TYCO MultiGAS Monitoring System

Hot/Wet IR Analyzer Technology

- Continuous Emissions Monitoring (CEMS)
- Environmental Compliance Monitoring
- Process Gas Analysis & Process Optimization
- Combustion Monitoring
Tyco MultiGAS Monitoring System

The Tyco MultiGAS Monitoring System is a Hot/Wet Gas Analysis System using proven Hot extractive monitoring technology for a ‘Wet Measurement’ of up to 8 different gases (including moisture), plus Oxygen. The Hot-Wet Sample System has only four parts that are in contact with the flue gas -- Probe, Sample Line, Pump, and Sample Cell.

The Tyco MultiGAS Monitoring System uses state-of-the-art Multicomponent IR Technology to measure gas concentrations on a real-time basis. The Tyco MultiGAS Monitoring System extracts the gas sample, analyzes it for the desired constituents (including moisture & oxygen), and processes the emission data as stipulated in 40 CFR Part 60/75 regulations.

Tyco MultiGAS Monitoring System Features:

- Hot/Wet IR Technology for Accurate Measurement of up to 8 Gases
- Stream-lined Hot/Wet Sample System (only two moving parts in contact with flue gas)
- Monitors: CO, CO₂, CH₄, H₂O, HBr, HCl, NH₃, NO, NO₂, N₂O, O₂, SO₂, Water Vapor and others.
- Separate Measurements of NO, NO₂, N₂O
- Measures Reactive Gases - HCl, NH₃
- Accurate Measurement of NH₃ in SCR Systems
- Additional Gas Detection Easily Added
- Low-Flow Sample Volume Means: Low Calibration Gas Usage & Reduced Blowback
- Real-Time Correction for Quantifiable Interfering Variables
- Direct Measurement of All Gases (including water vapor) Without Converters
- One Robust, “Bulletproof” IR Analyzer for All Measurements – Reduced Spare Parts Count
- Extremely High Data Availability
- Windows-Based Format, Simple Interface
- Color Touchscreen, 1 or 2 Touch Commands
- System Data on Laptop with Real Time & Historical System Data
- Remote Diagnostics Capability
Typical MultiGAS System Cabinet Configuration

System Cabinet - Closed

Touch Screen System Interface

System Cabinet - Open

PLC

Heated Pump

Calibration Gas Valves

Multicomponent IR Analyzer

Network Hub

System Computer

Additional space for other components (Datalogger, Flow Meter Controller, other Analyzers)

UPS
Tyco MultiGAS Analyzer System

Components

- Heated Probe Assembly
  - Built-In: Isolation, Calibration and Blowback
  - Stainless Steel or Hastelloy filters
  - Probe Tube Heater if Required (NH₃, HCl, etc.)

The Heated Probe Assembly provides specific functions needed for reliable sampling of flue gases while closely maintaining temperatures at elevated levels. Those functions are probe-back purge with instrument air, calibration gas injection, and failsafe inerting to protect the system from corrosion upon loss of temperature control.

The Heated Probe Assembly consists of a coarse (20 micron) sintered filter mounted on the probe tip, a probe tube, and a fine filter body, which is mounted on a 3" or 4" 150 PSI flange. A probe tube heater for stacks with condensing conditions can also be supplied. Standard materials of construction include: 316L, Hastelloy, Inconel or even Titanium. Filtration is provided in two stages using sintered filters. The coarse filter on the probe tip is rated at 20 microns and is protected by an impact shield. External to the flange is the fine filter assembly which houses the second sintered filter (normally 2 micron.) In many applications downstream of a baghouse or ESP, the probe tip filter can be eliminated.

Instrument air purging of the probe tip coarse filter is accomplished through the Fine Filter Assembly by use of a one-way valve for injection, and operation of a special bellows valve for isolation. How often the probe is back purged is determined by sampling conditions, but even with severe particulate conditions no more than four times a day is required. Like back purging, calibration gas is injected into the probe by a check valve, using the same bellows valve for isolation. Because the isolation function is of critical importance while calibrating, the Heated Probe uses a unique air operated bellows valve and seat to provide positive sealing at temperatures as high as 220°C. The back purge, calibration, and isolation valves are all built into the Heated Probe Assembly and are heated and temperature controlled to the same level.

