



SS2100 WATER IN HYDROGEN RECYCLE ANALYZER

FOR REFINERY CATALYTIC REFORMER H₂ RECYCLE STREAMS

Product Code 23101

KEY FEATURES

- Avoids damage to sensor from HCl and other contaminants in the process - Tunable Diode Laser and Detector are isolated from the process Gas
- Virtually maintenance free - No routine maintenance requirements
- Fast – No wet-up or dry-down times - Responds to changes in H₂O concentration in as little as 1 sec.
- No interference from other compounds – uses high resolution TDL technology



Control H₂ Recycle H₂O concentration for optimum catalyst performance and for catalyst regeneration control.

CATALYTIC REFORMING UNIT

The Catalytic Reformer Unit of a modern refinery is an important process unit for converting lower octane naphtha streams into higher octane aromatic compounds.

These chemical conversions are done in catalytic reactors that transform straight-chain C₆-C₈ compounds found in the naphtha into light aromatics such as Benzene, Toluene and Xylenes (BTX). This high octane reformat can then be used in gasoline blending or sold to chemical plants.

As shown in Figure 1, depentanized naphtha feed is mixed with recycled Hydrogen gas, preheated and passed through a series of reactors where the conversion to aromatics takes place.

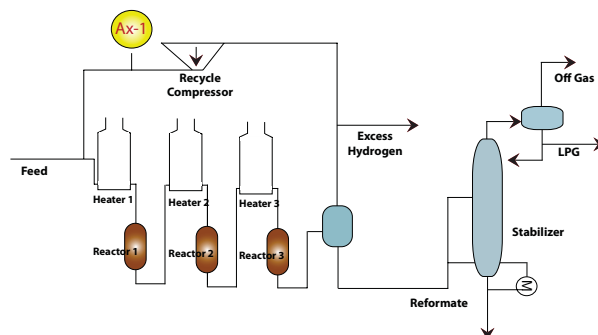
After the last reactor, a Hydrogen Separator strips out the Hydrogen and other light gases from the stream. After the removal of the Hydrogen, the stream enters a Stabilizer Tower (also called a Debutanizer) that removes the Butanes and lighter gases with the Reformat leaving the Bottoms for gasoline blending or sent to a chemical plant.

CRITICAL CONTROL OF MOISTURE

The catalyst in the reactors is very expensive and sensitive to poisoning if exposed to certain compounds; most notably H₂O, if left unchecked, the moisture damages the catalyst, thus shortening its life and resulting in costly replacement fees. Proper operation of the Reformer needs reliable monitoring of the moisture levels in the Hydrogen Recycle.

TRADITIONAL MEASUREMENT

SOLUTIONS Electrochemical moisture analyzers have been the traditional method



for monitoring the levels of H₂O in the Hydrogen Recycle stream. However, heavy hydrocarbons and trace HCl present in the stream contaminate electrochemical probes, which must then be replaced resulting in high maintenance costs. It's not uncommon for moisture probes to be replaced multiple times a year.

SPECTRASENSORS' SOLUTION

SpectraSensors SS2100 is the ideal solution for this challenging application. Its non-contact sensor is impervious to damage from contaminants. The use of Tunable Diode Laser technology means that measurement interferences from other infrared absorbing compounds are avoided. And being laser-based means there are no wet-up or dry-down delays, resulting in fast updates even when the concentration changes dramatically.

DUAL RANGE / DUAL CHANNEL

Refineries normally operate at about 5 – 50ppm moisture level in the Hydrogen Recycle stream. During catalyst regeneration moisture can be much higher. A Dual SS2100, with two measurement cells calibrated for different ranges in a single sample enclosure is the answer to this requirement.

The analyzer is supplied as a controller in a NEMA 4X enclosure with the cell and interconnecting cable supplied loose. SSI or a qualified systems integrator can supply a sample conditioning system suitable to the application.

SS2100 Moisture Analyzer

SPECIFICATIONS

Application Data

Target Components	H ₂ O in Hydrogen Recycle Gas
Typical Measurement Ranges	0-50ppm, 0-200ppm, 0-500ppm, 0-1000ppm*
Typical Precision	±2% of full scale*
Measurement Response Time	1 to ~60 seconds*
Principle of Measurement	Tunable Diode Laser Absorption Spectroscopy Non-Differential
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	0.8m (0-100ppm or 0-1000ppm) 8m Herriott at (0-50ppm)
Cell Temperature	Maintain at 50° C ±2° C
Maximum Cell Pressure	70kPag (10 PSIG)
Sample Flow Rate	1-1.5 L/min (2.1-3.2 scfh)* 3-4 L/min (6.4 to 8.5 scfh)* for 0-50ppm
Recommended Validation	Certified blend of H ₂ O in pure N ₂



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	3 each 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

Enclosure Type	NEMA 4X – stainless steel <i>standard</i>
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	68 Kg (150 lbs) with sample system - 13.1 Kg (28.6 lbs) without sample system
Sample Cell Dimensions	0.8m cell for ranges >200ppm, 438 mm H x 108 mm W (17 1/4"H x 4 1/4"W) 8m cell for ranges <200ppm, 559 mm H x 127 mm W (22"H x 5"W)
Sample Cell Construction	316L Series Polished Stainless Steel Standard
Number of Sample Cells	1 (Single Channel SS2100) or 2 (Dual Channel SS2100)

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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* Other ranges available.

** Application specific; consult factory.



SPECTRASENSORS SS2100 WATER IN HYDROGEN RECYCLE 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.

Cable lengths of 3m, 5m and 10m may be substituted by specifying the corresponding part number. See spare parts and accessories list.

Select the measured range desired. Other ranges are available by special order.

TYPICAL BACKGROUND STREAM COMPOSITION

Component	Minimum (Mole %)	Normal (Mole %)	Maximum (Mole %)
Hydrogen	70	80	90
Methane	8	12	20
Ethane	3	5	10
Propane	0	2	5
i-Butane	0	1	2
n-Butane	0	<1	2
C5	+0	0	1

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.

ALL SS2100 ANALYZERS ARE SUPPLIED WITH 9 DIGITAL OUTPUTS:

I. Four (4) 12 VDC powered and provided for driving switching valves associated with:

1. Scrubber (for differential systems only)
2. Process
3. Validation 1
4. Validation 2

II. Five (5) SPDT (Form C) dry contact digital outputs are available for alarms:

1. Common Analyzer Fault
2. Val 1 Active
3. Val 2 Active
4. Validation Fail
5. One user-assignable to any of the following standard software alarms
 - a. High Concentration
 - b. High Cell Temperature
 - c. Low Cell Temperature
 - d. Temperature Delta Limit Exceeded
 - e. High Cell Pressure
 - f. Low Cell Pressure
 - g. Pressure Delta Limit Exceeded
 - h. High Laser Current
 - i. Low Laser Current
 - j. Peak Tracking Limit Exceeded
 - k. Fitting Limit Exceeded