Anodyne™

GAS ANALYSIS SOLUTIONS

INNOVATION APPLIED TO GAS ANALYZERS

Anodyne is a team of experienced engineers developing innovative solutions around in Online Stack Emission Monitoring Systems & Solutions.The team has multidisciplinary skills in optics, air quality monitoring, electro – mechanical and software to cover all fields necessary to develop and produce cutting edge online analyzers.

The Continuous Emission Monitoring (CEM) System comprises of the total equipment necessary to determine the concentration of gaseous emission and/or emission rate using analytical measurements and a computer program to provide results in units of the applicable emission limits or standards. The data recorded/observed is send directly to a DAS (Data Acquisition System) for storage and onward transmission.

With years of research and development, and successful and long partnerships with various Principals, Anodyne offers a complete spectrum of analyzers. Anodyne supporting make in India concept, proudly announces its range of Series of Gas analyzers. In addition to this Anodyne's years old partnership with Gas Sensor specialist Uniphos Envirotronic Pvt. Ltd., offers compact, efficient, innovative gas analyzers with state of the art design and excellent quality.

ANODYNE RANGE OF GAS ANALYZERS (AGMS SERIES)

Extractive Systems
(Source-level extractive systems)

The sample of emission gases is continuously extracted and conveyed to the analyzer using a sampling line. Particulate matter may be removed from the gas, and it may be cooled and dried, but in all other respects the sampling process does not alter the sample.

What we offer

- Cold Dry Extractive systems with Moisture removal at Source
- Hot Wet Extractive Systems with Moisture removal at analyzer level.

In-Situ Systems
(Cross-duct)

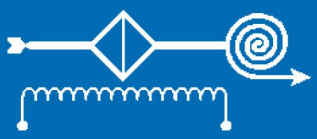
Cross stack monitors measure over the entire stack or duct diameter. They are based on a beam of a certain wavelength that crosses the duct and is attenuated proportionately to the concentration of the target compound. In some systems, a pipe maybe used in the stack for support or calibration purposes, or to reduce the optical path lengths in very large stacks or ducts.

EASE OF SAMPLING FOR EXTRACTIVE ANALYZERS

AGMS series of extractive gas analyzers covers Cold Dry extraction and Hot Wet extraction. These terminologies indicate the type of sampling, which varies and depends on application. The significant criteria to ensure proper and smooth functioning of AGMS gas analyzer is "Moisture" in Stack/Chimney, which differentiates the two extraction/sampling technologies.

Cold Dry Extractive (Dry Basis Analysis)

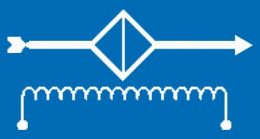
The gas sample is extracted and conditioned before transport, in order to have all moisture and condensible components removed at Stack Level prior to its analysis . Upon arrival to the Analyzer, the sample is clean, dry, at ambient temperature & water interference-free.



- Ideal for boiler applications for high moisture applications and reduced running and electrical costs
- Calibration gas injection allows full system calibration check
- Multi-component measurement possible
- Multi-stack with one analysis system possible
- Easy access to maintenance as sampling system is at stack level and analyzer is at ground level.
- Effective for low or high concentrations with IR (SO_2, NOx, CO/ Co_2), Chemiluminescence (Nox), UV Fluorescence (SO_2)....
- Comes with Patented Peltier based cooling system, locally called as Peltier probe for Wet Process
- Simple Probe in SS 316 for Dry Applications.

Hot Wet Extractive (Wet Basis Analysis)

The gas sample is extracted and transferred through heated sampling lines. It is heated above 180˚C in order to avoid acid dew points for the analysis process. Upon arrival to the analyzer, the sample is hot and wet.



- Ideal for highly soluble gases;
- Integrated back flush & calibration at sampling point
- Multi-component measurement possible
- Multi-stack with one analysis system possible
- Easy access to maintenance for all analyzers (ground position)
- Effective for low concentrations with IR (SO_2, NOx, CO/ Co_2), Chemiluminescence (NOx), UV Fluorescence (SO_2)....
- Comes with Nafion based cooling system, Permapure a patented design
- Simple Probe in SS 316 for Dry Applications, Nafion drier or cooling system not required

PELTIER PROBE
(COLD DRY SAMPLING SYSTEM)

Stack Mountable

- Sampling probe equipped with double stage particulate filtration
- Direct span gas injection for a complete system calibration
- PID Controlled Heated probe and Peltier Cooler

Unique Heat exchanger Design

- Minimum Gas – water interaction
- Avoids loss of highly condensible gases (e.g. HCl, SO_2 ,NO_2 and HF)
- Clean & dry sample transferred via unheated line

- Large selection of probes available (depending on process conditions: stack diameter, gas temperature, water content, particulate concentration)

HEATED PROBE
(FOR HOT WET EXTRACTION)

Stack Mountable

- Sampling probe equipped with double stage particulate filtration
- Direct span gas injection for a complete system calibration

Nafion Heat exchanger Design

- Gas – water interaction upto analyzer level
- Automatic back-flush function
- Sample transfer (clean & wet sample) by 140-180˚C heated line
- Longer heated sampling line available
- Heated probe with choice of materials & lengths to suit application

UV FLUORESCENCE
(AGMS- SO2/FL)

- Highly specific to SO_2 gas – Interferences are avoided
- Utilizing proven Pulsed UV fluorescence technology
- Suitable for Stack Emission and Ambient Air Monitoring
- Least low zero and span drift
- Optional with Peltier Probe for least running cost

Applications

- Continuous Emission monitoring
- Continuous Ambient Air monitoring
- Combustion Efficiency
- Vehicular Emission Monitoring
- Mobile Laboratory

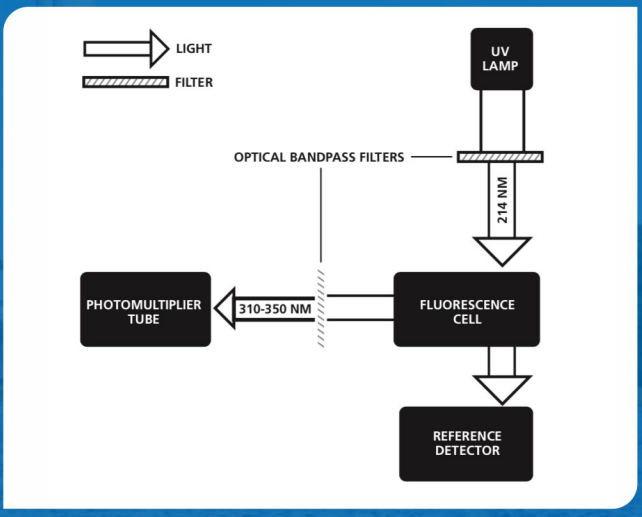
Technology

The analyzer is based upon UV radiation of the sulfur dioxide molecule using light in the range of 190-230nm. The molecule absorbs the light into an excited state (SO_2^*) and then decays back down to the ground state, where a photomultiplier tube (PMT) converts the signal into SO_2 concentration. The UV spectral region used has the least amount of interference from other gases present in the emission stream that can potentially quench the signal.

