EXM500
Online Gas Analyser

TETHYS INSTRUMENTS

Specialist Of UV Spectroscopy

> EXM500 Online Gas Analyser

*The **EXM500** is an extractive online gas analyser dedicated to **C**ontinuous **E**mission **M**onitoring*

This new model is based on a 2048 pixels CCD (charge-coupled device) giving a higher resolution (0.1 nm) and a longer lamp life time (3 years)

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 others.

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

The EXM500 is presented in a standard 19" rack.

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

- 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 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 2048 pixel CCD with a resolution of 0.1nm.

- 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.

Detector

Inlet   Outlet

UV Lamp   Gas Flow-Cell   Spectrograph
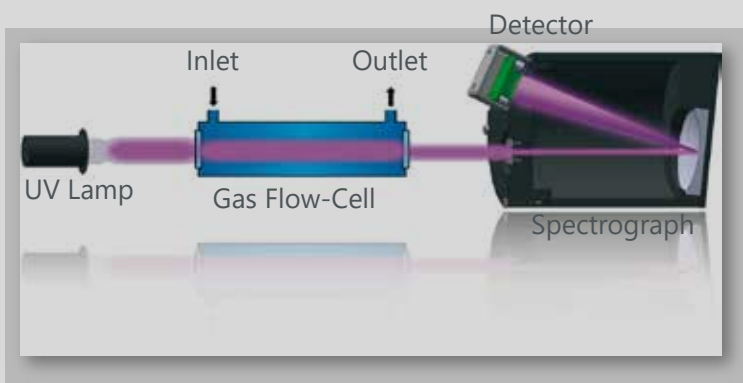
The measuring principle is based on the UV light absorption according to the Beer-Lambert Law:

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

[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

NO
NH3
NO2
SO2
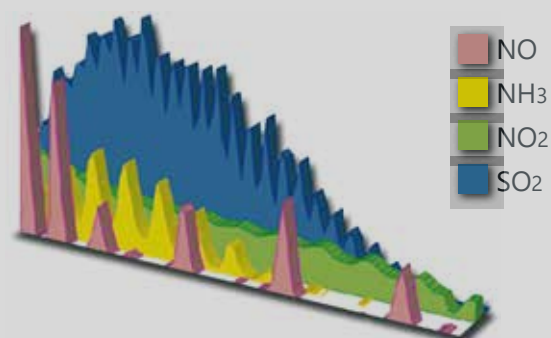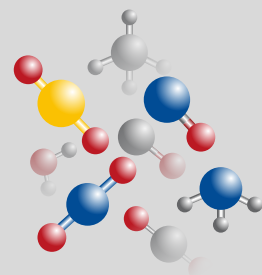
Several gases can be measured in a same analyser if the sample gas composition is compatible with the selected algorithms and wavelengths.
The analyser gives high measurement selectivity thanks to the recognition of the specific UV absorption spectrum of gases by using proprietary algorithms.
For Denox applications, special algorythms allow to measure NH3 in a 0-10 ppm range with high level of SO2 up to 1200 ppm like on coal power plants.

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 3 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.
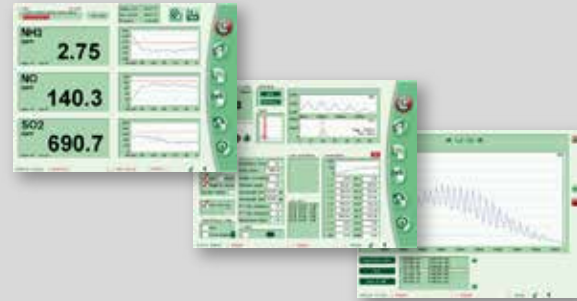
Measuring **Time**

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
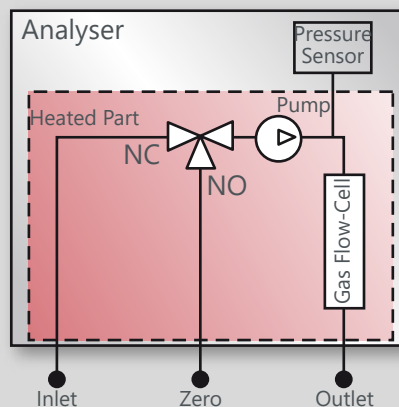
Inlet and zero are connected on a 3 ways electric valve. When the automatic zero is activated, the solenoid valve switches the flow cell on zero air. A pressure sensor takes the pressure of measured gas to compensate it and to give a flow indication.

