



SS2100 WATER IN ETHYLENE PLANT DRY CRACKED GAS

Product Code 54801

KEY FEATURES

- Extremely fast analysis time – 1 second updates possible
- Non-contact laser and detector - Reliable Tunable Diode Laser lasts years
- No frequent sensor change-out – Low cost of ownership
- High resolution laser and Differential Spectroscopy – Eliminates errors due to interferences and changing background gases
- High resolution laser-based measurement eliminates errors due to interferences and changing background gases

In Ethylene production the process gas is cooled to approximately -150°C in the separation section of the plant where the various products will be cryogenically fractionated. Water must be removed prior to cooling the process gas. The drier the process gas is, the longer and more efficiently the separation section can be operated without shut-downs.

CRACKED GAS DRYER Molecular Sieves and Activated Alumina are both used in Cracked Gas drying. As the inlet gas is saturated, water concentration can be estimated from the process temperature and pressure, and the cycle time of the dryers is controlled from their known capacity. However, dryers are subject to fouling with polymers and heavy hydrocarbons and channeling through the dryer bed can shorten the effective dryer cycle time.

CRITICAL CONTROL OF MOISTURE To maintain the efficiency of the process and to ensure the purity of the final Ethylene product, water measurements at the outlet of the dryer are essential.

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 times, 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. Due to their slow drift in calibration, capacitance probes have very high maintenance costs due to frequent replacement of the probe.

SPECTRASENSORS' SOLUTION The SpectraSensors SS2100 is the ideal solution for moisture in Dry Cracked Gas. 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 that have hampered other spectrometric approaches.

Also, the non-contact nature of the measurement with no moving parts in the analyzer means that the analyzer is simple to operate and little routine maintenance is needed. Only 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, and thus changing background gas compositions are compensated. 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.

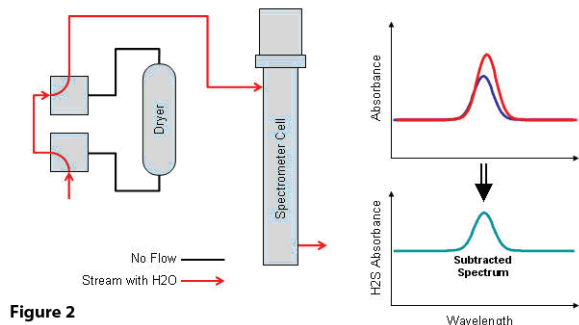


Figure 2

SS2100 Moisture Analyzer

SPECIFICATIONS

Application Data

Target Components	H ₂ O in Dry Cracked Gas
Typical Measurement Ranges	0-10ppm* (other ranges available by request)
Typical Precision	2% of Full Scale*
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 Herriott cell, 559 mm H x 127 mm W (22" H x 5" W)
Sample Cell Construction	316L Series Polished Stainless Steel Standard SilcoNert® 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.



ANALYZER

The Analyzer Scope consists of the Electronic controller, cell, and 1m long interconnecting cable. The customer or analytical systems integrator is responsible for providing a sample conditioning system and/or cell enclosure that maintains 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.

TYPICAL BACKGROUND STREAM COMPOSITION

Component	Unit	Typical Concentration	Min. for Application	Max. for Application
Water	ppmv	<5	0.05	10
Hydrogen Sulfide (H ₂ S)	ppmv	<2	0	10
Carbon Dioxide (CO ₂)	ppmv	<5	0	10
Hydrogen (H ₂)	Mole %	25	10	30
Methane (CH ₄)	Mole %	20	10	35
Ethane (C ₂ H ₆)	Mole %	15	5	30
Ethylene (C ₂ H ₄)	Mole %	25	20	40
Acetylene (C ₂ H ₂)	Mole %	0.3	0	0.5
Propylene (C ₂ H ₆)	Mole %	7.5	0	15
Propane (C ₃ H ₈)	Mole %	7.5	0	15
Methyl Acetylene (Propyne C ₃ H ₄)	Mole %	0.03	0	0.1
Propadiene (C ₃ H ₄)	Mole %	0.02	0	0.1
Carbon Monoxide (CO)	Mole %	0.05	0	0.1
Butanes	Mole %	0.05	0	1.0
Butenes	Mole %	0.3	0	1.0
1,3-Butadiene	Mole %	0.5	0	2.0
C5+	Mole %	0.1	0	2.0
Total	Mole %	100		

The background stream composition must be specified for proper calibration and measurement performance. Specify the Normal composition, along with the minimum and maximum expected values for each component, especially water, the measured component. Other stream compositions may be allowable with approval from SpectraSensors.