UV energy from a zinc discharge lamp (190 – 420 nm) is passed through a UV band pass filter to produce radiation at a specific UV wavelength. This light is then focused into the sample cell where it is absorbed by the SO_2 molecules.

Fluorescence occurs from excited SO_2 molecules and photons are emitted in the wavelength region of 240 – 420 nm, which are then passed through another band pass filter before they reach a photomultiplier tube, which measures the signal intensity. The fluorescence is directly proportional to the SO_2 concentration.

A reference detector monitors the emission from the zinc lamp to correct for any fluctuations in lamp intensity and ensure a consistently reliable reading.



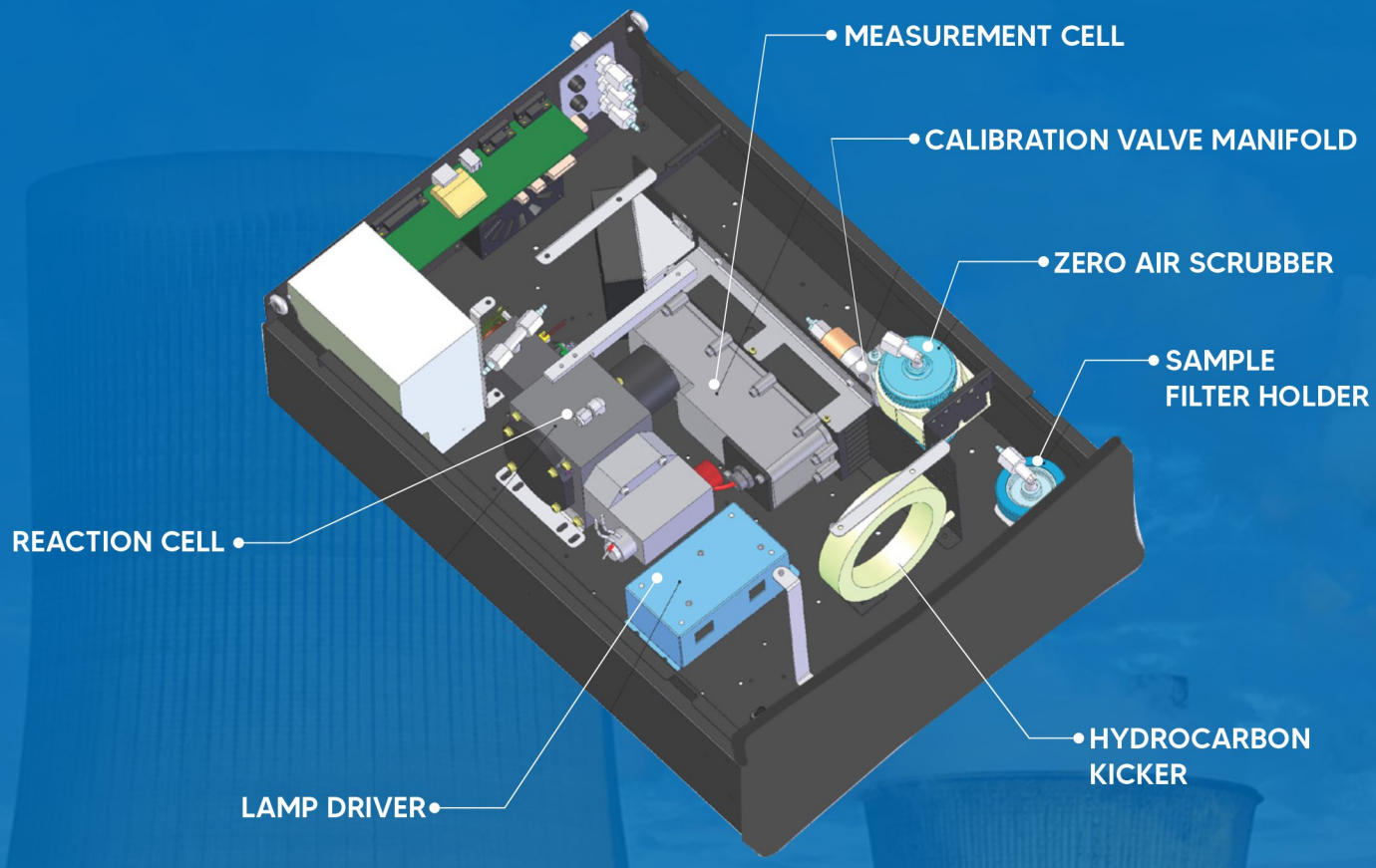
Features

- Low cost of ownership with instant response
- Continuous Measurement
- Easy Start Up without adjustment
- Touchscreen display
- User Selectable range of measurement
- Removable flash memory storing data
- Low power consumption
- Reduced on site Maintainence
- In built zero air generator for auto zeroing
- Moisture Removal and hydrocarbon scrubber system using PAH kicker
- Remote Calibration Diagnostic Status both on-screen and remotely
- Extended UV lamp source
- Easy to use touch screen based system
- Optional advanced GUI, with “quick menu” with keypad
- Long life internal low voltage pump

Specifications

Measurement Objects	So_2 gas in Stack and Ambient Air
Measurement Range	0 – 100, 0 – 1000, 0 - 2000 ppm (Available for higher range)
Accuracy	± 2 %
Lower Detection Limit	1 ppm
Sample Flow rate	800 ml/min
Noise	< 15 ppb
Protection Category	IP 67
Probe Length	As desired, depending on stack diameter
Accuracy	230 V AC
Analog – Digital I/O	DB 15F Socket
Analog Output	Isolated 4 – 20 mA
Communication Interface	Serial Communication (RS – 485/232) Optional •USB port (Advanced protocol only) •Bluetooth (Advanced protocol only) •TCP/IP network port
Display	Large OLED Display / Touchscreen interface available

Relay Delay Time	0 – 180 s
Temperature	Max 400 ˚C, Max 700 ˚C (optional) (Available for higher temperature range)
Operating Temperature	0 to 50 ˚C
Humidity	Max 95 % RH (Non Condensing)
Ambient Humidity	Max 95 % RH (Non Condensing)
Weight	16 kg
Dimensions	420 x 162 x 612 (w x h x d)



CHEMILUMINISCENCE
(AGMS- NOx/CL)

- Highly specific to NOx gas – Interferences are avoided
- Time-proven Chemiluminescence detection method to measure NO or NO/NO_2/NOx concentrations all in one analyzer
- Suitable for Stack Emission and Ambient Air Monitoring
- Least low zero and span drift
- Optional with Peltier probe for least running cost

Technology

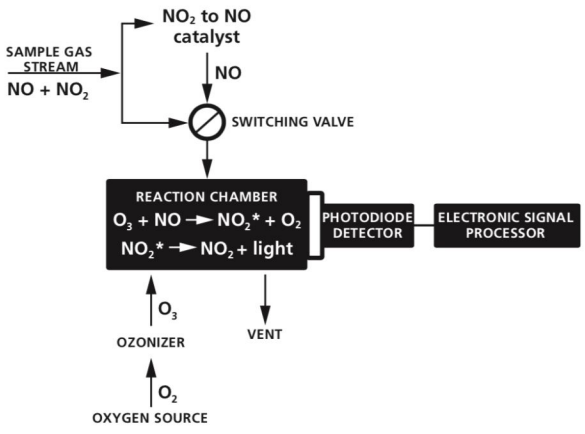
The analyzer uses ozone (O_3) which reacts with the nitric oxide (NO) in the sample stream, yielding an excited state of NO_2 (No_2^*) plus oxygen (O_2).

