OHIO LUMEX®

Ei4200 Dew Point Monitor

Online Detection and Measurement

Version 1.0

Application

The Ei4200 Dew Point Monitor (DPM) detects and measures acid dew point and other condensables in challenging industrial conditions. The direct measurement of the process gas dew point provides plant and process operations with information that would otherwise be a multi-variable equilibrium problem that is neither elementary, nor precise. Ei4200 DPM technology removes the guess work and provides real-time feedback.

Targeted Industries

The Ei4200 DPM is ideally suited to detect and measure the acid dew point in all industrial applications within the operating temperature range of the instrument. Applications include:

- Sulfuric Acid Production
- Copper Smelters
- Coal-Fired Utilities
- Refining and Petrochemical
- Pulp & Paper
- RTO's and Biomass
- Gas Turbines Combined Cycle

The Technology

The Ei4200 DPM measures conduction across a uniquely constructed sensor surface resulting from condensed substances, including sulfuric acid, below their dew points. The presence of a condensed liquid phase is determined by the resistance between two electrodes. When current is detected, the kinetic dew-point (or formation) temperature has been reached. The instrument has two operating modes: passive and active.

Passive Mode

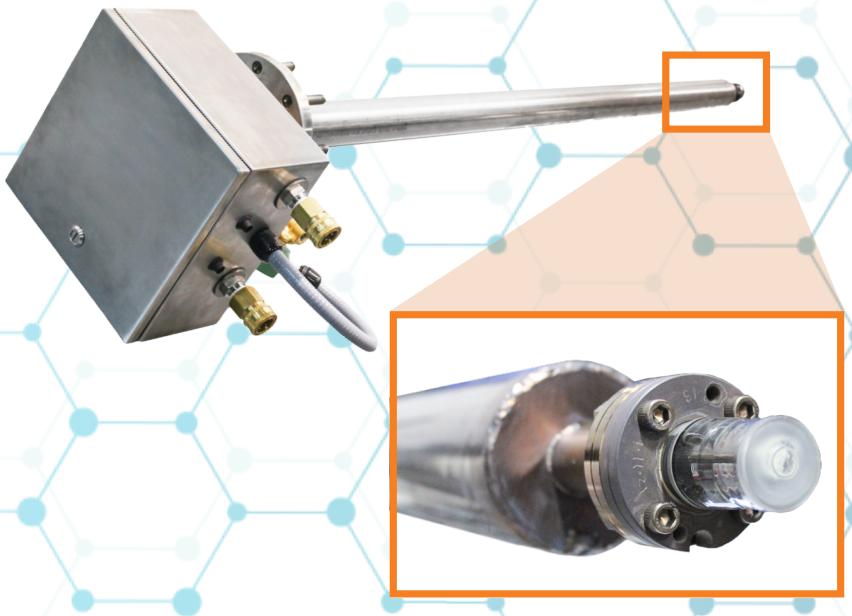
Passive detection mode is mainly used for applications such as sulfuric acid production, where the detection of unwanted condensation is the primary objective. This mode consists of maintaining the sensor at process temperature and detecting the moment condensation appears, thus warning the plant of a potential problem.

Active Mode

Active mode is used for applications such as copper smelters and coal-fired utilities where the primary objective is continuously measuring the dew point temperature. In this mode, a regulated supply of air cools the sensor surface. The rate of cooling is tightly controlled to allow continuous monitoring of condensate conditions on the sensor. Following detection of condensate, the cooling gas flow is stopped and the probe is allowed to return to localized gas temperature. As the probe heats, the instantaneous current is measured and reported back to the controller. When the liquid evaporation temperature is reached (detected by a rapid decrease in probe surface current), the process has completed and a new measurement cycle is initiated.

The instrument reports a multitude of information variables to the plant control room via Modbus or 4-20 mA signal. Examples of reported data include:

