

Raman analyzer application guide for the Oil & Gas and Chemical industries

Composition analysis of gas streams
and LNG



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Listed below are applications in the fertilizer, bulk gas, refining, synthetic natural gas (SNG), methanol, and Oil & Gas industries where Endress+Hauser Raman analyzers are used to measure gas and liquid composition. Measured gases include CO (carbon monoxide), CO₂ (carbon dioxide), H₂ (hydrogen), N₂ (nitrogen), O₂ (oxygen), H₂S (hydrogen sulfide), NH₃ (ammonia), CH₃OH (methanol), CH₄ (methane), C₂H₆ (ethane), C₃H₈ (propane), and more. Measured liquids are currently focused on the oil & gas industry and include liquefied natural gas and mixed refrigerant composition.

The Raman Rxn4 analyzer, Raman Rxn5 analyzer, Rxn-30 probe, and Rxn-41 probe were developed by and are manufactured by Endress+Hauser, and are powered by patented Kaiser Raman holographic technology. The Raman Rxn5 analyzer has been specifically designed with the high sensitivity required for gas-phase applications and the field instrument performance required for liquid process measurements. The Raman Rxn4 analyzer provides even higher accuracy required for LNG custody transfer applications.

Gas-phase applications

Industry	Process plant	Measurement parameter	Application note title/process measurement point
Fertilizer	Ammonia		Ammonia: production analytics overview
		Carbon number	Ammonia: natural gas feed to primary reformer
		Btu	Ammonia: fuel gas to reformer furnaces
		Composition/CH ₄	Ammonia: raw syngas - primary reformer outlet
		Composition/CO	Ammonia: raw syngas - secondary reformer outlet
		Composition/CO	Ammonia: high temperature shift converter outlet
		Composition/CO ₂	Ammonia: low temperature shift converter outlet
		Composition/CO ₂	Ammonia: CO ₂ absorber outlet - methanator inlet
		Composition/H ₂ /N ₂	Ammonia: methanator outlet - purified syngas
		H ₂ /N ₂ ratio	Ammonia: converter feed stream
		Composition/impurities	Ammonia: converter exit stream
	CH ₄ impurities	Ammonia: synthesis loop purge gas	
Bulk gas suppliers	HyCO plants		Merchant hydrogen: HyCO production analytics overview
		Carbon number	Merchant hydrogen: natural gas feed to primary reformer
		Btu	Merchant hydrogen: fuel gas to reformer furnaces
		Composition/CH ₄	Merchant hydrogen: raw syngas - primary reformer outlet
		Composition/CO	Merchant hydrogen: raw syngas - secondary reformer outlet
		Composition/CO	Merchant hydrogen: high temperature shift converter outlet
		Composition/CO ₂	Merchant hydrogen: low temperature shift converter outlet
		Composition/CO ₂	Merchant hydrogen: CO ₂ absorber outlet - feed to PSA
		Composition/H ₂ /N ₂	Merchant hydrogen: PSA unit H ₂ stream
		CH ₄ leakage	Merchant hydrogen: CO ₂ absorber recovery stream
Refining	H ₂ production		Captive hydrogen: production analytics overview
		Carbon number	Captive hydrogen: natural gas feed to primary reformer
		Btu	Captive hydrogen: fuel gas to reformer furnaces
		Composition/CH ₄	Captive hydrogen: raw syngas - primary reformer outlet
		Composition/CO	Captive hydrogen: raw syngas - secondary reformer outlet
		Composition/CO	Captive hydrogen: high temperature shift converter outlet
		Composition/CO ₂	Captive hydrogen: low temperature shift converter outlet
		Composition/CO ₂	Captive hydrogen: CO ₂ absorber outlet - feed to PSA
		Composition/H ₂ /N ₂	Captive hydrogen: PSA unit H ₂ stream
		CH ₄ leakage	Captive hydrogen: CO ₂ absorber recovery stream

Gas-phase applications

Industry	Process plant	Measurement parameter	Application note title/process measurement point
Syngas SNG	SNG		IGCC plant SNG production analytics overview
		Composition/CH ₄	SNG: raw syngas from gasifier effluent
		Composition/H ₂ /CO/CO ₂	SNG: syngas after scrubber
		Composition/H ₂ /CO/CO ₂	SNG: raw syngas from other trains
		Composition/H ₂ /CO/CO ₂	SNG: common syngas header after scrubbers
		Composition/H ₂ /CO/CO ₂	SNG: shift converter outlet
		Composition/H ₂ /CO/CO ₂	SNG: CO ₂ absorber outlet
		Composition/H ₂ /CO/CO ₂	SNG: at methanator outlet
		Composition/CH ₄ /H ₂ /CO/CO ₂	SNG: to pipeline
		Composition/CH ₄ /H ₂ /CO ₂ /N ₂	SNG: CO ₂ recovery stream
Methanol	Methanol plant		Methanol: production analytics overview
		Carbon number	Methanol: natural gas feed to primary reformer
		Btu	Methanol: fuel gas to reformer furnaces
		Composition/CH ₄	Methanol: raw syngas - primary reformer outlet
		Composition/H ₂ /CO/CO ₂	Methanol: raw syngas - secondary reformer outlet
		Composition/CH ₄	Methanol: raw syngas from gasifier effluent
		Composition/H ₂ /CO/CO ₂	Methanol: syngas after scrubber
		Composition/H ₂ /CO/CO ₂	Methanol: make-up syngas
		Composition/H ₂ /CO/CO ₂	Methanol: syngas to methanol reactor
		Composition	Methanol: synthesis loop recycle