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.
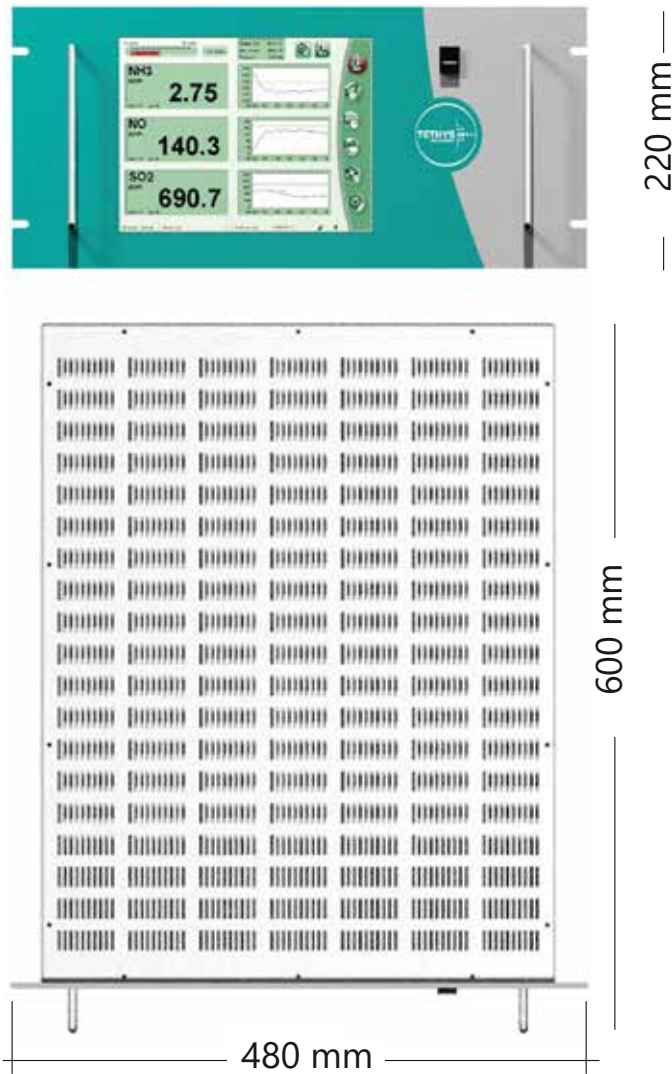
Communication

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.

Parameter	Range* (ppm)	Range* (mg/m3)	Typical Repeatability	Detection Limit *Typical Detection limit as 3x sigma on zero gas, 60 sec response time at 90%,*
NH3 Ammonia	0-10 ppm 0-100 ppm 0-1000 ppm	0 - 7 mg/m3 0 - 70 mg/m3 0 - 700 mg/m3	0.05 ppm at 10 ppm 0.1 ppm at 100 ppm 0.5 ppm at 1000 ppm	0.1 ppm
NO Nitrogen Oxide	0-2000 ppm	0 - 2500 mg/m3	1 ppm at 1000 ppm	3 ppm
SO2 Sulfur Dioxide	0-1000 ppm	0 - 3000 mg/m3	2 ppm at 1000 ppm	0.5 ppm
H2S Hydrogen Sulfide	0-500 ppm	0 - 750 mg/m3	0.5 ppm at 500 ppm	0.5 ppm
NO2 Nitrogen Dioxide	0-2000 ppm	0 - 4000 mg/m3		10 ppm
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

> EXM500 General Specifications

Data storage	5000 measurements for all parameters
Interfaces	Interface RS232 (MODBUS, AK) USB port (for memory stick) Internal WIFI interface IEEE 802.11 B (OPTION) Internal 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 640x480 pixels
Power supply	110-240 VAC/ 1000 VA / 50-60 Hz
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	Rack 5U, coated steel, IP00
Dimensions	Rack 5U (600mm x 480mm x 220mm)
Weight	25 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)

The manufacturer reserves the right to modify and/or change any specifications, dimensions, design or drawing at any time without prior notice

