



On-Line Gas Analyser

EXM400

TETHYS Instruments

EXM400
On-line Gas Analyser

Parameters

- NH3
- NO
- NO2
- SO2
- H2S
- Benzene
- Toluene
- Xylene

The EXM400 is the new generation of extractive gas analyser from Tethys Instruments. Specialized on ammonia gas detection by UV spectroscopy, Tethys now extended its technology to monitor a wide range of UV absorbing gases.

The EXM 400 is designed to work under harsh conditions with high performance measurements. Solid state technology and proprietary spectrum interpretation methods make it the system of choice for large demanding applications.

General

10 year UV lamp lifetime

The UV xenon lamp is specified for 10^9 flashes which gives more than 10 years of lifetime with one measurement per minute.

Maintenance and replacement costs are reduced as well as the risk to perform bad measurements due to lamp aging.

Automatic zeroing & calibration

Instrument zeroing is done automatically on zero air with an adjustable period to guaranty very accurate measurements. On most applications, ambient air can be used directly.

The factory set scale factor of the UV measurements is intrinsically stable, depending solely on the flow cell length (Beer-Lambert law). The EXM400 is therefore factory calibrated and normally no further calibration is necessary.

No risk of interference with O2, N2, CO, CO2, H2O

Major emission gases like O2, N2, CO, CO2 and H2O do not have UV absorption.

At the opposite of IR based systems, their presence in gas mixtures monitored by the EXM400 will not affect the measurements at all.

Heated version (option)

For applications on wet combution gases, the internal gas circuitry is heated at 180 °C to avoid condensation.

Configurable from one to eight gases, depending on the application

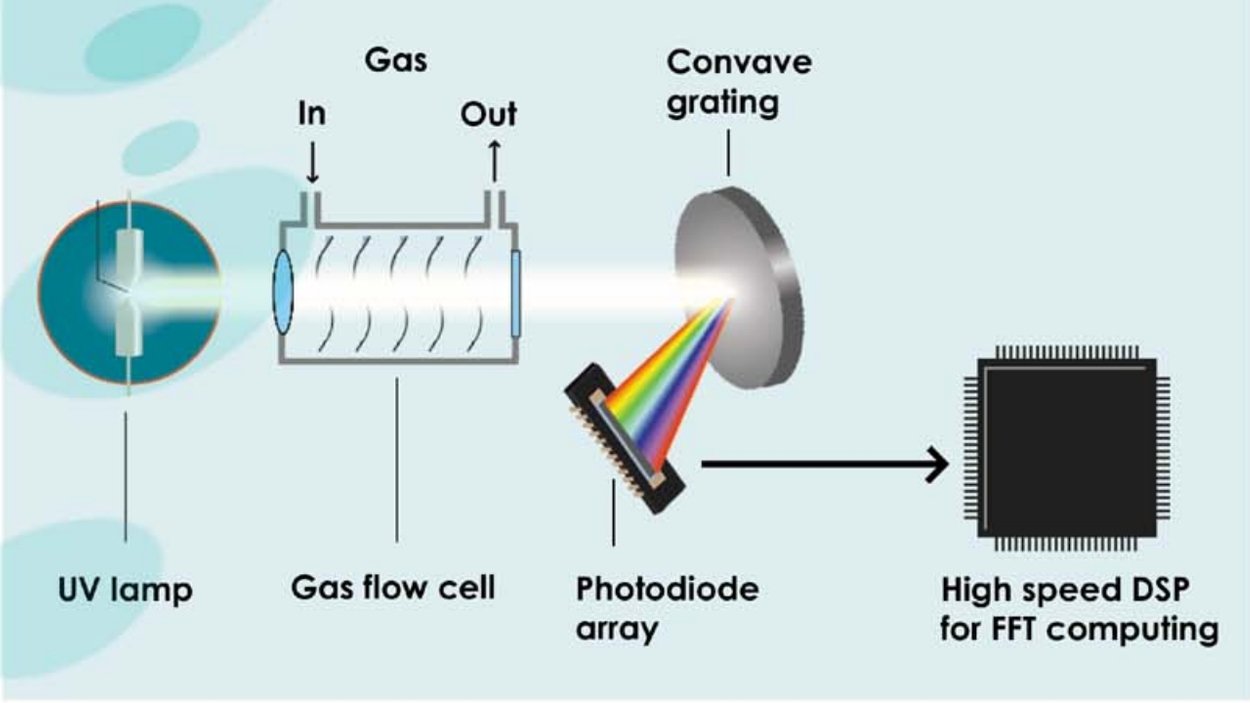
Implementing advanced UV spectrum analysis, the EXM400 is easily factory configurable to meet the user's application. Most combination of UV absorbing gases can be measured by the analyzer. A simple cost structure applies for more than one gas. High selectivity is ensured by applying aspecific algorithms for signal analysis.

