



Measurement & Analytics | Measurement made easy

## HP30 on-line process hydrogen analyzer Refinery hydrogen optimization

# A robust hydrogen analyzer package for refinery and petrochemical plants



## The HP30 process hydrogen analyzer

A typical refinery process unit uses upwards of 25 tons of hydrogen per year. The HP30 hydrogen analyzer can save you more than \$200,000 a year through improved Hydrogen management.

Hydrogen is a limited resource and a key driver of refinery profitability. The final fuel quality from a refinery is dependent on removal of sulfur from intermediates, as well as effective upgrading and conversion activities all of which require hydrogen.

Additionally, incorrect hydrogen management can lead to catalyst failure or significantly reduced throughput. The HP30 helps to prevent these process upsets and avoid millions in catalyst replacement costs.

### Benefits

- Improve refinery hydrogen management by better than 1%
- Improve profitability by enabling production of higher value environmentally compliant fuels
- Not affected by typical refinery contaminants such as  $H_2S$ ,  $CO$ ,  $CO_2$  and light hydrocarbons
- Save on expensive unit maintenance and extend catalyst life by managing hydrogen balance
- Maintenance free with no consumables

The HP30 offers a simpler and more maintainable installation than a GC-based analyzer and more reliable interference-free operation compared with thermal conductivity based sensors.

The refinery process units applicable to the HP30 include

- Naphtha hydro treating and desulphurization
- Gasoil hydro treating and desulphurization
- Naphtha conversion - catalytic reforming
- Naphtha conversion - isomerization
- Heavy oil upgrader units - hydrocracking

Many of these units make use of hydrogen as a key part of the process chemistry. In some cases (catalytic reformer), there is a net hydrogen gain but in most cases these units are heavy hydrogen consumers.

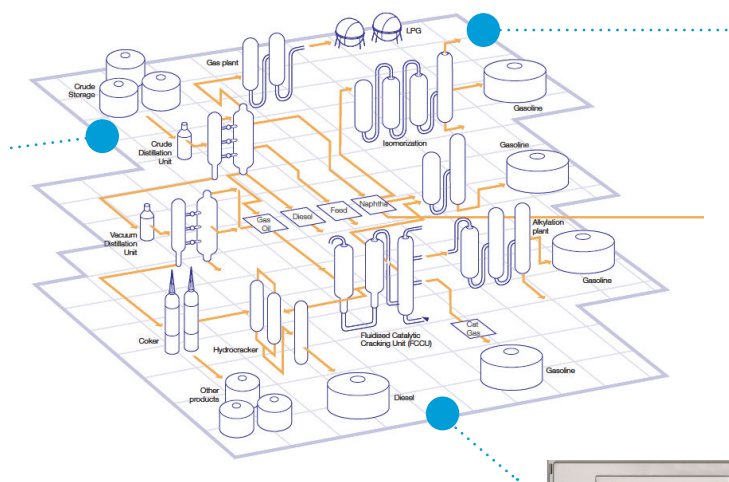
Correct unit operation in terms of managing hydrogen recycle stream quality and make-up hydrogen feed rates are essential and dependent on accurate, fast and reliable monitoring of hydrogen concentrations, both in the recycle and make-up gas streams.

Many of these streams are challenging because they contain not only hydrogen but also other components and contaminants, which either complicate the measurement by interference or risk damage to unprotected sensors.

**The ABB HP30 on-line hydrogen analyzer is designed to deal effectively with these challenging process environments and deliver fast and reliable hydrogen concentration measurements.**



# Refinery & Petrochemical Unit applications



- **Catalytic reformer recycle hydrogen:**  
Hydrogen, in a mixture with 80% hydrocarbons is recycled to the catalytic reformer from a product separator. Monitoring the hydrogen assists in the overall process control of the unit, ensuring maximum process efficiency.
- **Butamer off-gas:**  
In this process, the HP30 measures low-level hydrogen concentration at the stabilizer off-gas to ensure that adequate hydrogen is available in the reactor for the desired isomerization reactions.
- **Hydrocracker recycle & make-up hydrogen:**  
Hydrogen measurement within the recycle and make-up hydrogen streams is a critical operating criterion for the hydrocracker. A miss on hydrogen purity can cost millions in diminished hydrocracker rates.
- **Hydrodesulphurization / hydrotreater recycle hydrogen:**  
Hydrodesulphurization is a catalytic chemical process used to remove sulfur from gasoline, jet fuel, diesel fuel, etc. Hydrogen measurement is required to ensure overall process control and efficiency of the reaction.
- **Isomerization recycle hydrogen:**  
Hydrogen measurement provides critical information on the condition of the catalyst and can help to detect process-upset conditions.
- **Fuel gas:**  
Refinery off-gas is mixed with natural gas to increase/decrease BTU value. Measuring the hydrogen in refinery fuel gas provides information on the trending of the BTU value as hydrogen directly affects the BTU content within the process.

