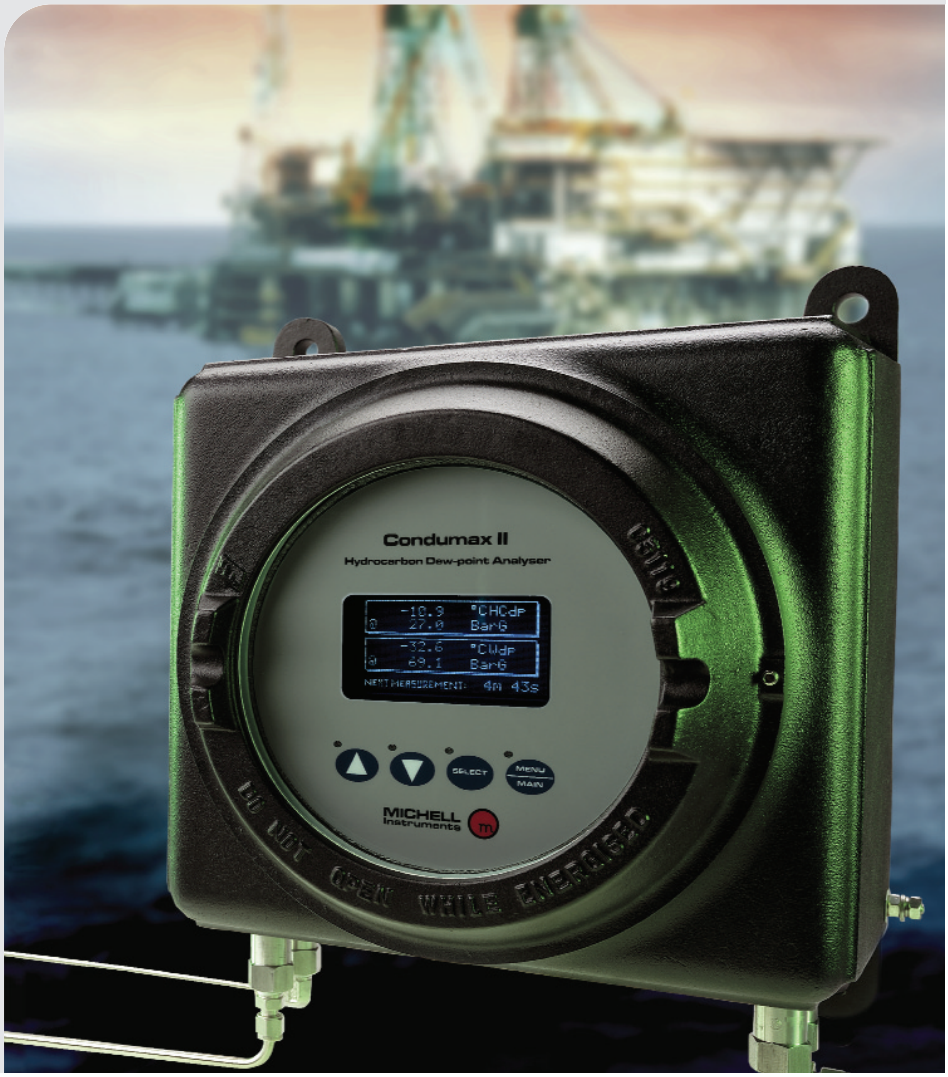
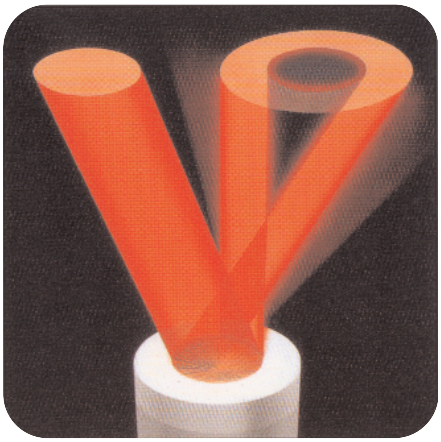
Condumax II