Liquid-phase applications

Industry	Process plant	Measurement parameter	Application note title/process	Analyzer platform
Liquefied natural gas	LNG	Composition/Btu	LNG: baseload custody transfer	Raman Rxn4
		Composition/Wobbe Index	LNG: natural gas quality	Raman Rxn4
		Composition	LNG: rundown to storage	Raman Rxn4
		Composition/Btu	LNG: truck loading	Raman Rxn4
		Composition/Btu	LNG: bunkering	Raman Rxn4

Raman analyzers and probes

Using the Rxn-30 probe, the Raman Rxn5 analyzer is ideally suited for the measurement of gas-phase samples. The Rxn-30 probe can be operated in a Class 1/Div 1, Zone 0 environment, and can be integrated into sample conditioning systems to handle more challenging process stream conditions. Using the Rxn-41 probe, the Raman Rxn4 analyzer is able to analyze LNG in the cryogenic liquid phase, avoiding the need for a vaporizer.



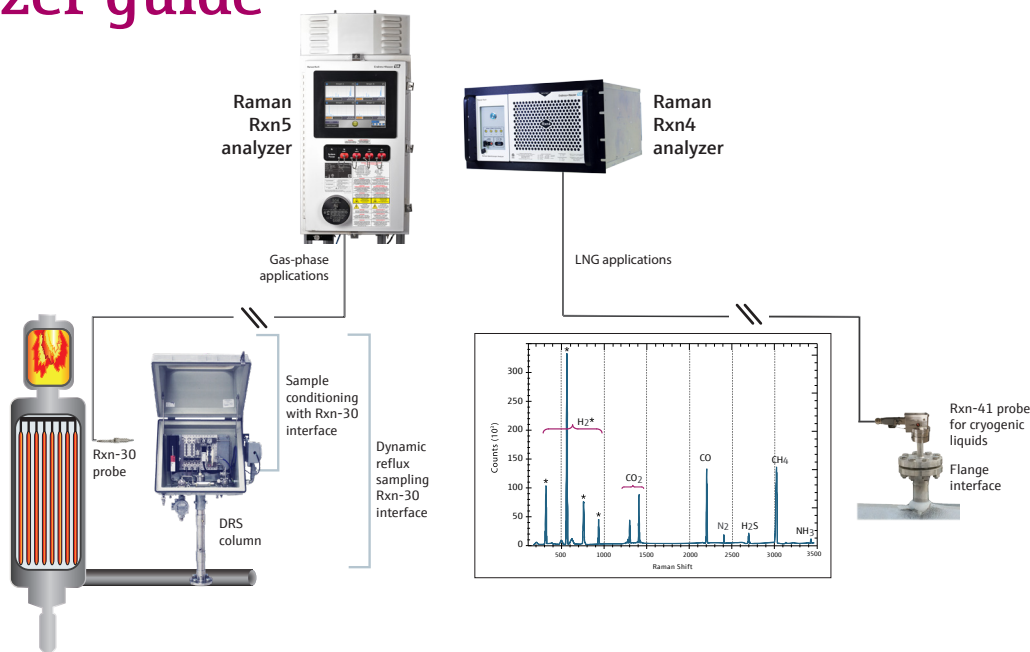
Raman Rxn5 analyzer



Raman Rxn4 analyzer

Rxn-30 probe
Fiber optic probeRxn-41 probe
Fiber optic probe

Analyzer guide



Sample streams

- Installed at the sample tap
- Syngas sample streams
 - Reformers
 - Gasifiers
 - Shift converters
 - PSA
 - Methanators
- Synthesis loops
 - Ammonia
 - Methanol
- LNG sample streams
 - Baseload custody transfer
 - Bunkering
 - Truck loading
 - Mixed refrigerant liquids
 - Mixed refrigerant gases
 - LNG quality adjustment
 - LPG

Sample interface

- Non-extractive optical probe
- Multiple options for syngas
 - For dry streams at moderate temps
 - Union cross
 - Rxn-30 sample panel*
 - For particle-laden, high temps, high moisture
 - Dynamic reflux sampler*
- Rxn-41 probe for cryogenic liquids
 - Direct-coupled/fast loop
- Rxn-30 probe for gas streams
- No flare
- Works at process P and T
- Class I/Div 1; Zone 1

*Provided by Endress+Hauser Solutions groups

Analysis result

- Full stream composition
- Peak areas proportional to concentration
- Simple method-based analysis (no complex models)
- Btu/Wobbe index output

Base unit

- Laser-based analyzer
- No vaporizer for LNG
- No columns or carrier gas
- No stream switching
- No sample transport
- Analyze four independent streams sequentially (Raman Rxn4 analyzer) or simultaneously (Raman Rxn5 analyzer)
- Raman Rxn4: general purpose (GP) area
- Raman Rxn5: Class I/Div 2; Zone 2