Features

- **Ultra fast response time**
- **Solid state technology**
- **High measurement selectivity**
- **No converter**
- **No risk of interference with CO, CO2, H2O, CH4**
- **Multi-gas configuration**
- **Heated version (180°C)**
- **User-friendly touch screen**
- **Electronic flow meter**
- **Automatic pressure and temperature compensation**

The EXM 400 is based on a high performance DSP (Digital Signal Processor) for an ultra fast response time.
The device enables a high measurement selectivity thanks to the recognition of the specific UV spectrum of gases by proprietary algorithms using Fast Fourier Transform and mean square method.
The major emission gases like CO, CO2, H2O and CH4 do not have UV absorption, and so will never interfere with the measured gases.
For applications on the flue gas, the EXM 400 can be provided with a heated gas circuit.
The user-friendly colour touch screen interface gives an easy way to check and calibrate each parameter.
For each measurement, the analyser takes into account the pressure and the temperature of the gas.

Measurement principle

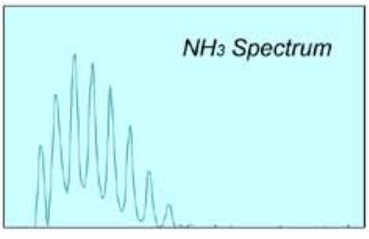


The measurement is based on **UV spectroscopy**. The concentration of different gases is determined by measuring the absorbed wavelenght and the intensity of the absorption trought the path lenght of the flow cell.

NH_3

Measuring principle

The measurement principle is based on the UV absorption spectrum of the ammonia gas (NH_3) in the UV range.



The periodic structure of the absorption bands coming from the different levels of rotational energy of the gas molecules is analysed by performing a Fourier Transform on the absorption spectrum with a high speed DSP*.

The selectivity of the analyser is guaranteed by the typical periodic structure of the analysed gas, different for any other gases.

The optical path length of the analyser could be adapted to a range of measurement from ppm to hundreds of ppm.

A calibration verification (or recalibration under exceptional circumstances) may have to be conducted but only over a period of several months due to the inherent stability of the measurement system.

*DSP: Digital Signal Processor

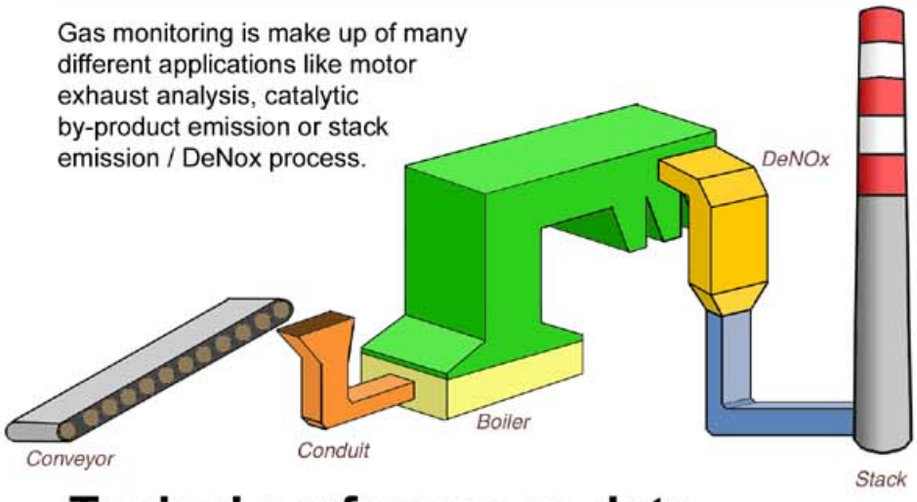
Comparison with other methods

In the FTIR approach, the Fourier Transform is done by optical components. At the opposite, the Fourier Transform in the UV range is done by electronic circuits, which constitutes a more reliable and economical solution.

The method using NH3 to NO conversion under high temperature need maintenance, and could have a drift of conversion efficiency. Moreover, the response time is sigificantly higher.

Application

Gas monitoring is make up of many different applications like motor exhaust analysis, catalytic by-product emission or stack emission / DeNox process.