Hydrocarbon Dew Point Analyzer

Automatic, on-line measurement of hydrocarbon and water dew point in natural gas



- Fully automatic on-line analysis
- Objective, repeatable measurements
- 1° F (0.5 °C) hydrocarbon dew point accuracy
- Fundamental chilled mirror principle
- Patented detection technique
- Self-cleaning
- CSA Certified to Class 1, Div 1, Groups B, C, D, T4. Certificate number 1701657
- ATEX approved to II 2 G EExd IIB + H_2 T4 for hazardous area operation
- No purge air or external cooling system required
- Optional combined water and hydrocarbon dew point analysis
- Modbus RTU communications protocol



The Dark Spot™ Principle

Hydrocarbon dew point - a critical natural gas quality parameter

For natural gas producers and pipeline operators, hydrocarbon dew point is a tough parameter to measure and control – but it is vital to meeting the contractual limits which are increasingly being set and avoiding custody transfer disputes which frequently result in shut-ins. In fact, satisfactory hydrocarbon dew point measurement and control has emerged as THE issue at gas quality conferences, including AGA. The need for harmonization of analysis methods to ensure consistent best practice is being promoted by research groups within independent organizations such as API (USA), National Gas Council (USA) and GTE (European Union). These groups are evaluating relationships between direct hydrocarbon dew point measurement, potential hydrocarbon liquid content (PHLC) and analytical techniques such as gas chromatography.

The direct chilled mirror technique incorporated in the Michell Instruments' Condumax is the definitive method of measuring and controlling hydrocarbon dew point, and is preferred by most gas producers and pipeline operators across the world. Since 1986, the original Condumax I has enabled users to make direct fundamental measurements, automatically, on-line, with minimal maintenance demands in service and with a level of objectivity previously impossible. Condumax II extends this capability, adding the latest features and specifications to a proven and patented measurement technique. Condumax II offers the user the opportunity to standardize on a hydrocarbon dew point measurement technology that provides excellent correlation against PHLC and GC equation of state calculations, in an instrument that is simple to install and virtually maintenance free.

The Dark Spot™ measurement principle

Condumax II uses a patented chilled mirror optical measurement technique that is radically different to that of any other instrument. Sensitivity of better than 1 ppm molar (1mg/m^3) of condensed hydrocarbons enables the analyzer to detect the almost invisible films of condensate that are characteristic of hydrocarbon gases at dew point, due to their low surface tension and colorless appearance. The result is a breakthrough in accuracy and repeatability.

The optical sensor comprises an acid etched, semi-matte stainless steel "mirror" surface with a central conical-shaped depression, which is cooled during a measurement cycle. Collimated visible red light is focused onto the central region of the optical surface. In the dry condition, the incident light beam is dispersed by the matte surface providing a base signal to the optical detector. During a measurement cycle, hydrocarbon condensate is formed on the optical surface and it becomes reflective, due to the low surface tension of the condensate. An annular ring of light forms around the detector and there is a dramatic reduction in the scattered light intensity within the central Dark Spot™ region.
This secondary effect is monitored and interpreted. The Dark Spot™ detection technique utilizes the physical characteristic of hydrocarbon condensate that makes it so difficult to detect in a manual visual dew point meter. When a pre-determined layer of condensate has been detected, the instrument electronics record the temperature of the optical surface as the hydrocarbon dew point. In the subsequent recovery cycle, the optical surface is actively heated to evaporate the condensates back into the flowing gas sample. This fully automatic process is complete in under ten minutes.

Sensor Cell

The design of the Condumax II sensor cell is critical to its dynamic performance. This cell combines the optical detection system, Dark Spot™ sensor, thermocouple and three stage Peltier heat pump in a stainless steel unit that can withstand operating pressures up to approximately 1500 psig (100 barg) and still achieve a depression capability (lowest measurable hydrocarbon dew point) of almost -31° F (-35 °C) at room temperature.

