 to 10 l/min Fittings : Swagelok, stainless steel 316 for tube OD ¼" (6.4 mm)