Excited NO_2^* will return to a more stable ground state, and in the process, produces a chemiluminescent light, the intensity of which is proportional to the concentration of NO that was converted into NO_2 within the reaction chamber. A photodiode detector is used to measure the light and reports out a ppm NO value.

In order to produce a total NOx signal, the sample is first routed through an internal converter that turns any NO_2 in the sample into NO. This stream is then subjected to O_3 gas and the resultant reaction is now directly proportional to the total NOx concentration. The analyzer then makes an internal calculation, deriving the final concentration from the NOx converter efficiency.

Applications

- Continuous emissions monitoring (CEMs)
- Ambient air monitoring
- Scrubber efficiency
- Combustion efficiency
- Turbine/generator feedback control
- Process gas analysis
- Vehicle emissions
- Engine testing
- SCR/SNCR feedback control



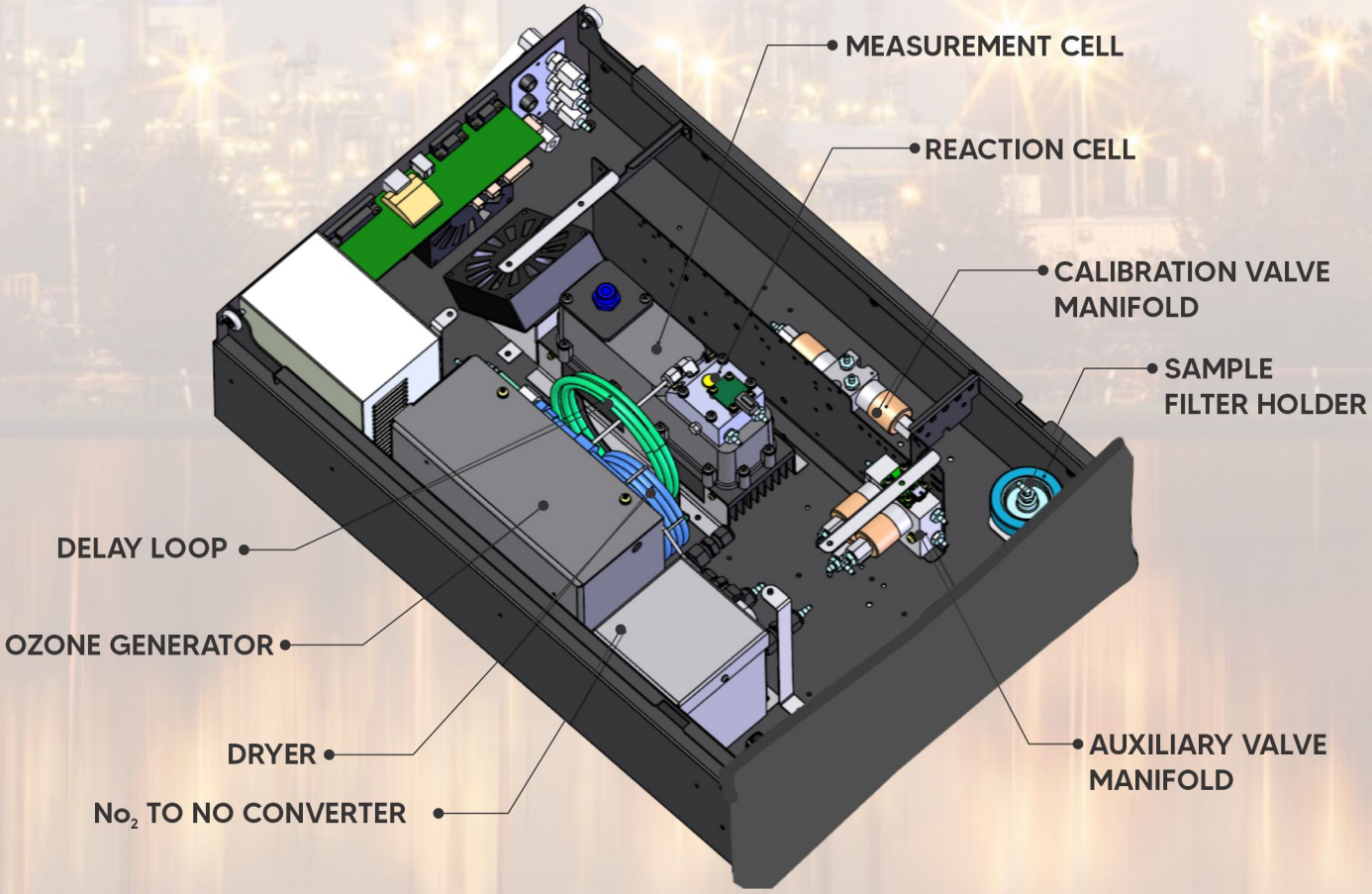
Features

- Non Depleting photodiode / PMT provides Low cost of ownership instant response
- Continuous Measurement
- Easy Start Up without adjustment
- Touchscreen display
- User Selectable range of measurement
- Removable flash memory storing data
- Low power consumption
- Reduced on site Maintainence
- In built zero air generator for auto zeroing
- Internal Ozone Generator
- Electronic Sample and Ozone Flow Control
- Inbuilt NO_2 to NO converter
- Low temperature Vitreous Carbon NO_2 to NO converter means no Ammonia interference
- Standard product contains auto zero/ span/sample switching and an optional paramagnetic oxygen analyzer for normalization.
- Remote Calibration Diagnostic Status both on-screen and remotely
- Extended UV lamp source
- Easy to use touch screen based system
- Optional advanced GUI, with "quick menu" with keypad

Specifications

Measurement Objects	Nox gas in stack
Measurement Range	0 – 100, 0 – 1000, 0 - 2000 ppm (Available for higher range)
Accuracy	± 2 %
Lower Detection Limit	1 ppm
Sample Flow rate	250 ml/min
Noise	< 15 ppb
Protection Category	IP 67
Probe Length	As desired, depending on stack diameter
Accuracy	230 V AC
Analog – Digital I/O	DB 15F Socket
Analog Output	Isolated 4 – 20 mA