Flow Decoupling

A flow de-coupling method is used in order to achieve maximum accuracy. Discrete measurement cycles, at user definable intervals, lock a fixed sample of the hydrocarbon gas mixture into the sensor cell. As the optical surface is chilled, sequential condensation of hydrocarbon components occurs until the pre-selected optical trip level is reached that signals the effective hydrocarbon dew point temperature of the gas. The fixed sample ensures representative condensation of hydrocarbon components and prevents preferential drop-out of heavy ends that would occur with a flowing sample, leading to a falsely high indication of the hydrocarbon dew point.

Intelligent Control

Condumax II has a fully automatic, intuitive and intelligent control system that improves accuracy, sensitivity and reproducibility under any operating condition. A three-stage Peltier cooler under powerful digital command allows Condumax II to vary its chill rate to enable detection of the smallest amount of condensate on the optical surface. During start-up, Condumax II will perform a measurement cycle at a standard chill rate in order to "range-find" the hydrocarbon dew point level. On subsequent cycles, the previous measured value is used to determine an optimized chill rate that will cause the sensor surface to cool quickly in the initial phase, but reduce its chill rate to 0.1°F/sec (0.05°C/sec) as it approaches the hydrocarbon dew point. This gives the user previously unattainable levels of precision and reproducibility and allows easy correlation with other HCDP measurement techniques. Condumax II can also operate in Condensate Mode in order to give reliable PHLC measurement at a specific pre-set pressure and temperature condition.

Condumax II is designed for easy operation, with innovative touch-screen control of all functions through the simple user menu that can be viewed in complete safety within the hazardous area environment on the high-resolution vacuum fluorescent alphanumeric display.

System Description

Main Unit

The Condumax II main unit contains all of the critical components in a single explosion proof/flameproof enclosure. The Dark Spot™ sensor cell and optional water dew point sensor are mounted inside the unit in conjunction with the pressure transducers, flow switches, measurement electronics and display. Flame arrestors on the gas inlet and outlet ports provide safety protection. Electrical connections are made through cable glands at the base of the enclosure. The main unit is a fully functional hydrocarbon dew point analyzer and requires only a clean, pre-conditioned gas sample and AC power for its operation.

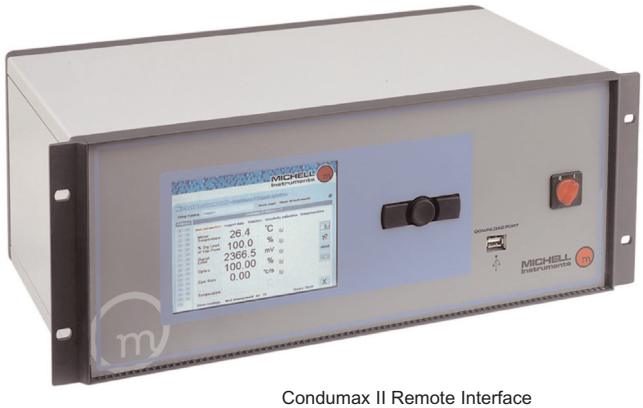
Sampling System

Indoor and outdoor standard sampling systems are available, providing comprehensive sample conditioning of natural gas at any pressure up to approximately 3000 psig (200 barg). The sampling system comprises pressure regulation, flow control and most importantly micro-porous membrane filtration with by-pass arrangement and condensate drain to give fast response and protection from liquid hydrocarbon/glycol contamination. Dual channel sampling is available for the combined hydrocarbon/water dew point analyzer package. The outdoor version is covered in a NEMA 4 rated, insulated stainless steel enclosure. Thermostatically controlled heating ensures no condensate or water drop-out prior to measurement. For both the indoor and outdoor sampling systems, the Condumax II Main Unit is mounted integral to the Sampling System.