- Dew Point
- Estimated SO_3 Concentration
- Process temperature
- Alarms



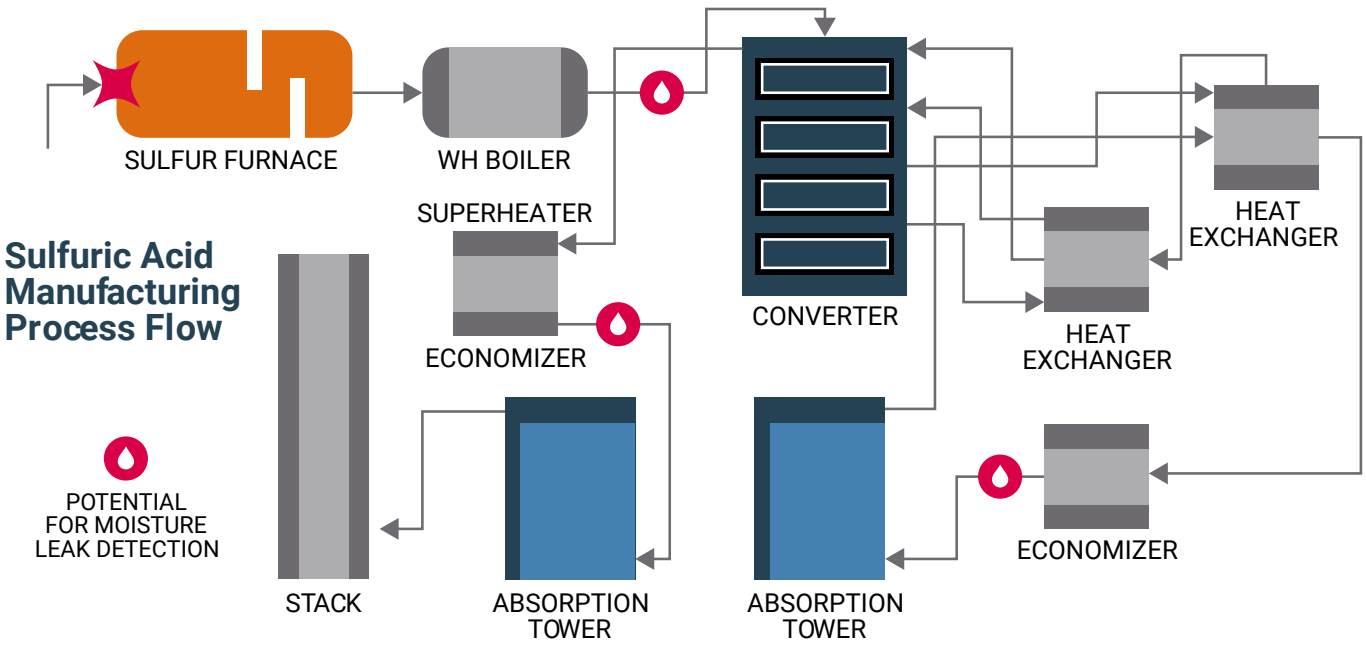
Sulfuric Acid Production

Instant Leak and Dew Point Detection

The Ei4200 DPM is optimized for the challenging conditions of the sulfuric acid process. It provides a quick indication of process gas moisture leaks hours, sometimes even days, before other methods.

In the sulfuric acid production process, gas laden with SO_3 is kept moisture-free. The only time moisture would be introduced into the gas stream is when there is a process upset. The ingress of moisture will cause a high process gas dew point and is generally indicative of one of the following conditions:

- Drying tower malfunction/performance
- Moisture in feed/fuel
- Waste heat boiler tube leaks
- Economizer tube leaks
- Cleaning system malfunctions



By performing moisture leak detection in the sulfuric acid process, plants can minimize equipment corrosion, process downtime, and avoid hydrogen safety hazards. In Passive Mode, the system will continuously maintain the sensor at process-gas temperatures. When moisture leaks into the process, condensable vapors will deposit on the sensor surface, be sensed by a conductivity measurement, and alert the plant operators to the potential for a moisture leak.

On-demand, or at pre-set intervals, the system will switch to Active Mode and cool the sensor to force condensation on the surface in order to measure the process gas dew point and perform an automatic operability check.

Coal Power Plants & Other Industrial Applications

Acid Dew Point/SO_3/Ammonium Bisulfate Detection & Measurement

Direct Measurement of Sulfuric Acid Vapor

The Ei4200 DPM for monitoring Acid Dew Point/SO_3/Ammonium Bisulfate is an industry-proven instrument for measuring the species and levels of the target vapors in industrial gas streams. It can be placed anywhere downstream of the economizer, from the SCR inlet to the scrubber inlet.

The system works by controlling the boundary layer temperature between the flue gas and the sensor. Precisely controlled cycling between preset high and low temperatures results in accurate determination of the dew point of the flue gas condensables. In cases where the vapor is pure H_2SO_4, the system combines this information with gas moisture levels using mathematical analysis to provide a real-time estimate of SO_3 concentration.

SO_3 Formation in Flue Gas Streams

Many boiler operational parameters influence the degree of total SO_3 formation including:

- Fuel sulfur content
- Ash content and composition
- Convective pass surface area
- Gas and tube surface temperature distributions
- Excess air level
- Coal fineness
- SCR catalyst condition

As a result, the same coal burned in two different boilers, or in the same boiler at different operating conditions, can produce substantially different levels of SO_3. Assumption of the level of total SO_3 based on any one variable is inadequate.