Communication Interface	Serial Communication (RS – 485/232) Optional •USB port (Advanced protocol only) •Bluetooth (Advanced protocol only) •TCP/IP network port
Display	Large OLED Display / Touchscreen interface available
Relay Delay Time	0 – 180 s
Temperature	Max 400 ˚C, Max 700 ˚C (optional) (Available for higher temperature range)
Operating Temperature	0 to 50 ˚C
Humidity	Max 95 % RH (Non Condensing)
Ambient Humidity	Max 95 % RH (Non Condensing)
Weight	16 kg
Dimensions	450 x 450 x 250 (w x h x d)



NDIR - NON DISPERSIVE INFRARED
(AGMS – X/IR)

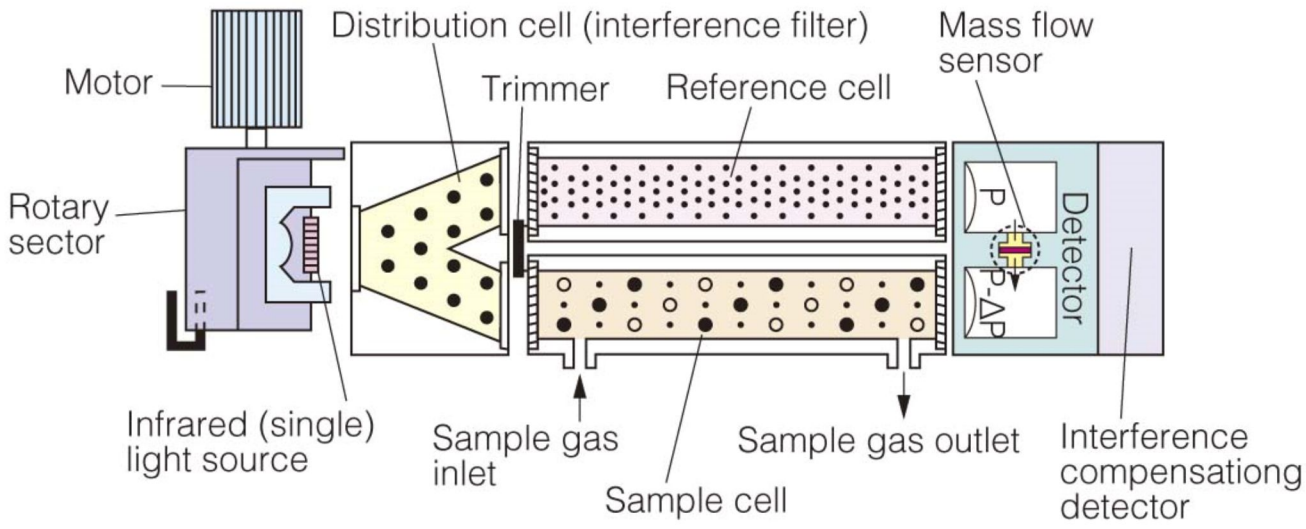
- Ideal for monitoring SO_2, NOx, CO, H_2O, CH_4, and $\%CO_2$
- Time-proven infrared detection method to measure all gases (maximum 4) in one analyzer.
- Optional addition option for $\% O_2$ analysis (based on in-situ Zirconia technique)
- Most Suitable for Stack Emission Monitoring
- Least low zero and span drift
- Optional with Peltier Probe for least running cost

Applications

- Continuous emissions monitoring (CEMs)
- Utility Boilers
- Clinical Waste Incinerators
- Chemical Incinerators
- Mobile labs
- Vehicle emissions
- Engine testing

Technology

The analyzer technology is based on absorption of light in Infrared spectrum. When a heteronuclear diatomic or polyatomic molecule, is exposed to infrared light, it absorbs some of the light and thus gains energy to vibrate and rotate. As a result, the infrared absorbing gas expands. The wavelength region in which a gas absorbs is unique to each gas Infrared radiation from a source is interrupted by a rotating chopper at a specific frequency and passed through a measurement cell. A target gas as a sample in the measurement cell absorbs



some of infrared energy and so reduced energy reaches a detector. The detector consists of front and rear expansion chambers, both are filled with the target gas. First, some amount of energy is absorbed in the front expansion chamber, and then the rest of energy is absorbed in the rear expansion chamber. This causes the pressure to rise in both chambers.

The chambers are designed so that the pressure rises differently in the two chambers. The pressure difference between the two chambers causes a subtle flow in the path, which is detected by the sensor and converted into a digital signal. The digital signal is processed, together with a synchronous signal by the rotating chopper, to provide an output signal, which is proportional to the concentration of the target gas.