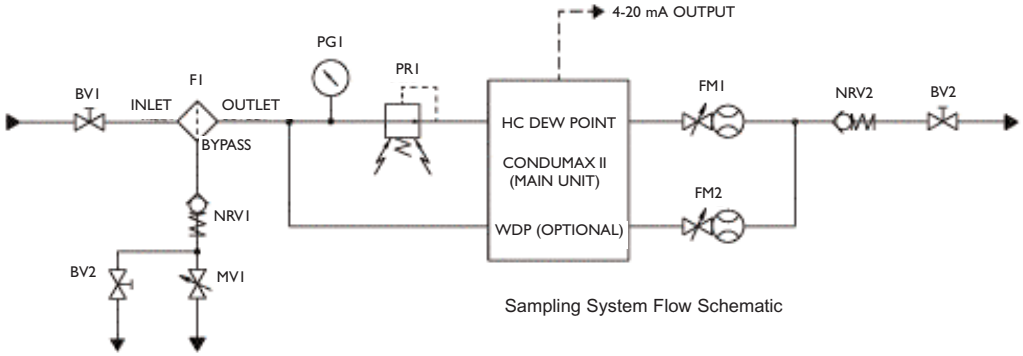
Human Interface

Condumax II is designed to be flexible in terms of measurement display and connectivity to other equipment. As standard, Condumax II provides a multi-function vacuum fluorescent display on the Main Unit that shows all measurement parameters and allows the user to adjust certain control parameters, view log data, max/min statistics etc. In addition, Condumax II provides two 4-20mA outputs, configurable from the Main Unit user interface for any combination of measurement parameters. A digital output using Modbus RTU protocol is provided, for connection to an external computer, DCS or PLC system located in a safe area. Active X controls are an available option for integration in DCS systems.

Optionally, a dedicated Remote Interface with Windows-based operating software is available with full remote control capability, including OPC (OLE for Process Control Technology).



Condumax II Remote Interface



Sampling System Flow Schematic

Technical Specifications

HAZARDOUS AREA CERTIFICATION

CSA certification to Class 1, Div 1, Groups B, C, D. -40 °C to +60 °C ambient. Temp. Code: T4.
Cerificate number 1701657
ATEX certified to II 2 G EExd IIB + H_2 T4, certificate number TRL04ATEX11060X

HYDROCARBON DEW POINT MEASUREMENT

Measuring Technique	DARK SPOT™ fixed sample analysis. Direct photo-detection of hydrocarbon condensate at hydrocarbon dew point temperature
Sensor Cooling	Automatic via 3-stage Peltier effect electronic cooler
Maximum Range	-29° F (-34 °C) HCDP from 70° F (21 °C) ambient @ approximately 400 psig (27 barg) (range depends on sensor temperature)
Accuracy	±1° F (±0.5°C) hydrocarbon dew point
Sample Gas Flow Rate	1 scf/hr (0.03 m³ln/hr)

WATER DEW POINT MEASUREMENT (OPTIONAL)

Measuring Technique	Michell Ceramic Moisture Sensor
Range	Calibrated from -148° F to +68° F (-100 to +20°C) dew point
Accuracy	±2° F from -74° F to + 68° F (±1°C from -59 to +20°C) dew point; ±3.5° F from -148° F to -76° F (±2°C from -100 to -60°C) dew point
Sample Gas Flow Rate	2 to 10 scf/hr (0.06 to 0.3 m³/hr)

PRESSURE MEASUREMENT

Range	HCdp - 0 to ±1500 psig (0 to 100 barg) Wdp - 0 to ±3000 psig (0 to 200 barg)
Accuracy	+/- 0.25% FS, thermal hysteresis: ±1% over a △T of 144° F (80 °C)

