Moisture and Hydrocarbon Dew-Point Measurement

Condumax II
Hydrocarbon Dew-point Analyzer

-11.0 °C HCDP
27.0 Bar G

-32.5 °C LWP
69.0 Bar G

Next Measurement: 0m 11s
Michell Instruments offers a comprehensive range of process analyzers for measuring water dew point, trace moisture and hydrocarbon dew point for the petrochemical and natural gas industries.

The range includes intrinsically safe and flameproof/explosion proof systems which are supplied as complete packages consisting of an analyzer – or combination of analyzers – and a fully integrated sampling system and control unit. A wide choice of standard process sampling systems are available, as well as the option of customized systems, designed by our dedicated Systems Engineering department to suit demanding or complex applications.

Michell’s Condumax II is the hydrocarbon and water dew-point analyzer of choice for the majority of gas transmission companies across the whole European gas distribution network.

**On-Line Process Analyzers: Universal Features**

In the petrochemical industry the measurement of moisture content in a multitude of process gases and liquids is one of the most difficult and demanding tasks for the process engineer. To maintain a certain moisture content or avoid defined moisture levels is crucial for most chemical processes.

Michell’s state-of-the-art, on-line analyzers help increase plant efficiency and safety in many petrochemical sites across the globe.

**Applications**

**Natural Gas Applications**

- Gas quality measurements to ensure compliance to transmission pipeline tariff specifications
- Avoiding hydrate formation and corrosion by monitoring the glycol dehydration plant output
- Gas heater ‘Superheat’ control of fuel gas to protect turbine power plants and save energy
- Protect turbo expanders and pipeline compressors from liquid impact damage

**Petrochemical Applications**

- Monitoring recycle gases during catalytic processes to maximize catalyst life and productivity
- HDPE and LDPE process gases and liquids – ethylene, hexane, butane and many more
- LNG/LPG production and quality control
- Liquid benzene for styrene manufacture
- Fuel refining and custody transfer to avoid liquid water phase separation

**Background to Michell Instruments**

Michell Instruments is the international leader in the field of moisture and humidity measurement solutions. With over 40 years’ experience, Michell designs and manufactures a wide range of transmitters, instruments and system solutions capable of measuring trace moisture, humidity, dew point and oxygen in a vast range of applications and industries ranging from compressed air, power generation, process, oil and gas, pharmaceutical and many more.

Michell uses four key dew-point measurement technologies in its products:

- Impedance method using a ceramic tile which delivers unrivalled speed of response and robustness
- Chilled Mirror method which has been incorporated into advanced, precision instruments for industrial and laboratory use
- Dark Spot™ technology which was developed in partnership with Shell, to offer a world-class solution for the measurement of hydrocarbon dew point
- Quartz Crystal technology for a high precision, fast responding moisture measurement with self-calibration

**Comprehensive analyzer packages with a selection of standardized sampling systems or customized solutions to suit exact application and installation requirements**

- Choice of certified explosion-proof (EEExd) or intrinsically safe (I.S.) measurement systems
- CSA approved for Class I, Division 1
- ATEX approved for Zone 1 and 2 installation
- Unique Michell Calibration Exchange Service provides cost effective field maintenance of moisture measurement certified traceable to standards of NPL (UK) and NIST (USA)
- Systems compatible with aggressive samples such as sour natural gas
Michell’s Advanced Ceramic Sensor technology provides rugged and reliable measurement of the water dew point and moisture content in both gases and liquids throughout natural gas and petrochemical industries. Our sensors are resilient to chemical attack and will not fail even when subjected to the most severe pressure shock. The Ceramic Sensor works by adsorbing water vapor in equilibrium with the fluid being measured into its porous active layer, sandwiched between two conductive plates.

High sensitivity even at ultra low trace moisture levels is achieved by use of semiconductor techniques to achieve an extremely thin active layer, protected by a micro-porous metallic surface coating. Therefore the sensor responds rapidly to changes in applied moisture, both when being dried (on process start-up) and when called into action if there is moisture ingress into a process. All Michell Ceramic Moisture Sensors provide up to 1°C accuracy and excellent long-term stability in process applications. The unique Michell Calibration Exchange Service enables all our customers worldwide to maintain traceable certified calibration of our process moisture analyzers at modest cost with minimal spares stock and down time.

**Hydrocarbon Dew Point for Natural Gas**

Michell’s hydrocarbon dew-point technology uses the patented Dark Spot™ optical principle, a technique radically different from that of any other chilled mirror system. Sensitivity of the order of 5 mgm$^3$ of condensate enables the analyzer to detect the almost invisible films of condensate which are characteristic of hydrocarbon gases at dew point, due to their low surface tension and colorless appearance.

The optical surface is the key element of the sensor cell and comprises an acid etched, semi-matt surface with a central conical shaped depression. A collimated beam of visible red light is focused onto the central region of the optical surface to form an annulus ring of light. Optical detection is made of light dispersed. As the sensor is cooled during a measurement cycle, hydrocarbon condensates form on the optical surface and its optical properties are modified – the reflected light intensity of the annulus ring increases and there is a dramatic reduction in the scattered light intensity within the dark spot region. This highly sensitive secondary effect is used to determine the hydrocarbon dew point.