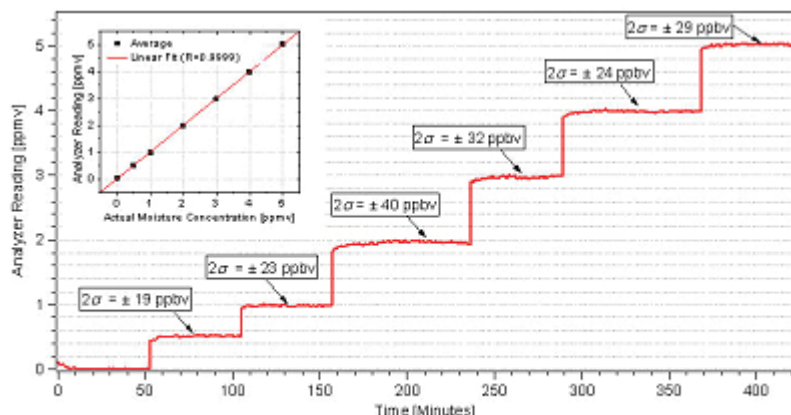
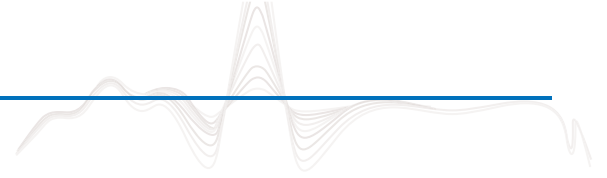


Figure 3: Differential Spectra of H₂S in mixed Hydrocarbon Background



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:

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	

VALIDATION

Validation is done using a special dilution system in the sample conditioning system. A certified standard of Water in Nitrogen is diluted under flow control to approximately 5 ppm H₂O using the sample gas dried through the dryer in the system.

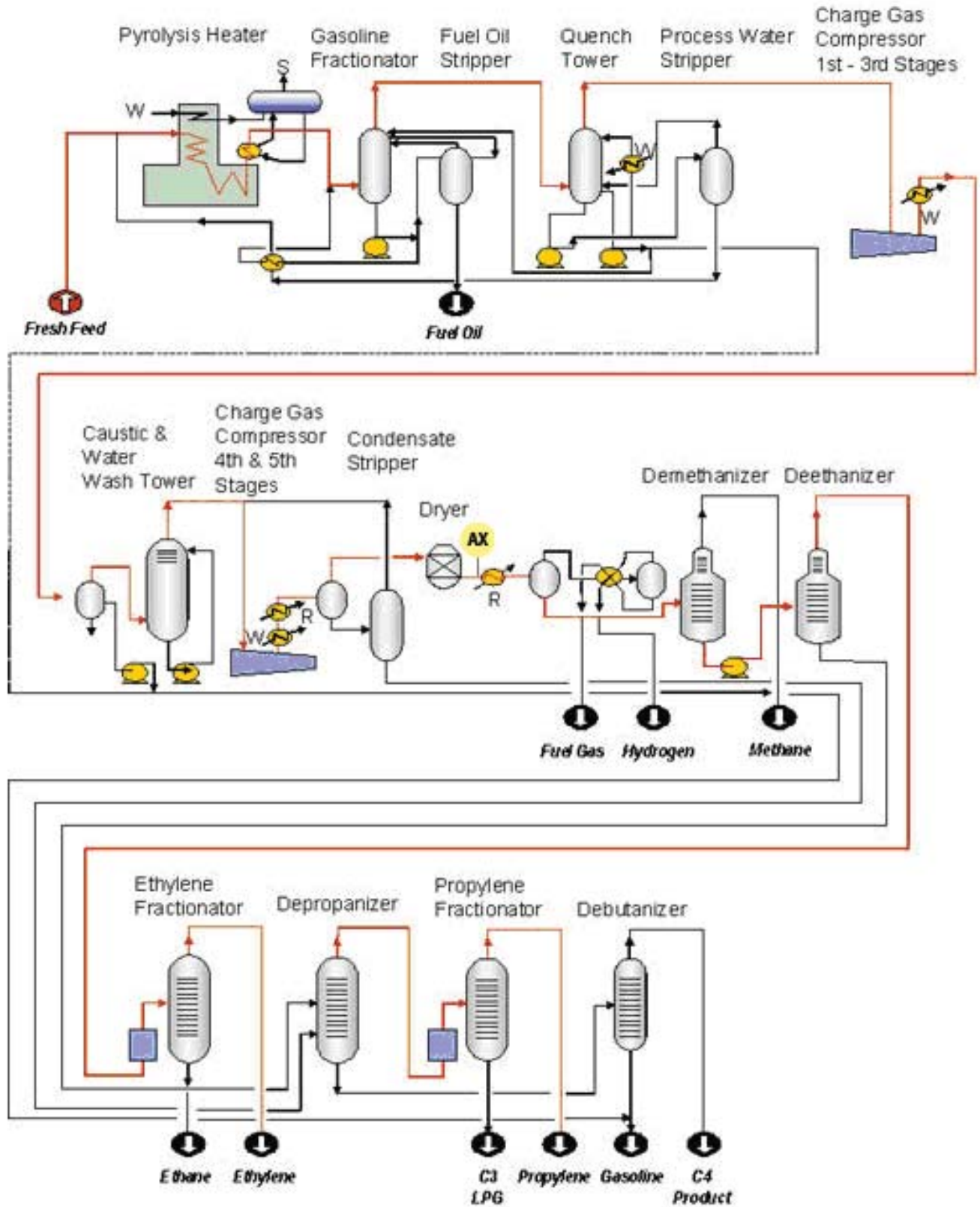


Figure 1: Typical Ethylene process flow showing Dryer