# HP30 base system and option



## Features

The HP30 process hydrogen analyzer offers significant advantages over alternative technologies for hydrogen measurement in refinery process gas streams. The measurement is real-time, with no requirement for carrier or reference gases. There is no cross-sensitivity with other gases such as CO, CO<sub>2</sub>, H<sub>2</sub>S, methane or other hydrocarbons. Installation is simple with a minimal sample system requirement and low on-going maintenance.

The sensor technology used in the HP30 is fully protected against common stream contaminants in refinery hydrogen recycle streams including CO, CO<sub>2</sub>, H<sub>2</sub>S, hydrocarbons and moisture. Because of this, the HP30 analyzer can be used confidently in these challenging process environments.

## Key specifications

- Integrated sample cabinet with manual flow and back-pressure regulation
- Coalescing and membrane filtration
- 100% Hydrogen specific
- Range 0.5% to 100% Hydrogen by volume in dirty process streams
- Real time measurements in process gas streams up to 55°C
- Fully protected for CO, H<sub>2</sub>S and hydrocarbon contaminants in stream
- RS232/422 serial connectivity ModBUS and 4-20 mA Output
- UL Class 1 Div 1, Groups B,C & D, Hazardous Location
- ATEX Ex Proof II 2 G Ex d IIB + H<sub>2</sub> T4 Gb
- Recommended verification – once every 90 days
- Verification kit available from ABB

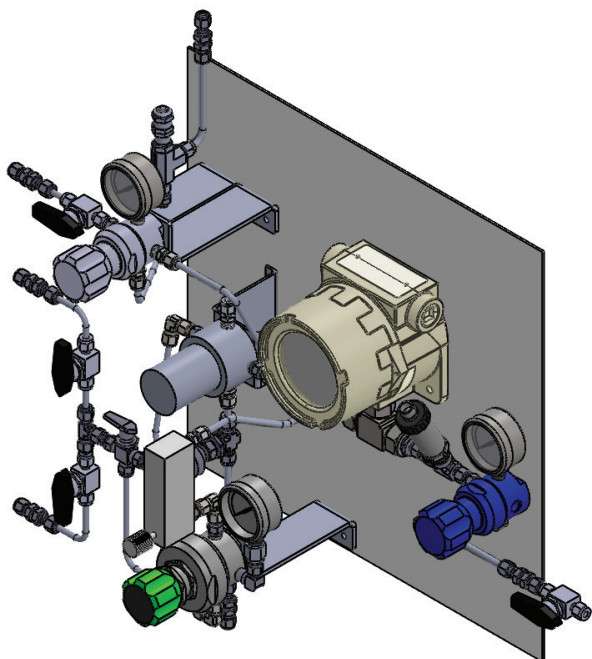
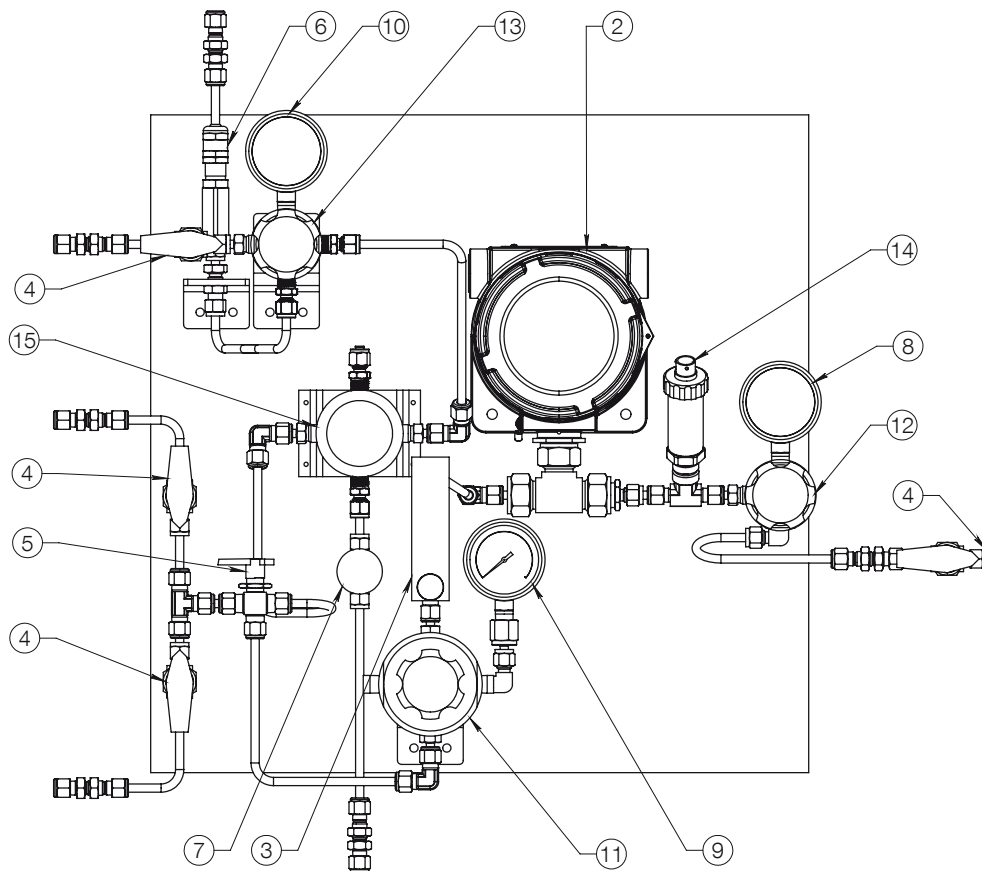
## Key differentiators include