- Heated Sample Line
  - 2 Heated tubes (185°C PTFE), Sample and Spare
  - 3 Non-heated tubes (PFA-PTFE) Calibration, Isolation, Blowback

The heat traced sample umbilical maintains the gases at an appropriate temperature all the way from the HW3 Probe Assembly to the analyzer enclosure. Good engineering practice dictates that this should be short as possible, but it is of more importance to place the analyzer in a convenient location. Lengths of up to 150m are possible. The sample umbilical bundle contains one or more tubes for the sample gas and additional tubes for instrument air and calibration gas. It may also have conductors and control wires for other functions.
needed at the HW3 Probe Assembly. The materials of the sample tube may be either Teflon or SS depending upon the temperature requirement and makeup of the sample gas. The measurement of HCl or ammonia require the highest sample line temperatures, at greater than 220 °C.

Heated Sample Pump

Sample flow is provided by a specially designed, highly reliable, high capacity heated pump. A key to reactive gas sampling is the importance of minimizing the residence time in the sampling system, which means the pump must have high capacity. This pump provided by Tyco has proven to be very reliable in this service.

Gas Analyzer Technology

Tyco MultiGAS Multicomponent IR Analyzer

The Tyco MultiGAS Multicomponent IR Analyzer simultaneously measures concentrations of gases including, but not limited to: SO2, NO, NO2, N2O, CO, HCl, HBr, NH3, CH4, CO2, H2O and O2. A single analyzer can measure up to 8 components simultaneously, plus Oxygen.

Principle of Operation

The Tyco MultiGAS Multicomponent IR Analyzer uses state-of-the-art IR detection technology to measure concentrations on a real-time basis. Using a single optical bench, each component in the gas mixture is measured directly. This is accomplished through the use of a long path heated sample cell utilizing gas-filled cells and interference filters. Software algorithms eliminate cross-interference between the components. Oxygen measurement is obtained using a fully integrated Zirconium Oxide sensor.

Why the Tyco MultiGAS Monitoring System Measures Accurately

Reason #1 Detection Techniques

Combination of Gas Filter Correlation (GFC) and Single Beam Dual Wavelength (SBDW) Techniques:

A single Infrared Detector is used because of its ability to use Gas Filter Correlation, a technique allowing much greater selectivity and interference rejection, and at the same time Single Beam Dual Wavelength, which has advantages in some gas measurements. This is all done simultaneously to measure up to 8 different gases, including the interfering gases. Measurement of interfering gases enables continuous real time corrections to internal analyzer signals. The result is an amazingly sensitive and accurate device, with significant advantages over other discrete devices not capable of performing dynamic corrections for interferences.

GFC is a well-established method to reduce cross sensitivities to gases that cause interference in infrared measurements. In the technique an optical band pass filter is used to select an infrared band.
Then, a cell filled with 100% concentration of the gas of interest is placed in the beam, effectively blocking the spectral lines that the gas absorbs at. It is important to note that variations in optical clarity - such as dirt on cell windows, source strength, and other causes not related to the spectral lines selected, will have no effect on the ratio of two pulses. This makes GFC an extremely sensitive and selective analytical technique. Typically CO, NO, NH₃ and HCl are measured using the GFC technique.

In the SBDW technique, ultra narrow band optical filters are used to select infrared wavelengths. One wavelength is at a spectral line that the gas of interest absorbs at (measuring), and the other is at a spectral line which the gas of interest does not absorb at (reference). Typically SO₂, NO₂, CO₂, and H₂O are measured using the SBDW technique.

Additionally, separate measurements for NO, NO₂ and N₂O are possible. For SCR Applications this means both NO and NO₂ can be measured separately and added arithmetically. No conversion errors possible. The use of Hot/Wet sampling technology and a High Temperature Sample Cell means the multi component IR analyzer measures Ammonia accurately, even at very low levels.

* All components at 185 °C or above; standard sample cell path 6 meters
Measuring Ranges
User can select appropriate range within the range interval.