The SCR DeNOx system on flue gas is one of the typical applications for the EXM 400.
The process involves the reduction of NO to N_2 with urea or ammonia.

The overall reaction is:
$4NO + 4NH_3 + 0_2 \rightarrow 4N_2 + 6H_2O$

The measurement of NH3 and NOx is essential to control the DeNOx process.

NO
NO_2
NH_3
SO_2

Typical performance data

Range of measurement : 0 - 100 ppm *
0 - 75 mg/m³

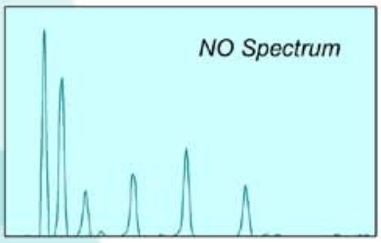
Typical repetability : +/- 0.2 ppm
+/- 0.15 mg/m³

* Note : Higher range available on request

NO

Measuring principle

The measurement principle is based on the UV absorption spectrum of the nitrogen oxyde gas in the UV range.



The absorption spectrum treatments are done with a high speed DSP*.

The optical path length of the analyser could be adapted to a range of measurement from ppm to thousands of ppm.

The sensitivity is determined by the optical path length of the quartz flow cell, which remains perfectly constant and thereby eliminates periodic recalibration of the analyser.

A calibration verification (or recalibration under exceptional circumstances) may have to be conducted but only over a period of several months due to the inherent stability of the measurement system.

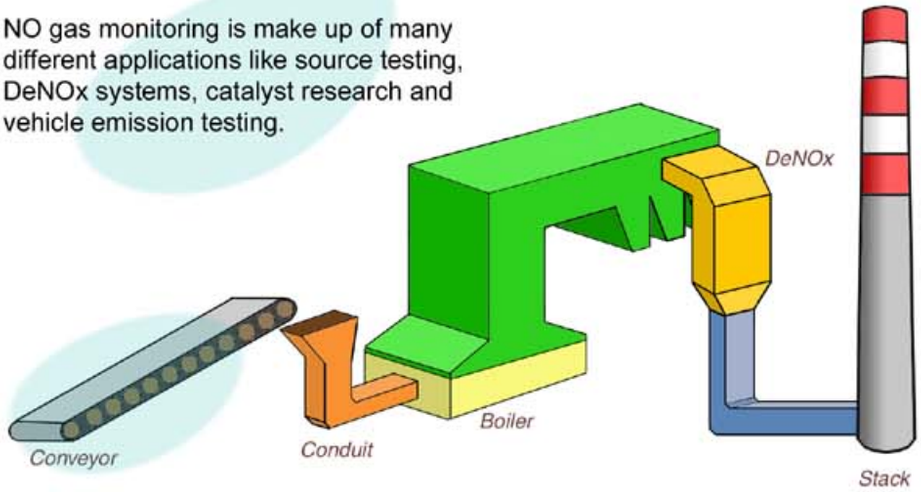
*DSP: Digital Signal Processor

Comparison with other methods

The NO can be monitoring by chemical-luminescence method. But the measurement are subject to interference or quenching effect caused by CO_2, H_2O and NH_3. Moreover it is a mono-gas measurement method.

Application

NO gas monitoring is make up of many different applications like source testing, DeNOx systems, catalyst research and vehicle emission testing.



The SCR DeNOx system on flue gas is one of the typical applications for the EXM 400.
The process involves the reduction of NO to N_2 with urea or ammonia.

The overall reaction is:
$4NO + 4NH_3 + 0_2 \rightarrow 4N_2 + 6H_2O$

The measurement of NH3 and NOx is essential to control the DeNOx process.

NO
NO_2
NH_3
SO_2

Range

Range of measurement : 0 - 2000 ppm *
0 - 2680 mg/m^3

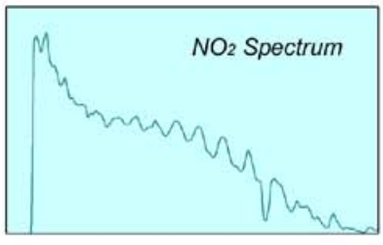
Typical repetability : +/- 5 ppm
+/- 8 mg/m^3

* Note : Higher range available on request

NO_2

Measuring principle

The measurement principle is based on the UV absorption spectrum of the nitrogen dioxyde gas in the UV range.



The absorption spectrum treatments are done with a high speed DSP*.

The optical path length of the analyser could be adapted to a range of measurement from ppm to thousands of ppm.