- Turn-key simple customer installable package
- Accurate measurement in multi-component gas streams
- No requirement for carrier or reference gas
- Real time Hydrogen specific measurement
- Minimal field maintenance requirement
- NEMA 4X / IP56 weather-proof enclosure as standard

## Options

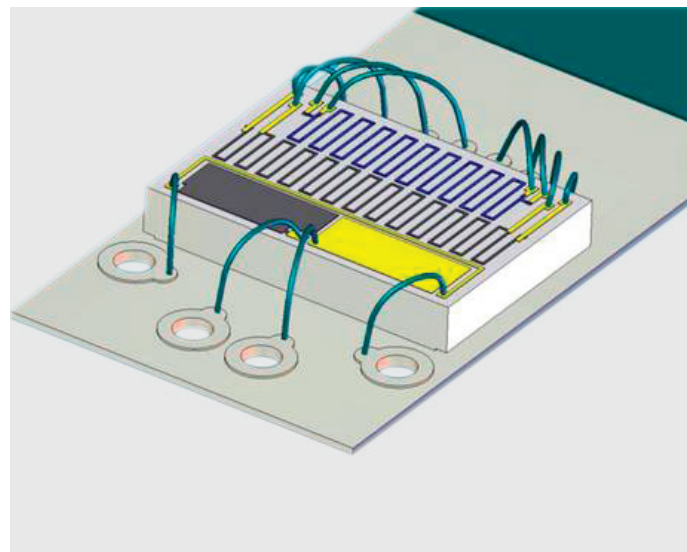
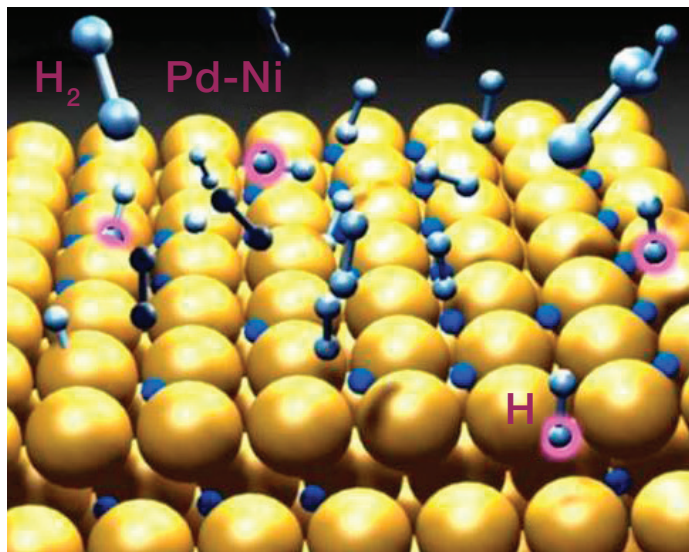
- High precision option with a pressure transducer linked to H<sub>2</sub> sensor pressure input
- Low hydrogen range option (0.1% to 20%)
- Add fast loop filter & slipstream
- Add heating option to sample cabinet
- Sample outlet pump for return to process
- Add junction box in place of wiring stubs.