<table>
<thead>
<tr>
<th>Gas</th>
<th>Typical Low Range*</th>
<th>Typical High Range *</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO₂</td>
<td>0-50 PPM</td>
<td>0-1,000 PPM</td>
</tr>
<tr>
<td>NO</td>
<td>0-50 PPM</td>
<td>0-500 PPM</td>
</tr>
<tr>
<td>NO₂</td>
<td>0-50 PPM</td>
<td>0-500 PPM</td>
</tr>
<tr>
<td>N₂O</td>
<td>0-100 PPM</td>
<td>0-1,500 PPM</td>
</tr>
<tr>
<td>CO</td>
<td>0-200 PPM</td>
<td>0-5,000 PPM</td>
</tr>
<tr>
<td>HCl</td>
<td>0-20 PPM</td>
<td>0-100 PPM</td>
</tr>
<tr>
<td>NH₃</td>
<td>0-20 PPM</td>
<td>0-100 PPM</td>
</tr>
<tr>
<td>CH₄</td>
<td>0-100 PPM</td>
<td>0-1,000 PPM</td>
</tr>
<tr>
<td>CO₂</td>
<td>0-2%</td>
<td>0-20%</td>
</tr>
<tr>
<td>H₂O</td>
<td>0-2%</td>
<td>0-25%</td>
</tr>
<tr>
<td>O₂</td>
<td>0-10 %</td>
<td>0-25%</td>
</tr>
</tbody>
</table>

**Reason #3 Construction**

The gas analyzer is specifically designed for Continuous Emission Monitoring service. The optical bench, sample cell and control components are all integrated into one convenient, and easily serviced enclosure. In particular, the integrated design allows the photometer source and detector to be housed in the same temperature controlled housing - which significantly improves stability. A stepper motor controls the filter disk. The geometry and size of the filters is such that alignment of the filters is not critical. The solid-state detector is located on its own subassembly, but in the temperature controlled housing.

**Benefits of Reliability & Accuracy**

**RECENT FIELD PERFORMANCE RESULTS**

The Relative Accuracy Test Audit (RATA) and system availability/downtime are two important criteria that can be used to determine the performance of Continuous Emissions Monitoring Systems (CEMS). The RATA results determine not only whether a plant’s CEMS is in compliance, but also how often a RATA test series must be performed. It is important to elaborate on the cost implications associated with CEMS availability and RATA results. Minimal downtime automatically translates into elimination of expenses associated with skilled technical labor and replacement part cost. In addition, during prolonged CEMS downtime there is also the possibility of excess emissions that could go unrecorded, exposing the plant to regulatory scrutiny and data substitution penalties.

It is important therefore, to identify a CEMS that is technologically current, is highly accurate and has a proven track record of high data availability with minimal downtime. **High CEMS Accuracy can result in Significant Cost Savings associated with reduced frequency of required RATA tests.** Contact Tyco for more details.
System Control Touchscreen Interface

Main Menu

Operator Functions  Config Functions  Calibration Menus  System Functions
Control CEM  System Configuration  View Calibration  Change Passwords
Status Configuration  PLC Configuration  Calibration Setup  System Flow
Optical Energy  Temp Setups  Last Calibration  System Settings
Charts  Plant Analog Inputs  CGA Configuration  Timeshare setup
Digital Inputs  Flow - Opac Cal  Direct To PLC
Digital Outputs  Flow Monitor Cal  Change Analyzer
Analog Outputs  Cal Dat. History

Measure

Help  GRAPH
System Control

- Windows-Based Software for System Control
- Remote Access via IP Protocol or Modem
- Wide Variety of Available PLCs
- Standard Touch-Screen Interface
- SQL Server Database with Backup

Data Acquisition

- Regulatory requirements 40 CFR Part 60, Part 75, NOx Budget and state regulations
- Data Acquisition Loggers, Windows/Unix PLC, and interface to plant process control (Honeywell, Bailey, Emerson Delta V)
- Integrate into existing DAS software – Tyco Environmental Systems has experience working with leading DAS vendors

Custom Development For Client Applications

- Gateway software for interface to Allen Bradley DH+ and Emerson DeltaV
- Experience with PA customers in implementing the latest reporting rules
- Custom Reporting Software for Texas medical waste incinerator
- Specialized techniques for N₂O (greenhouse gas) and HBr monitoring
- QA/QC plans for meeting all state regulations

Customer Service

Tyco’s “Emissions Monitoring Specialists” provide complete service and support to ensure your System Availability is as high as possible.

Tyco services include:

- Installation supervision and turn-key installation contracts.
- System start-up services
- Training programs (Plant site or Factory)
- Certification testing and Q.A. audits
- Emergency Service & Spare Parts
- Service & Maintenance Agreements