**Multi-Channel Solutions**

**MCU - Multi-Channel Process Moisture Analyzer**

Liquidew I.S. and Promet I.S. are offered in the multi-channel MCU for up to four channels of liquid or gas phase measurement. Addition of further MCU units extends the capability to 8, 12, or more measurement channels, offering ultimate flexibility and cost efficiency.

**Remote Interface**

For users of our EExd analyzers wishing to have a dedicated host system within a convenient safe area location, the optional RI provides advanced graphical display, status information, comprehensive logging functions and all programme configuration functions for up to 31 analyzers. Access to full functionality is available through any web browser.
Hydrocarbon Dew Point in Natural Gas

**Condumax II**
Continuous on-line measurement of the hydrocarbon dew-point temperature of natural gas. Optional water dew-point for simultaneous measurement of both parameters with the sample analyzer system.

**HCDP Range**
Up to Δ -55K measurement depression from Main Unit operating temperature

**Water DP Range**
Calibrated from -100 to +20°Cd

**Accuracy**
±0.5°C hydrocarbon dew point
±1°C from -90 to +20°C dew point
±2°C from -100 to -60°C dew point

**Operating Temperature**
Indoors/Outdoors -20 to +50°C

**Temperature**
(+45°C for ATEX / IECEx T4)

**Certification**
ATEX / IECEx: II 2 G
Ex d IIB + H2 Gb Tamb = -40°C to +45°C Tamb
-40°C to +60°C T3
(CSA: Class 1, Div 1, Groups B (US only), C & D
GOST-R, GOST-K, GOST-T & TC TR EX-Cert)

**Outputs**
Modbus RTU, RS485 @ 9600 baud rate. Two 4-20 mA linear (non-isolated) outputs, user configurable for any combination of dew point or pressure parameters

**Alarms**
Process and analyzer status via software register and display annotation; Integrated low flow alarms; Analyzer status fault flag 23 mA on mA output 1; Status messages appear on HMI display

**Condumax II Transportable**
Transportable natural gas dew-point analyzer system with integrated sample conditioning and connection hoses for operation in the field.

**HCDP Range**
Up to Δ -55K measurement depression from Main Unit operating temperature

**Water DP Range**
Calibrated from -100 to +20°Cd

**Accuracy**
±0.5°C hydrocarbon dew point
±1°C from -90 to +20°C dew point
±2°C from -100 to -60°C dew point

**Operating Temperature**
Indoors/outdoors 0 to +40°C**

**Certification**
As Condumax II on-line certification above

Moisture in Process Gases

**Promet I.S.**
A complete, turnkey hygrometer system for moisture measurement in critical process gas applications. Single and multi-channel Control Unit, in combination with Liquidew IS for moisture in gases and liquids.

**Dew-Point Range**
-100 to +20°Cd
(-100 to +20°Cd calibration)

**Accuracy**
Dew point: ±1°C between -60 & +20°Cd
Moisture content: ±10% of reading
Dew point: ±2°C between -60.1 & -100°Cd

**Operating Temperature**
Sensor/Sampling System: -20 to +50°C

**Pressure**
Up to 45 MPa (450 barg)

**Certification**
ATEX / IECEx: II 1 G
Ex ia IIC T4 Ga (-20°C ≤ Ta ≤ +70°C)
PM: IS / 1 / 1 / ABCD / T4 Ta = +70°C
CSA: IS Class 1, Division 1, Groups ABCD T4 +70°C
IECEx: Ex ia IIC T4 (-20°C ≤ Ta ≤ +70°C)
TC TR Ex

**Outputs**
Analog: Two 4-20mA per channel
Digital: RS485 Modbus RTU

**Alarms**
4 alarm relays per channel

**Promet EExd**
Wholly hazardous area installed analyzer system for critical process gas applications.

**Dew-Point Range**
-120 to +30°Cd
(-100 to +20°Cd calibration)

**Accuracy**
Dew point: ±1°C between -59.9 & +20°Cd
Moisture content: ±10% of reading
Dew point: ±2°C between -60 & -100°Cd

**Operating Temperature**
Indoor/Outdoor -20 to +60°C
(+45°C for ATEX / IECEx T4)

**Pressure**
Max. 206 barg

**Certification**
ATEX / IECEx: II 2 G
Ex d IIB + H2 Gb Tamb = -40°C to +45°C Tamb
-40°C to +60°C T3
(CSA: Class 1, Div 1, Groups B (US only), C & D
GOST-R, GOST-K, GOST-T & TC TR EX-Cert)

**Outputs**
Analog: Two 4-20 mA per channel
Digital: RS485 Modbus RTU

**Alarms**
Two alarm relays per channel; optional flow alarm
Moisture in Process Liquids

**Liquidew I.S.**
Precise real-time measurement and control of process moisture conditions without the need for collection and analysis of liquid samples in a laboratory. Single and multi-channel Control Unit, in combination with Promet IS for moisture in gases and liquids.

