



SS2100 WATER MEASUREMENT

IN PURE ETHYLENE

Product Code 55001

Ethylene is one of the most important feedstocks for the petrochemical industry. Since it is used in the manufacture of a wide range of compounds, Ethylene has very stringent purity specifications especially for Polymer Grade Ethylene as water poisons polyethylene catalysts. Sample points for water in Polymer Grade Ethylene are either in the Ethylene plant product (Fig. 1 on page 4) or in a Polyethylene plant feed (Fig. 2). Large quantities of Ethylene are transported via pipelines and stored in underground salt caverns. In both cases, the purity of the Ethylene must be verified at the point of custody transfer.

WATER CONTROL AND REDUCTION

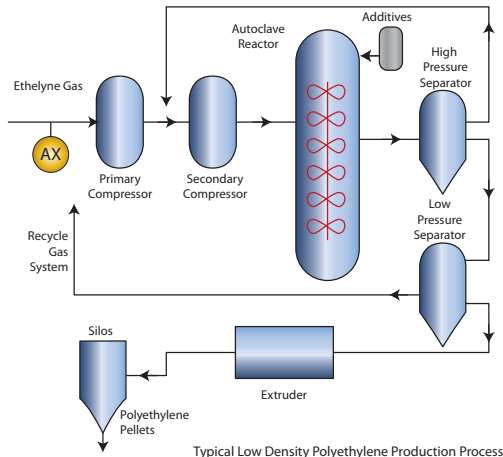
As Ethylene is separated from Ethane in a cryogenic distillation, the cracked gas must be dried, typically over Molecular Sieves and the Ethylene product is quite dry. However, from that point on, Ethylene can pick up traces of water from transportation in pipelines and ships, storage in salt caverns, and other handling. Molecular Sieve dryers can be used to dry off-spec Ethylene.

TRADITIONAL MEASUREMENT SOLUTIONS

Vibrating crystal, AlO₃ capacitance probes and electrolytic moisture analyzers have been the traditional methods for monitoring the levels of water in Polymer Grade Ethylene. These methods suffer from slow wet-up and dry-down time, slow drift in calibration and sensitivity to contamination. Due to the very short residence times in Ethylene feed storage vessels and the desired to measure Ethylene in flowing pipelines, the delay in measurements can easily lead to excursions in concentrations before it is detected.

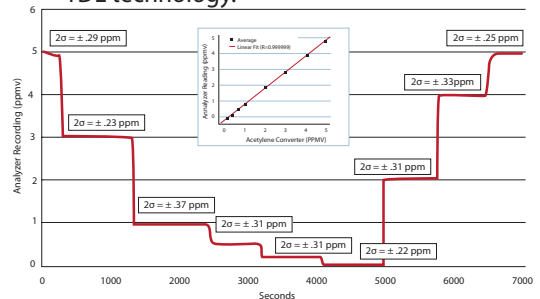
SPECTRASENSORS' SOLUTION

The SpectraSensors SS2100 is the ideal solution for Ethylene purity applications.



Typical Low Density Polyethylene Production Process

The use of Tunable Diode Laser technology means that analysis results can be updated every second. Furthermore, the high resolution that is inherent to the laser eliminates errors due to interferences which have hampered other spectrometric approaches. Also, the non-contact nature of the measurement with no moving parts in the analyzer means it is simple to operate and little routine maintenance is needed. SpectraSensors applies differential spectroscopy where the sample is dried using a metal getter technology and the background spectrum of the sample is collected. The dryer is then bypassed and the wet sample spectrum is collected. The dry spectrum is subtracted from the wet spectrum to get a sensitive measurement free of background gas interferences. The dryer has a typical lifetime greater than 18 months, and is the only consumable part of the analyzer. See Fig. 3 for typical calibration performance. In addition to water, trace Acetylene measurements can be made using TDL technology.



SS2100 Moisture Analyzer

SPECIFICATIONS

Application Data

Target Components	Water in Pure Ethylene
Typical Measurement Ranges	0-10ppm*
Typical Precision	±0.05ppm or 2% of Full Scale (whichever is greater)*
Measurement Response Time	1 to ~60 seconds*
Principle of Measurement	Differential Tunable Diode Laser Absorption Spectroscopy (H ₂ O scrubber included)
Environmental Temperature Range	-20° to 50° C (-4° to 122° F) -10° to 60° C (14° to 140° F) <i>optional</i>
Sample Inlet Pressure	70kPag (10 PSIG) typical 210kPag (30 PSIG) maximum
Sample Cell Temperature Range	Maintain at 50° C ±2° C
Maximum Cell Pressure	70kPag (10 PSIG)
Sample Flow Rate	3-4 L/min (6.4 to 8.5 scfh)*
Recommended Validation	A certified blend of H ₂ O in Nitrogen balance is diluted with dried sample in the sample conditioning system under flow control