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> EXM500 Parts references

Basic unit

EXM500 **Basic unit (one gas included)**
Recommended flow for sample and zero air: 0.1 to 10 litres/min
Fittings: Swagelok stainless steel 316 for tube OD ¼" (6.35 mm)
Color graphic display 640x480 pixels with touch screen
Built-in data logger, memory 5000 measurements
12 sockets for input and output modules (not included, refer to options)
RS232 included (Sub-D 9 ways female connector) with 2 meters cable for PC
USB Port for USB key (measurements and configuration download, software update)
Power supply 110-240 VAC 47-63 Hz 1000 VA with power cord 2 meters
Rack 19' 5U IP00 (482x220x560 mm, 25 kg)
Sampling pump not included (see options)
Heated version at 190 °C (adjustable)
For use on wet combustion gas

Internal pump

PUMP500 **Internal membrane pump with heated head**
Built-in inside the enclosure
Flow about 6 l/min
Heated version at 190 °C

Additional gases *(The measurement range is given for an optical path of 240 mm)*

Additional gas
4-20 mA isolated output included

NH3 **Ammonia**
Range: 0 - 10 ppm or 0 – 100 ppm NH3 (0 - 7 mg/Nm3 or 0 – 70 mg/Nm3 NH3)
Measurement possible until 1000 ppm NH3 (or 700 mg/Nm3 NH3)

H2S **Hydrogen sulphide**
ange: 0 – 500 ppm H2S (or 0 – 750 mg/Nm3 H2S)
Measurement possible until 1000 ppm H2S (or 0 – 1500 mg/Nm3 H2S)

NO **Nitric oxide**
Range: 0 – 2000 ppm NO (or 0 – 2500 mg/Nm3 NO)
Measurement possible until 5000 ppm NO (or 6000 mg/Nm3 NO)

NO2 **Nitrogen dioxide**
Range: 0 – 2000 ppm NO2 (or 0 – 4000 mg/Nm3 NO2)
Measurement possible until 5000 ppm NO2 (or 10000 mg/Nm3 NO2)

SO2 **Sulfur dioxide**
Range: 0 – 500 ppm SO2 (or 0 – 1500 mg/Nm3 SO2)
Measurement possible until 1000 ppm SO2 (or 3000 mg/Nm3 SO2)

C6H6 **Benzene**
Range: 0 – 100 ppm C6H6 (or 0 – 300 mg/Nm3 C6H6)
Measurement possible until 200 ppm C6H6 (or 600 mg/Nm3 C6H6)

C7H8 **Toluene**
Range: 0 – 30 ppm C7H8 (or 0 – 100 mg/Nm3 C7H8)
Measurement possible until 60 ppm C7H8 (or 200 mg/Nm3 C7H8)

C8H10 **Xylene**
Range: 0 – 30 ppm C8H10 (or 0 – 100 mg/Nm3 C8H10)
Measurement possible until 60 ppm C8H10 (or 200 mg/Nm3 C8H10)

CS2 **Carbone disulfide**
Range: 0 – 100 ppm CS2 (or 0 – 300 mg/Nm3 CS2)
Measurement possible until 1000 ppm CS2 (or 3000 mg/Nm3 CS2)

C2H2 **Acetylene**
Range: 0 – 5000 ppm C2H2 (or 0 – 5000 mg/Nm3 C2H2)
Measurement possible until 10,000 ppm C2H2 (or 10,000 mg/Nm3 C2H2)

Input modules

IN4-20 **4-20 mA input module**
Isolated 4-20 mA input
Impedance: 100 Ohm

LOGIC500 **Double logical inputs module**
Input no 1 : external pulse command for measurement
Input no 2 : measurements inhibition
Isolated 0 – 24 V DC inputs
Impedance: >10 Kohm

Output modules

OUT4-20 **4-20 mA output module** (Included with one gas)
Isolated 4-20 mA output
Active output, Max load 500 Ohm

RELAY500 **Relay module**
Contact rating: 2A/220V

Communications

ETHER500 **Ethernet interface**
Ethernet 10 base-T (IEEE 802.3)

Recommanded consumables for 2 years :

L-XEN-1: xenon lamp with trigger (x1)
MKIT-SPL- G-1: Pump kit with membrane (x2) only if sampling pump

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Management System
ISO 9001:2008

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