HYDROCARBON DEW-POINT ANALYSER

Sample Gas Supply	Natural gas up to 1500 psig (100 barg), pressure regulated in sampling system.
Enclosure	CSA Class 1, Div. 1/EEx d cast enclosure with removable glass window viewing port. Internally heated for condensation protection.
Sample Gas Connections	¼" NPT female ports for both hydrocarbon and water dew point channels.
Operating Environment	Indoors/Outdoors -4° to +140° F (-20 to +60 °C). Max 95% RH.
Power Supply	90 - 264Vac 50/60Hz, 200W Main Unit; 300W c/w indoor sampling system; 400W c/w outdoor sampling system
Weight	Main Unit 50 lbs. (22.5 Kg) c/w Sampling System (indoor) 93 lbs. (42kg) c/w Sampling system (outdoor) 125 lbs (57kg)
Integrated Display	Touch screen with vacuum fluorescent display.
Outputs and Alarms	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. Hydrocarbon and water dew point alarms via software register. Integrated low flow alarms for each sample flow.

OPTIONS AND ACCESSORIES

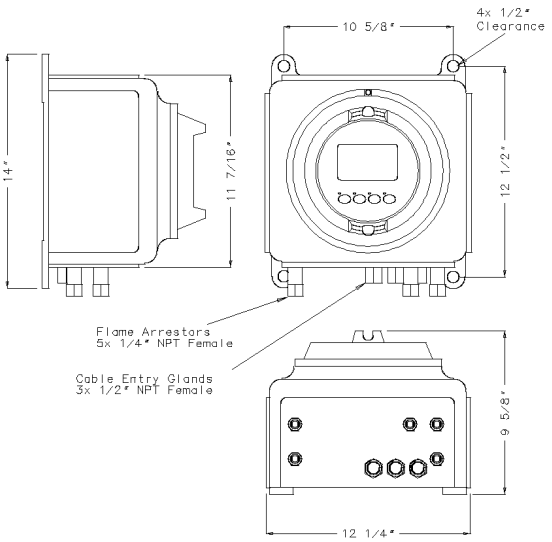
Remote Interface	Integrated safe-area control unit for Condumax II, providing display of all variables, charting and logging functions, parameter control and remote diagnostic facilities. 19" Sub-Rack unit with 6.5" colour LCD display and mouse control.
Plant control Integration	ActiveX components to be used by software programmers for integration of modbus protocol into a general plant software system.

Q6284
ISO9001:2000

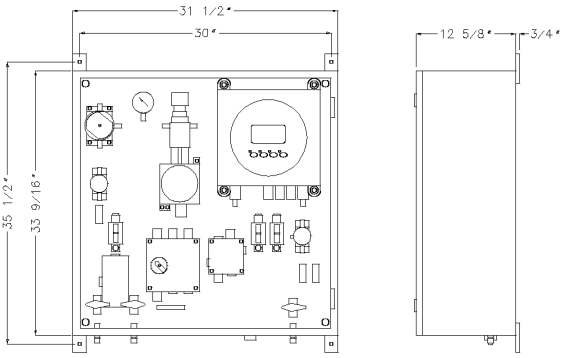
MICHELL Instruments

The Dew Point Specialists

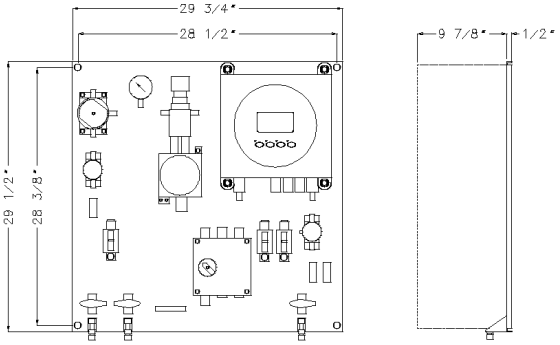
Dimensions



Main Unit



Condumax II - Complete with Outdoor Sampling Systems



Condumax II - Complete with Indoor Sampling Systems

Process Measurement & Controls Inc
Michell Instruments Condumax Division
11 Old Sugar Hollow Road
Danbury CT 06810 USA
Tel: 203-792-8686
Fax: 203-743-2051
E-mail: us.sales@michell-instruments.com
www.michell-instruments.com