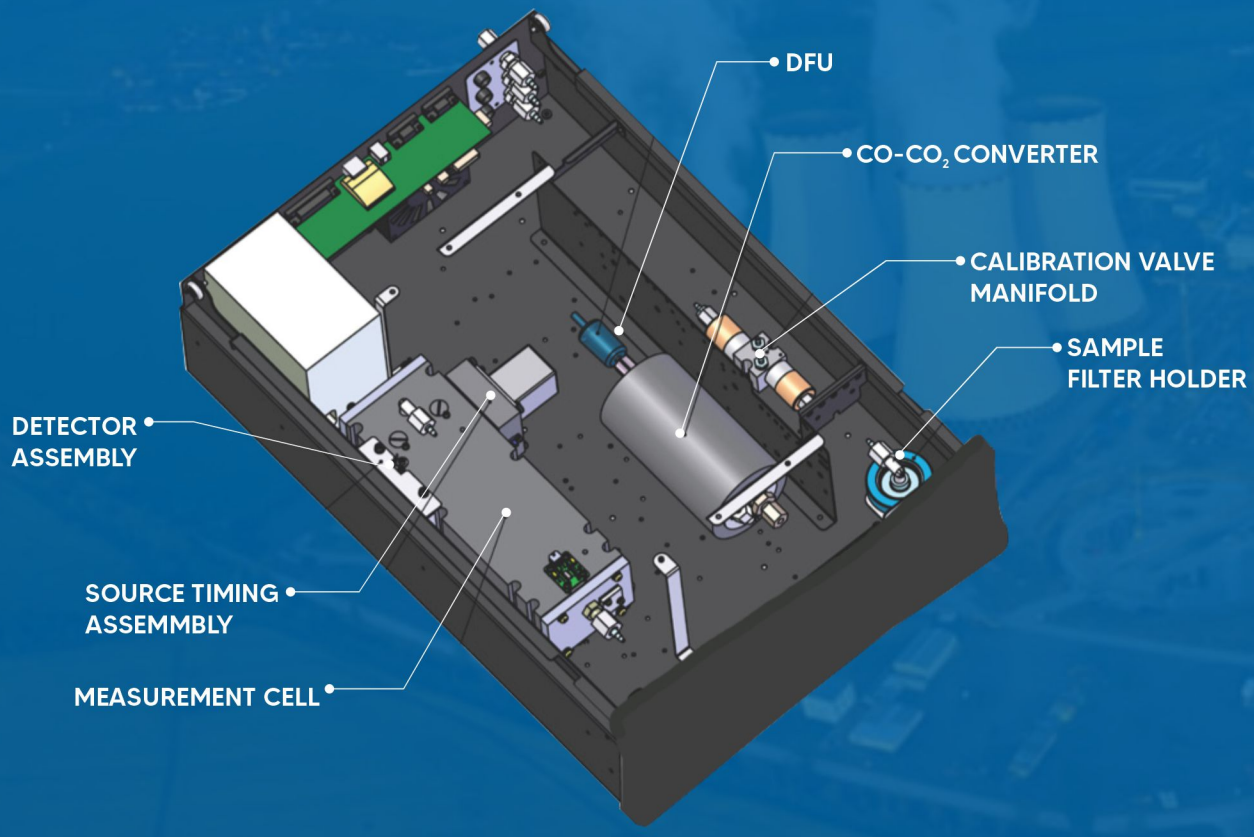
Features

- Provides a complete continuous emissions monitoring solution for flue gas analysis
- Easy Start Up without adjustment
- Intuitive-use icon-driven color touchscreen for easy device interaction and configuration
- User Selectable range of measurement
- Removable flash memory storing data
- Reduced on site Maintainence
- In built zero air generator for auto zeroing
- Non-depleting sensors for ultra stable, accurate and selective measurements
- Standard product contains auto zero/ span/sample switching and an optional paramagnetic oxygen analyzer for normalization.
- Remote Calibration, Diagnostic Status both on-screen as well as remotely accessible.
- Optional advanced GUI, with “quick menu” with keypad
- Long life internal low voltage pump
- Extended IR lamp source
- Separate measurement of each gas and non-interference from other gases and water vapour.

Specifications

Measurement Objects	SO_2, NOx, CO, CO_2
Measurement Range	SO_2 (0 – 100, 0 – 1000, 0 - 2000 ppm) NOx (0 – 100, 0 – 1000, 0 - 2000 ppm) CO (0 – 100, 0 – 2000 ppm) CO_2 (0 – 25 %); (0 – 50 %) CH_4 (0 – 5 %); (0 – 100 %)

Accuracy	± 1 %
Lower Detection Limit	1 ppm
Sample Flow rate	800 ml/min
Noise	< 15 ppb
Protection Category	IP 67
Probe Length	As desired, depending on stack diameter
Accuracy	230 V AC
Analog – Digital I/O	DB 15F Socket
Analog Output	Isolated 4 – 20 mA
Communication Interface	Serial Communication (RS – 485/232) Optional •USB port (Advanced protocol only) •Bluetooth (Advanced protocol only) •TCP/IP network port
Display	Large OLED Display / Touchscreen interface available
Relay Delay Time	0 – 180 s
Temperature	Max 400 ˚C, Max 700 ˚C (optional) (Available for higher temperature range)
Operating Temperature	0 to 50 ˚C
Humidity	Max 95 % RH (Non Condensing)
Ambient Humidity	Max 95 % RH (Non Condensing)
Weight	16 kg
Dimensions	450 x 450 x 250 (w x h x d)



UV DOAS - ULTRAVIOLET DIFFERENTIAL OPTICAL ABSORPTION SPECTRUM)

(AGMS – X/UV)

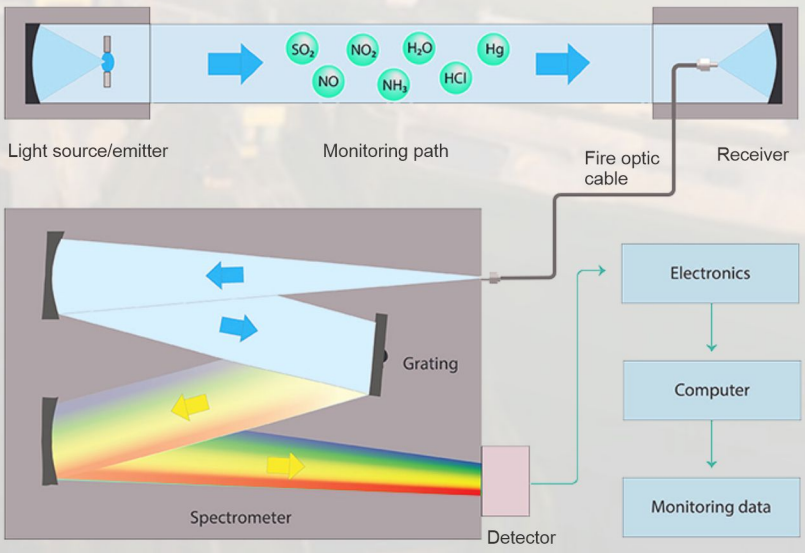
- Ideal for monitoring SO_2, NOx, NH_3, H_2S, Cl_2.
- Time-proven infrared detection method to measure all gases (maximum 4) in one analyzer.
- Optional addition option for % O_2, CO and CO_2 analysis (based on in-situ Zirconia and NDIR technique respectively)
- Most Suitable for Stack Emission Monitoring

Applications

- Continuous emissions monitoring (CEMs)
- Utility Boilers
- Clinical Waste Incinerators
- Chemical Incinerators
- Mobile labs
- Vehicle emissions
- Engine testing

Technology

Differential Optical Absorption Spectroscopy (DOAS), which is based on Beer-Lambert's absorption law. It states the relationship between the quantity of light absorbed and the number of molecules in the lightpath.
DOAS is based on transferring a beam of light from a special source – a high-pressure xenon lamp – over a chosen path
The light from the xenon lamp is very intense, and includes both the visible spectrum and ultraviolet and infrared wavelengths.
The lamp emits UV light into the gas chamber.
The light is captured by a receiver and conducted through an optical fibre in the analyser. The analyser includes a high-quality spectrometer, and associated control circuits. The spectrometer splits the light into narrow wavelength bands



using an optical grating. This can be adjusted so that an optimum range of wavelengths is detected. The light is transformed into electrical signals.
A narrow slit sweeps past the detector at high speed, and a large number of instantaneous values are built up to form a picture of the spectrum in the relevant wavelength range. This scan is repeated a hundred times a second, and the registered spectra are accumulated in the computer's memory while awaiting evaluation.

The absorption spectrum just registered from the light path is compared with one calculated by the computer. The calculated spectrum consists of a well-balanced summation of the reference spectra for the analysis concerned.