# HP30 base system and options



1. Enclosure 24" x 24" x 16"
2. HP30 hydrogen sensing unit
3. Flowmeter - custom calibration
4. Ball valve 1/4" tube
5. Ball valve 1/4" tube, 3 ways
6. Relief valve
7. Needle valve 1/4" tube, kalrez o-ring
8. Gauge vacuum-30 psi
9. Gauge 0-15 psi
10. Gauge 0-100 psi
11. Pressure reducing regulator
12. Back pressure regulator
13. Pressure reducing regulator
14. Pressure transducer
15. Coalescent and membrane filter

# Novel protected hydrogen-sensing technology



## User-friendly robust analyzer for routine H<sub>2</sub> measurement

“Our first HP30 has been in service for 4 months. It has added significant efficiency to the process by providing real time and accurate H<sub>2</sub> measurements. This will also help us extend catalyst life, thus allowing longer runs between regenerations or change-out. We are extremely happy with the performance of the technology and are actively looking for additional installation points.”

### – Supervisor Maintenance / Instrumentation

## Highly-reliable solid-state technology

The principle of operation of the HP30 hydrogen analyzer depends on the interaction between hydrogen gas in the process stream and a palladium (Pd) alloy substrate. In the process stream hydrogen exists in molecular form, the Pd catalyzes the rapid dissociation of the hydrogen molecules into hydrogen atoms which are very rapidly adsorbed within the Pd crystal matrix.

Within the matrix these adsorbed hydrogen atoms directly affect bulk resistivity and charge density. Thus precise monitoring of the Pd element electrical properties gives a direct reading of hydrogen concentration as partial-pressure in the process gas. The hydrogen adsorption and desorption is extremely rapid, so fast responses to process changes are achieved.

**The technology features a proprietary protective coating on the sensor die that enables tolerance to % levels of H<sub>2</sub>S and CO whilst maintaining sensitivity and specificity for hydrogen measurements.**



# HP30 specifications

Specifications	HP30 analyzer system
Hydrogen range	0.5 to 100% at 1 atm
Accuracy	± 0.5% absolute (0.5 to 10% H <sub>2</sub> ) and +/- 1.2% absolute (10 to 100% H <sub>2</sub> )
Verification cycle	Verification with calibrated gas recommended every 90 days
Process gas tolerance	CO <sub>2</sub> , H <sub>2</sub> O, N <sub>2</sub> , CO (up to 20%), H <sub>2</sub> S (up to 10%), hydrocarbons
Process gas temperature	-20 to 55°C (-4 to 131°F)
Outputs	1 4-20mA analog output, 3 relay outputs (5A @30VDC, 240VAC) 1 RS422 serial output
Ambient temperature – operating	-20 to 55°C (-4 to 131°F)
Ambient temperature – storage	-30 to 80°C (-22 to 176°F)
Ingress protection	NEMA type 4x (outdoor use, exceeds requirements for IP56)
Operating humidity	0 to 95% Relative humidity
Power supply	90 to 240 VAC at 15 W
Certification	CE mark Suitable for installation in a Class 1 Div 1 or ATEX Zone 1 Ex environment
System life expectancy	10 years
	HP30 hydrogen sensor module
Accuracy at 25°C	±0.3% absolute 0.5 to 10%, ±1.0% 10 to 100% H <sub>2</sub>
Response time (T90)	90 sec at a flow of 1 SLPM
Drift per week	±0.2% absolute 0.5 to 10%, ±0.4% 10 to 100% H <sub>2</sub>
Repeatability	±0.2% absolute 0.5 to 10%, ±0.4% 10 to 100% H <sub>2</sub>
Linearity	±0.2% absolute 0.5 to 10%, ±0.4% 10 to 100% H <sub>2</sub>
Flow rate	0.1 to 50 slpm capable; 0.1 to 10 slpm optimum
Pressure	0 to 7 bar gauge (max 1.1 bara for ATEX version)
Certification	UL Class I, Div 1, Groups B, C, D DEMKO 11 ATEX 1107270 X II 2 G Ex d IIB + H <sub>2</sub> T4 Gb CE mark

# Contact us

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