The sensitivity is determined by the optical path length of the quartz flow cell, which remains perfectly constant and thereby eliminates periodic recalibration of the analyser.

A calibration verification (or recalibration under exceptional circumstances) may have to be conducted but only over a period of several months due to the inherent stability of the measurement system.

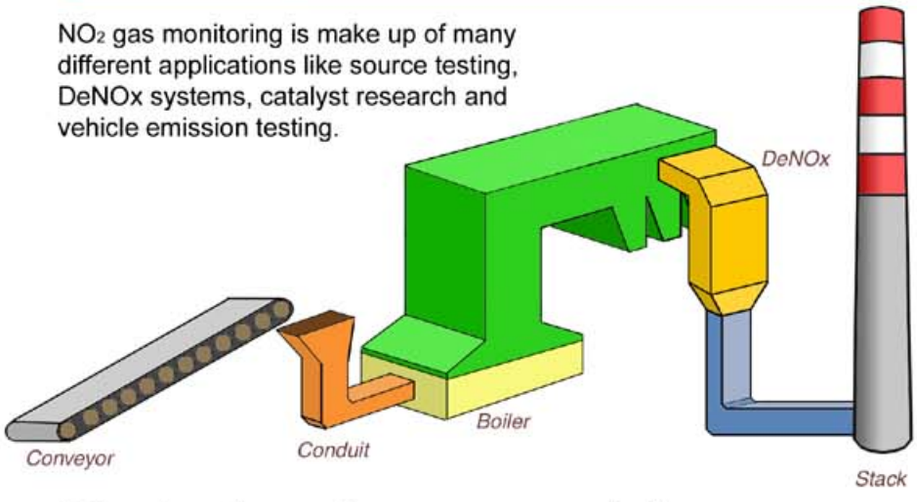
*DSP: Digital Signal Processor

Comparison with other methods

The NO_2 can be monitoring by chemical-luminescence method.
But this method needs maintenance, and it is a mono-gas measurement method.

Application

NO_2 gas monitoring is make up of many different applications like source testing, DeNOx systems, catalyst research and vehicle emission testing.



The SCR DeNOx system on flue gas is one of the typical applications for the EXM 400.
The process involves the reduction of NO to N_2 with urea or ammonia.

The overall reaction is:
$4NO + 4NH_3 + 0_2 \rightarrow 4N_2 + 6H_2O$

The measurement of NH3 and NOx is essential to control the DeNOx process.

NO
NO_2
NH_3
SO_2

Typical performance data

Range of measurement : 0 - 2000 ppm *
0 - 4100 mg/m^3

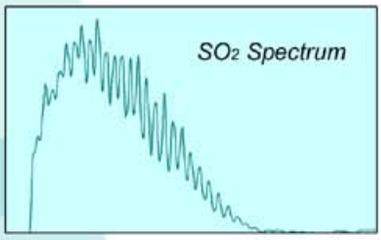
Typical repetability : +/- 10 ppm
+/- 20 mg/m^3

* Note : Higher range available on request

SO_2

Measuring principle

The measurement principle is based on the UV absorption spectrum of the SO_2 gas in the UV range.



The periodic structure of the absorption bands coming from the different levels of rotational energy of the gas molecules is analysed by performing a Fourier Transform on the absorption spectrum with a high speed DSP*.

The selectivity of the analyser is guaranteed by the typical periodic structure of the analysed gas, different for any other gases.

The optical path length of the analyser is adapted to a range of measurement from ppm to hundreds of ppm.

A calibration verification (or recalibration under exceptional circumstances) may have to be conducted but only over a period of several months due to the inherent stability of the measurement system.