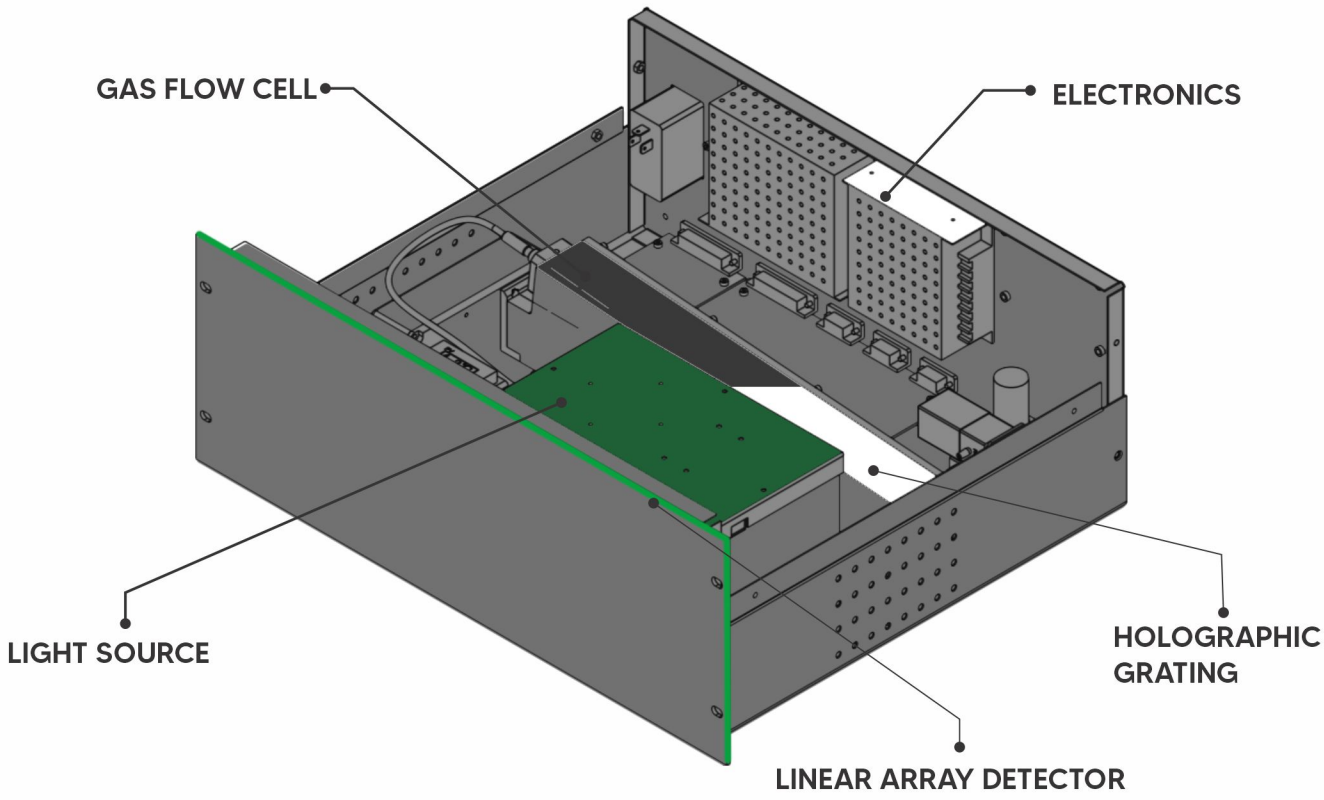
Features

- Provides continuous emissions monitoring solution for flue gas analysis with easy Start Up without adjustment
- Low detection limit
- Complete UV spectrum scanning.
- UV has no moisture absorption
- Separate measurement of each gas and non-interference from dust and water vapour.
- Strong gas chamber and single chamber can measure 3 -5 gas components.
- Removable flash memory storing data
- Reduced on site Maintainence
- Standard product contains auto zero/ span/sample switching and an optional paramagnetic oxygen analyzer, NDIR analyzer for CO and CO_2. (for normalization)
- Optional Remote Calibration Diagnostic Status both on-screen and remotely
- Extended lamp source having life of 10 years due to pulsed application.

Specifications

Measurement Objects	So_2, NOx
Measurement Range	SO_2 (0 – 300, 0 – 3000) NOx (0 – 300, 0 – 3000)
Accuracy	±1.5 %
Repeatability	0.5 %
Lower Detection Limit	1 ppm
Sample Flow rate	0.5 - 2 l/min
Noise	< 15 ppb
Protection Category	IP 67

Probe Length	As desired, depending on stack diameter
Power Supply	220 V AC
Analog – Digital I/O	DB 15F Socket
Analog Output	5, O/p can be configured, maximum load capacity +/ < 800 ohm
Communication Interface	Serial Communication (RS – 485/232) Optional •1 x RS - 485 •1 x RS - 232
Display	Large OLED Display with touch buttons
Pre – heating time	Standard (No preheating) Ultra Low Range (Approx. 10 min)
Temperature	Max 400 ˚C, Max 700 ˚C (optional) (Available for higher temperature range)
Operating Temperature	0 to 50 ˚C
Humidity	Max 95 % RH (Non Condensing)
Ambient Humidity	Max 95 % RH (Non Condensing)
Weight	10 - 12 kg as standalone analyzer. In 19" cabinet weight varies.
Dimensions	485 x 132 x 400 (w x h x d)



TDLAS - TUNABLE DIFFERENTIAL LASER ABSORPTION SPECTRUM (AGMS – X/TDLAS)

- Ideal for monitoring HCl, HF, NH_3, H_2S, C_2H_2, C_2H_4
- Optional addition option for % O_2, CO and CO_2 analysis (based on in-situ Zirconia and NDIR technique respectively)
- Most Suitable for trace level detection for Stack Emission Monitoring.
- Both in-situ and extractive options available

Applications

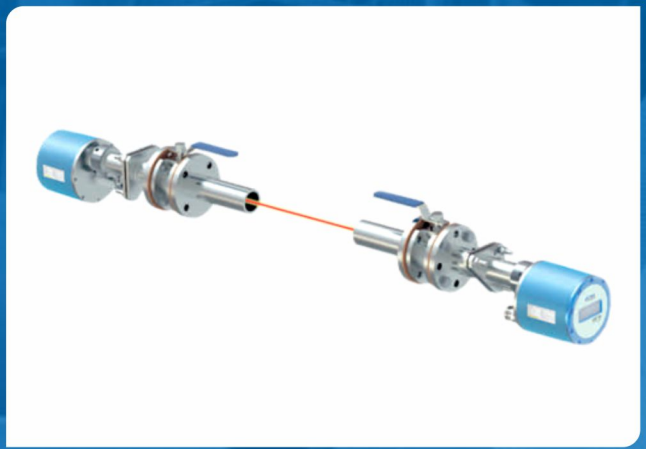
- Continuous emissions monitoring (CEMs)
- Utility Boilers
- Clinical Waste Incinerators
- Chemical Incinerators

Technology

TDLAS is the best suitable technique for trace level detection of atmospheric pollutants. Coupled with high frequency wavelength modulation spectroscopy allows high sensitivity of target gas to be measured.