**Liquidew EExd**
The moisture in liquid analyzer that offers the complete moisture measurement package for critical petrochemical liquid applications.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Liquidew I.S.</th>
<th>Liquidew EExd</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dew-Point Range</strong></td>
<td>-100 to +20°Cd (0.01 ppm to saturation)</td>
<td>-120 to +30°C (0.001 ppm to saturation)</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>Dew point: ±1°C between -60 &amp; +20°Cd</td>
<td>Dew point: ±1°C between -59.9 &amp; +20°Cd</td>
</tr>
<tr>
<td></td>
<td>Moisture content: ±10% of reading</td>
<td>Moisture content: ±10% of reading</td>
</tr>
<tr>
<td></td>
<td>Dew point: ±2°C between -60.1 &amp; -100°Cd</td>
<td>Dew point: ±2°C between -60 &amp; -100°Cd</td>
</tr>
<tr>
<td><strong>Operating Temperature</strong></td>
<td>Sensor/Sampling System: -20 to +50°C</td>
<td>Indoor/outdoor max -20 to +60°C (+45°C for ATEX / IECEx T4)</td>
</tr>
<tr>
<td><strong>Pressure</strong></td>
<td>Max 300 barg</td>
<td>Max. 50 barg</td>
</tr>
<tr>
<td><strong>Certification</strong></td>
<td>ATEX / IECEx: II 1 G Ex ia IIC T4 Ga (-20°C ≤ Ta ≤ +70°C)</td>
<td>ATEX / IECEx: II 2 G Ex d IIB + H2 Gd Tamb = -40°C to +45°C T4 Tamb -40°C to +60°C T3</td>
</tr>
<tr>
<td></td>
<td>FM: IS / I / I / ABCD / T4 Ta = +70°C</td>
<td>CSA: IS Class I, Division 1, Groups ABCD T4 +70°C</td>
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<tr>
<td></td>
<td>CSA: IS Class I, Division 1, Groups ABCD T4 +70°C</td>
<td>+70°C</td>
</tr>
<tr>
<td></td>
<td>IECEx: Ex ia IIIC T4 (-20°C ≤ Ta ≤ +70°C)</td>
<td>IECEx: Ex ia IIIC T4 (-20°C ≤ Ta ≤ +70°C)</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td>Two 4-20 mA per channel. RS485 Modbus RTU</td>
<td>Two 4-20 mA per channel. RS485 Modbus RTU</td>
</tr>
<tr>
<td><strong>Alarms</strong></td>
<td>Four alarm relays per channel</td>
<td>Two alarm relays per channel</td>
</tr>
</tbody>
</table>

* Ex certification stated for analyser. Ex certification for associated sample system may vary dependant on design.

** Michell’s Liquidew I.S sensors and sample conditioning system, housed in a temperature-controlled enclosure. Tamoil refinery, Switzerland. **

** Michell Instruments’ Condumax II On-Line Hydrocarbon Dew-Point Analyzer. Kinder Morgan, USA. **
Michell Instruments operates in the following markets:

- Compressed Air Dryers
- Pharmaceutical
- Standards Laboratories and Metrology
- Semiconductors
- Natural Gas and Petrochemicals
- Industrial and Pure Gas Production
- Power Generation

Other Product Ranges

Dew-Point Transmitters
Michell offers the widest range of dew-point sensors and transmitters on the market. From the industry standard Easidew 2-wire transmitter to the new, rugged Easidew PRO IS for hazardous areas, all are supplied with sensors traceable to national standards.

Portable Instruments
Michell’s range of easy-to-operate portable instruments provides fast, accurate and stable measurement of dew point, relative humidity and moisture concentration. They are designed to satisfy the most demanding industrial conditions, and are unique in the market for giving repeatedly fast response to low dew points.

Chilled Mirror Instruments
Chilled Mirror is a fundamental measuring technology offering the user exceptionally accurate, reliable and repeatable measurements from trace moisture to high humidity. Michell offers a range of instruments based on a rugged sensor design that is equally suitable for installation in demanding process environments or for use as an accurate reference instrument in a National Standards Laboratory.

Calibration Instruments
Michell has a wide offering of calibration equipment for the verification of trace moisture, dew-point and relative humidity sensors. A modular concept means that Michell’s engineers can build for you a customised calibration solution that meets your exact needs. Components may include air compressor and dryer; low range or high range humidity generator; simple sensor housing or environmentally controlled test chamber and finally, verification using a traceable Michell Chilled Mirror Hygrometer.

Oxygen Analyzers
Michell brings you the very latest technologies in oxygen measurement, designed to give years of reliable and accurate service in laboratory, process and fume gas applications. From instruments featuring a unique sealed reference zirconia sensor to a transmitter with the latest generation thermo-paramagnetic oxygen technology, all Michell oxygen analyzers are available in a range of different configurations.

Relative Humidity Instruments
Michell’s own RH sensing technology provides excellent resolution, long term stability and speed of response. We offer a wide range of humidity and temperature measuring sensors and instruments, including relative humidity transmitters, humidity and temperature transmitters as well as handheld indicators. The humidity generator range includes the most stable humidity generator on the market.