The Challenge – Control of Sulfuric Acid

High sulfuric acid levels produce multiple detrimental effects including:

- ABS formation, corrosion, and fouling of heat exchangers and ductwork
- Increased carbon emissions through elevated air heater outlet temperature
- Formation of acid mist in the stack plume

Conversely, sulfuric acid has the beneficial effect of promoting fly ash collection in cold-side electrostatic precipitators. Successful control of sulfuric acid levels can have a significant impact on EGU performance.

Optimize the Processes with the Ei4200 DPM

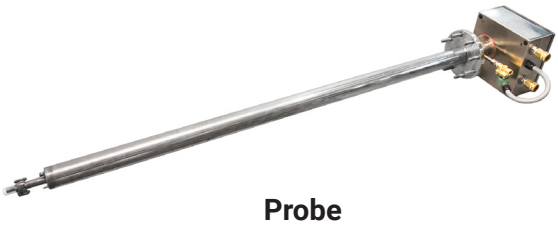
There are many processes within the power plant environment that can be optimized by controlling sulfuric acid vapor concentration. By using the Ei4200 DPM, plants can:

- Directly measure SCR catalyst MOT which can benefit operations by reducing minimum stable load
- Improve heat rate through both the control of ABS and air heater cold-end temperature
- Avoid ESP back-end and duct corrosion
- Improve ESP performance through control of the acid dew point and using the acid dew point/ESP inlet temperature relationship
- Mitigate blue plume (acid mist)
- Optimize dry sorbent injection (DSI)

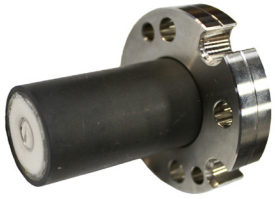
Ei4200 DPM Components & Features

Standard Components & Features

- **Probe (Image 1)**
  - 316 stainless steel standard, Hastelloy optional*
  - Houses sensor, heater, cooling line, & particulate blower
- **Sensor Assembly (Image 2)**
  - Durable Hastelloy housing*
  - Field replaceable*
- **Pneumatic, Electrical, and Communications Bundle**
  - Custom lengths
- **Control Cabinet (Image 3)**
  - Houses pneumatic controls, electronics, & HMI
- **Communications**
  - Modbus or 4-20 mA signal
  - Integrated remote access capabilities*
- **Sensor Temperature Control System**
  - Tightly controlled with proportional valve
  - Feedback sensor for cooling air flow*
- **Integrated Sensor Heater**
  - Internal to sensor, not exposed to process gas*
- **Integrated HMI**
  - InteliSense™ Software*
- **Standby Mode***
  - Protects sensor during downtime or system upsets
- **Data Processing**
  - Automatic data processing and interpretation*
  - Customizable alarm settings*
- **Automatic leak check***
  - Pressure sensor detects system leaks
- **Automatic zero correction***
  - Reduces baseline drift



Probe
(Image 1)

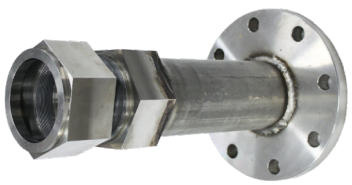


Sensor Assembly
(Image 2)

Control Cabinet
(Image 3)

Optional Components & Features

- **Automatic Sensor Cleaning System**
  - For high particulate applications
  - Pre-heated air blows off sensor surface
- **Flange Assembly (Image 4)**
  - To minimize process gas leaks during probe insertion/removal
- **Hastelloy Probe***
  - For highly corrosive applications



Flange Assembly
(Image 4)

*New Feature

Ei4200 DPM Specifications

Measurement Specifications	
Dew Point Range	100 to 700 °F (38 to 371 °C) (dependent on process gas temperature)
Accuracy	Within +/- 2 °F of operating range
Environmental Specifications	
Probe	Process wetted materials 316 SS, Hastelloy, Borosilicate
Max Process Temp	900 °F (482 °C)
Control Cab. Ambient Temp Limits	-20 to 131 °F (-29 to 55 °C)
Probe Ambient Temp Limits	-20 to 149 °F (-29 to 65 °C)
Installation Specifications	
Insertion Depth	Customizable
Probe Mounting	4” 150 lb ANSI Flange, Vertical or Horizontal Mounting
Air/Nitrogen Requirement	75psi (5.1 7 Bar) @ 25 SCFM (708 l/min) clean dry instrument air or nitrogen
Control Cabinet	
Electrical Requirements	120/240 VAC 50/60Hz, 20 Amp, 800 Watt dedicated circuit with fuse or circuit breaker protection hardwired to Control Cabinet
Analog Outputs	Two 4-20 mA signals
Modbus	Ethernet via Modbus TCP/IP
Alarms	Two dry contact outputs

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