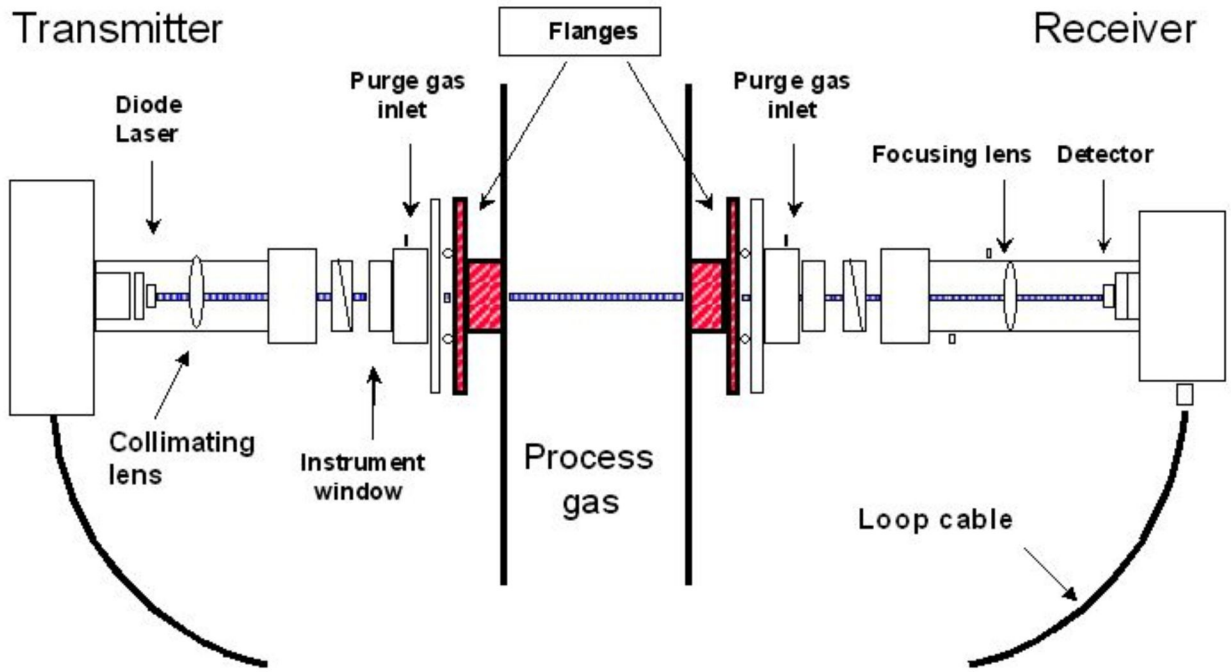
AGMS-X/TDLAS extractive system the laser emits a wavelength of near-infrared (NIR) light specific for the target analyte into the sample cell where it passes through the gas and is reflected back by a mirror at the opposite end of the cell to a solid state detector. Analyte molecules present in the gas sample absorb and reduce the intensity of laser light energy. The difference in light intensity measured by the solid state detector is proportional to analyte concentration in the process gas.

In-situ AGMS TDLAS analyzer involves passing of laser beam from the transmitter unit across the stack or duct, which undergoes absorption by the measured gas. The attenuated light is then detected by the photoelectric sensor in the receiver unit, and the resulting signal is sent back to the transmitter unit and analyzed to yield gas concentration.



Specifications

Measurement Range	Hcl (0 – 100 ppm / 0 – 50 %) HF (0 – 20 ppm / 0 – 50 %) NH_3 (0 – 100ppm / 0 – 100 %) CH_4 (0 – 100 ppm / 0 – 50 %) C_2H_2 (0 – 50 ppm / 0 – 100 %) C_2H_4 (0 – 100 ppm / 0 – 100 %)
Accuracy	±1 %
Analog I/P	2 x 4 – 20 mA
Analog O/P	2 x 4 – 20 mA
Communication Interface	Serial Communication (RS – 485/232)
Enclosure Rating	IP 65 (Extractive) IP 66 (ATEx and Exd model)
Operating Temperature	0 to 50 °C



SET-UP FOR A IN-SITU CROSS STACK TDLAS SYSTEM

ZIRCONIA OXYGEN ANALYZER
(AGMS – O2/Zr)

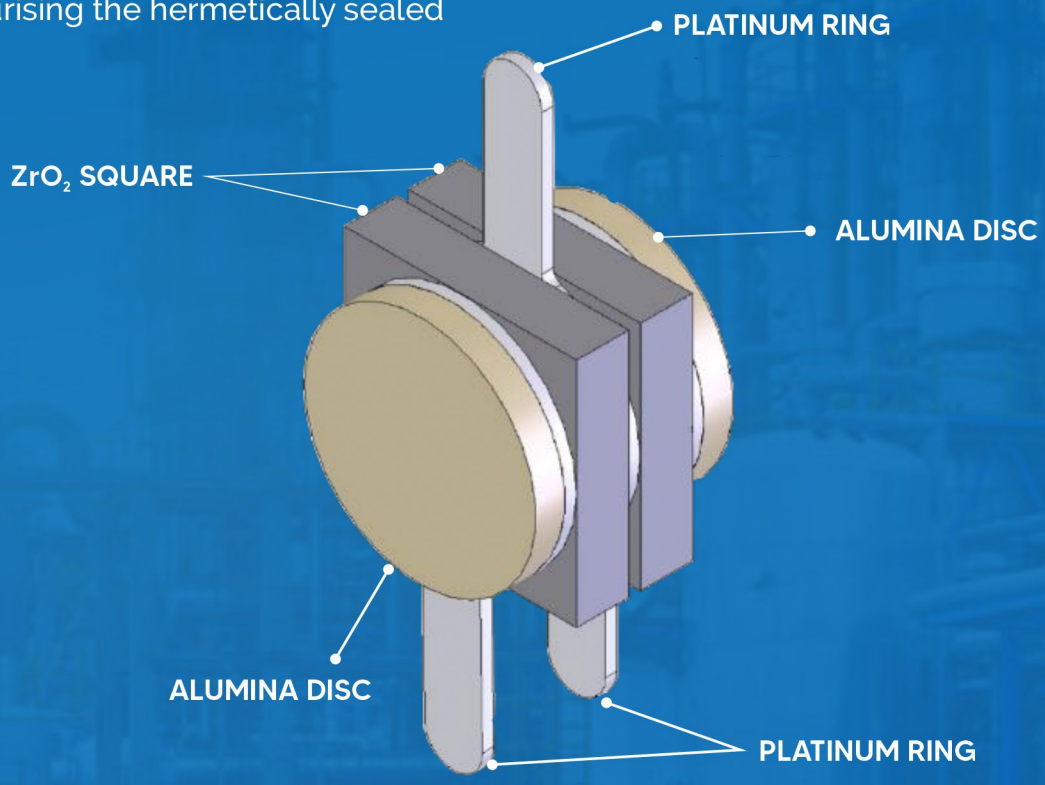
- In –situ analysis and advanced technique for Oxygen
- monitoring for Stack Emission, Oxygen normalization, Oxygen efficiency in utility boilers and
- Optional addition option for % O_2 with any analyzer

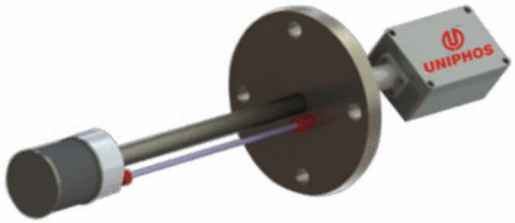
Technology

AGMS – O_2/Zr uses well proven Zirconium Dioxide based element for O_2 analysis. Zirconia sensor consists of two zirconium dioxide (ZrO_2) squares coated with a thin porous layer of platinum which serve as electrodes. These electrodes provide the necessary catalytic effect for the oxygen to dissociate, allowing the oxygen ions to be transported in and out of the ZrO_2. The two ZrO_2 squares are separated by a platinum ring, which forms a hermetically sealed sensing chamber.