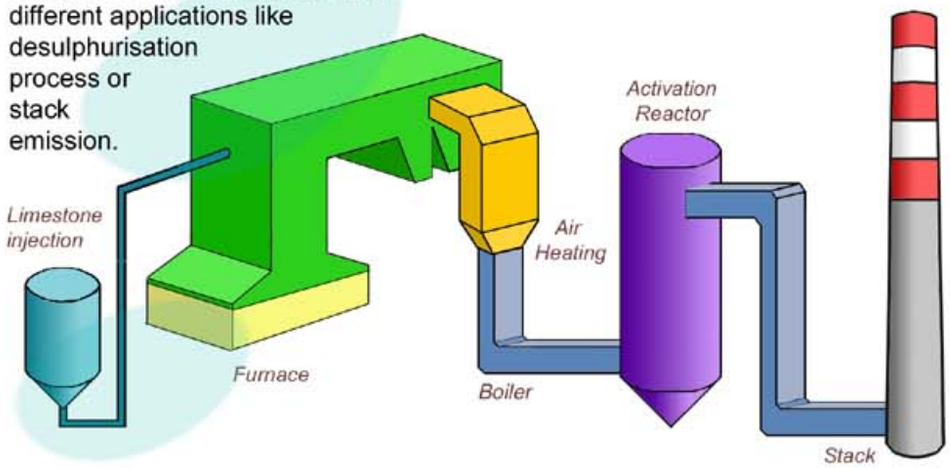
*DSP: Digital Signal Processor

Comparison with other methods

The SO_2 can be monitoring by UV fluorescence method. But this method is essentially mono-gas. Moreover, benzene, toluene and xylene may interference with this method.

Application

SO_2 gas monitoring is make up of different applications like desulphurisation process or stack emission.



One of process to reduce the SO_2 gas is the desulphurisation process by furnace limestone injection.

The principle is to pulverise limestone in the flue gas.
Under high temperature, the limestone reacts with the SO_2 following the chemical equations :

$CaCO_3 \rightarrow CaO + CO_2$
$CaO + SO_2 + {}^1/_2\, O_2 \rightarrow CaSO_4$

Range

Range of measurement : 0 - 1000 ppm *
0 - 2860 mg/m^3

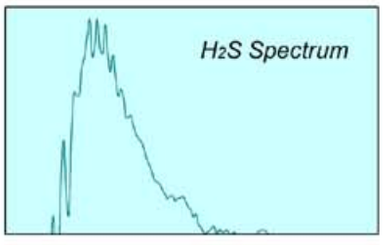
Repetability : +/- 5 ppm
+/- 15 mg/m^3

* Note : Higher range available on request

H_2S

Measuring principle

The measurement principle is based on the UV absorption spectrum of the hydrogen sulfide (H2S) in the UV range.



The absorption spectrum treatments are done on the with a high speed DSP*.

The optical path length of the analyser could be adapted to a range of measurement from ppm to hundreds of ppm.

The sensitivity is determined by the optical path length of the quartz flow cell, which remains perfectly constant and thereby eliminates periodic recalibration of the analyser.

A calibration verification (or recalibration under exceptional circumstances) may have to be conducted but only over a period of several months due to the inherent stability of the measurement system.

*DSP: Digital Signal Processor

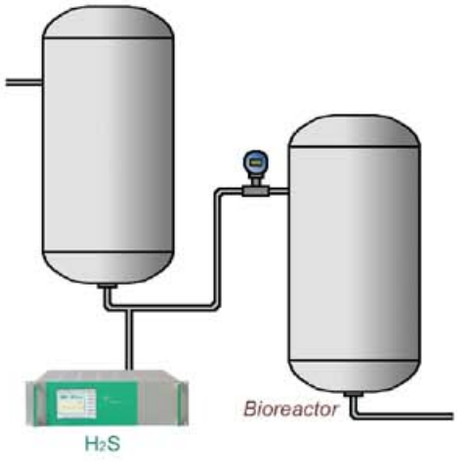
Comparison with other methods

The H_2S gas can be monitoring by electrochemical system, but this method suffers of drift problems and is more adapted to security application with no regular concentration.

Moreover the sensor need to be replaced on a regular basis.
H_2S can be measured by chromatography but this method is complex, expensive and need more maintenance.

Another method is based on H2S to SO2 conversion under high temperature, but there is require more maintenance, and the conversion efficiency may change.

Application



H_2S gas monitoring is make up of different applications like bioreactors or biodigesters, wastewater treatment plants, natural gas monitoring, or gas manufacturers.

Waste water contains naturally dissolved H_2S. Therefore, on some water treatment plant, it is required to take off H_2S in order to avoid a formation of H_2SO_4 in water.

Bio-digesters are used extensively to process sewage sludge and other waste streams. As a by-product of this process large quantities of methane gas and carbon dioxide are produce. Moreover, the digester can contain high concentration of H_2S which is a very corrosive and dangerous gas.

Typical performance data

Range of measurement : 0 - 100 ppm *
0 - 150 mg/m^3

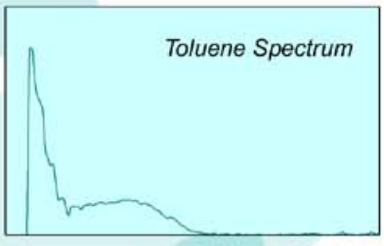
Repetability : +/- 0.2 ppm
+/- 0.3 mg/m^3

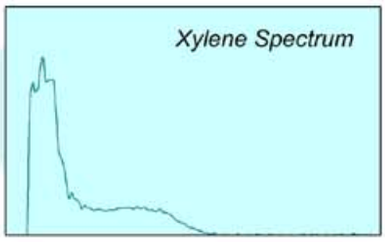
* Note : Higher range available on request

Benzene, Toluene, Xylene

Measuring principle

The measurement principle is based on the UV absorption spectrum of the benzene gas in the UV range.