Electrical Data

Power	100-240 VAC, 50-60 Hz standard
Max Current	Controller: 1A @ 120 VAC
Controller to Cell Cable Length	1m standard (3m, 5m & 10m available optionally)
Communication	Current Loop Output 4-20 mA Isolated, 1200 ohms @ 24 VDC max load. Serial: ASCII Text RS232C standard, Modbus RS232C
Digital Outputs	Four (4) 12 VDC for valve operations: Scrubber (if required), Process/Val, Val 1, Val 2 5 SPDT (Form C) Dry Contacts: Common Fault, Val 1 Active, Val 2 Active, Val Fail, One user assignable DO to standard alarms
LCD Display	Concentration, Cell Pressure and Temperature, Diagnostic Data

Physical

Controller Enclosure	NEMA 4X – 304 stainless steel <i>standard</i>
Controller Dimensions	343 mm H x 305 mm W x 165 mm D (13.5" H x 12" W x 6 7/16" D)*
Weight Approximately	13.1 Kg (28.6 lbs)*
Sample Cell Dimensions	28m cell for ranges <100ppm, 559 mm H x 127 mm W (22"H x 5"W)
Sample Cell Construction	316L Series Polished Stainless Steel Standard Silitek® coated
Number of Sample Cells	1 (Single Channel SS2100) or 2 (Dual Channel SS2100)
Dimensions with Sample System	1678 mm H x 613 mm W x 427 mm D (66" H x 24-1/8" W x 16-13/16" D)
Weight with Sample System	68 Kg (150lbs)

Area Classification

Certification	CSA Certified for Class I, Div. 2, Groups ABCD T3C Ex II 2G Ex d IIB+H2 T5; Tamb : -20 ÷ +60 °C
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* Application specific; consult factory.

TYPICAL BACKGROUND STREAM COMPOSITION

Component	Unit	Typical Concentration	Min for Application	Max for Application
Propylene (C ₃ H ₆)	Wt%	99.75	99.5	100
Water	ppmw	<2	0	100
Ethylene (C ₂ H ₄)	ppmw	50	0	100
Ethane + Propane	Wt%	0.25	0	0.5
Diolefins + Acetylenes	ppmw	<10	0	25
Carbon Monoxide	ppmw	<10	0	30
Carbon Dioxide (CO ₂)	ppmw	<1.0	0	2
Oxygen (O ₂)	ppmw	<1	0	2
Total	Mole%	100		

ANALYZER

The Analyzer consists of the electronic controller, cell, and 1m long interconnecting cable (standard). Interconnecting cable lengths of 3m, 5m and 10m are also available for mounting the controller remotely, for example, with the controller mounted inside an analyzer shelter and the cell and sample system outside the shelter. The sample conditioning system and/or cell enclosure must maintain the sample and cell at a constant temperature (generally 50°C +/- 0.2°C) that is above the hydrocarbon and moisture dew points of the process stream. The sample flow, sample pressure, and temperature specifications listed above must be maintained at all times. Any departure from these specifications must be approved by SpectraSensors.

RELAY CONTROL AND COMMUNICATIONS

All SS2100 Process Analyzers are supplied with 9 relays:

- o Four (4) are 12 VDC powered and provided for driving switching valves associated with Process, Validation 1 and Validation 2 and a scrubber (for differential systems only).
- o Five (5) SPDT (Form C) dry contact digital outputs are provided for common fault, Val 1 active, Val 2 Active, Validation Fail, and one (1) user-assignable DO to any standard alarm, such as high concentration, high cell pressure, low cell temperature, high cell temperature, low sample flow, etc. depending on the application.

Data Output is via 4-20 mA Isolated Analog Output.

Serial Communication via Modbus protocol is provided. See Modbus specifications for details.

MEASUREMENT SOLUTION

Proper sample conditioning is essential to an accurate and reliable measurement. SpectraSensors provides standard and custom-engineered Measurement Solutions for all applications. Standard features include:

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| Inlet Pressure Relief Valve | Automatic Valve for Validation Gases |
| Inlet and Outlet Shut-off Valves | Cell Flow Rotameter and Control Valve |
| Sample Filter | Outlet Pressure Gauge |
| Sample Bypass Pressure Gauge | Cell Outlet Non-return Valve |
| Bypass Flow Rotameter and Control Valve | |