The first ZrO_2 square works as an electrochemical oxygen pump, evacuating or re-pressurising the hermetically sealed chamber.

Depending on the direction of theDC constant current source, theoxygen ions move through theplate from one electrode to theother, this in turn changes theoxygen concentration andtherefore the oxygen pressure (P_2)inside the chamber. A difference in oxygen pressure across the second ZrO_2 square generates a Nernst voltage, which is logarithmically proportional to the ratio of the oxygen ion concentrations.





Specifications

Measurement Objects	O_2
Measurement Range	0 – 25 %
Accuracy	± 2%
Resolution	1 %
Sample Flow	0 – 10 m/s
Response Time	< 2 mins
Warm Up time	< 2 – 3 sec
Protection Category	IP 67
Probe Length	As desired, depending on stack diameter
Power Supply	230 V AC
Analog O/P	4 – 20 mA, 0 – 10 VDC
Communication Interface	Serial Communication (RS – 485/232)
Permissible Gas Temp.	0 – 400 °C
Display	Large OLED Display on Controller

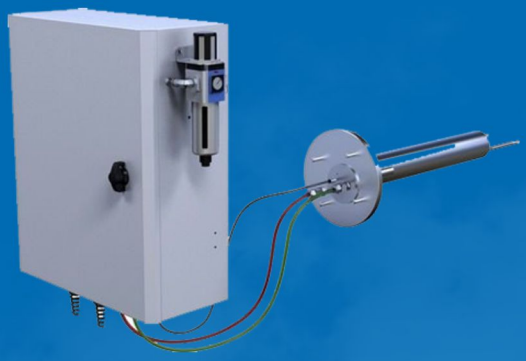
INTEGRATED TEMPERATURE, FLOW AND PRESSURE MONITOR

Features

- Low cost of ownership with instant response
- Continuous Measurement
- Easy Start Up without adjustment
- User Selectable range of measurement
- Low power consumption
- Reduced on site Maintainence

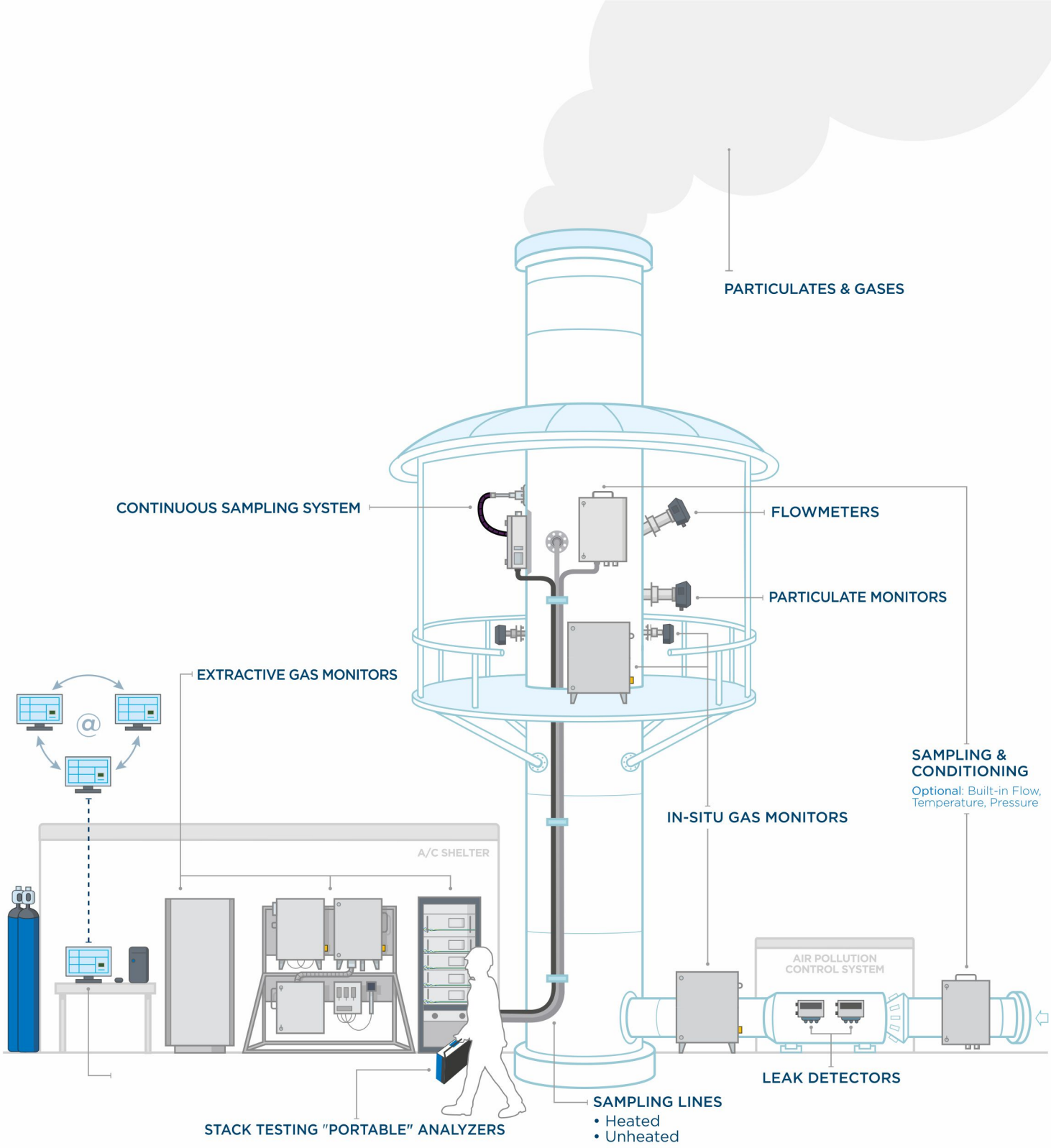
Applications

- Continuous Emission monitoring
- Continuous Ambient Air monitoring
- Combustion Efficiency
- Vehicular Emission Monitoring
- Mobile Laboratory



Specifications

Measuring Parameters	Temperature Pressure Flow
Measurement Technology	Temperature: RTD with Thermowell Pressure: Absolute pressure Sensor (comes with fin type cooling tower for high temperature stacks) Flow: S type Pitot Tube (SS 316) with Differential Pressure Sensor (available with Back Purge arrangements)
Range	Temperature: 500 °C Pressure: 0 – 30/50 psia Flow: 0 – 10/20 m/s
Accuracy	Temperature: Class 'A' Pressure: +/- 1% FS Flow: +/-1 % FS
Power Supply	24V (2 wire)
Output	4 – 20 mA (2 wire) x 3
Display	Loop Powered 7 segment display at the controller
Weight	8 kgs



CERTIFICATIONS & TESTING

(Standards As Per)

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