The absorption spectrum treatments are done with a high speed DSP*.

The optical path length of the analyser is adapted to a range of measurement from ppm to hundreds of ppm.

The sensitivity is determined by the optical path length of the quartz flow cell, which remains perfectly constant and thereby eliminates periodic recalibration of the analyser.

A calibration verification (or recalibration under exceptional circumstances) may have to be conducted but only over a period of several months due to the inherent stability of the measurement system.

*DSP: Digital Signal Processor

Comparison with other methods

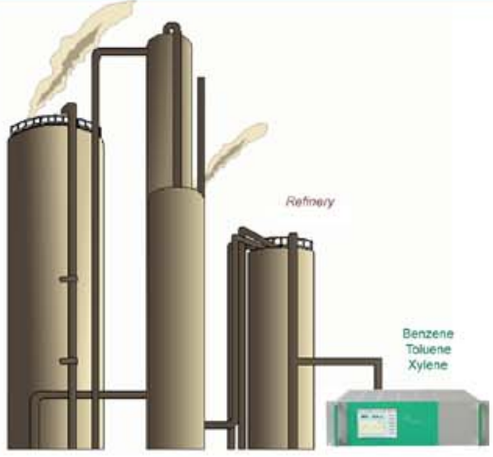
The benzene gas can be monitoring by electrochemical system, but this method suffers of drift problems, and has a low sensibility.

Benzene, toluene or xylene can be measured by chromatography. But this method is complex, expensive and need more maintenance.

Another method is by flame ionisation detector (FID), but this method needs to use hydrogen with risk of explosion and problem of storage.

Application

Benzene gas monitoring is make up of many different applications like process chemical (refinery) or control of ambiant air.



Typical performance data

Benzene : 0 - 50 ppm *
0 - 175 mg/m^3

Toluene : 0 - 25 ppm
0 - 100 mg/m^3

Xylene : 0 - 25 ppm
0 - 120 mg/m^3

* Note : Higher range available on request

Specification

Sampling gas:	Relative pressure: min -0.1 bar (0 PSI), max 0.1 bar (1.5 PSI) Flow: 0.1 to 5 litre/min(0.025 to 1.5 GPM) Temperature: min 0 °C (32 °F) max 80 °C (176 °F), heated version at 180 °C (374 °F) Fittings: Swagelok, stainless steel 316 for tube OD ¼" (6.4 mm)
Zero gas:	Relative pressure: min -0.1 bar (0 PSI), max 0.1 bar (1.5 PSI) Flow: 1 to 5 litre/min(0.25 to 1.5 GPM) Temperature: min 0 °C (32 °F), max 80 °C (176 °F) Fittings: Swagelok, stainless steel 316 for tube OD ¼" (6.4 mm)
Measurement rate:	1 seconds to 1 hour
Data storage:	3 000 measurements
Communication:	RS485 with MODBUS, RS-232 with Windows Hyperterminal or MODBUS or AK protocol
Outputs:	4-20 mA, isolated, 500 Ohm max, screw terminal (option) alarms or default relay contacts NO or NC, screw terminal, 2A max (option)
Power supply:	90-264 VAC / 40 VA / 50-60 Hz
Ambient temperature:	0 °C (32 °F) to 60 °C (140 °F)
Dimensions:	Rack 19" 3U (L x l x H : 560 mm x 435 mm x 132 mm)
Weight:	< 10 kg

EUROPE
Tethys Instruments SAS
57 Chemin du Vieux Chene
F-38240 Meylan
France
Tel +33 476 41 86 39
Fax +33 476 41 92 27
sales@tethys-instruments.com

ASIA
Tethys Instruments
Level 29, Shanghai Kerry Centre
1515 Nan Jing West Road
Shanghai 200040
China
Fax +86 21 6103 7171
sales@tethys-instruments.com

NORTH & SOUTH AMERICA
Tethys Instruments
211 East Ontario Street, 18th Floor
Chicago IL 60611
USA
Tel: +312 283 3584
Fax: +312 283 5005
sales@tethys-instruments.com