Chemicals, petrochemicals and refineries

Solutions for the chemical Processing Industry

Endress+Hauser

People for Process Automation

Challenges in chemical processing plants

Refineries and chemical plants operate in an extremely challenging environment. Handling of hazardous materials within large scale, highly dynamic markets, stiff global competition, and stringent environmental standards are key characteristics of this industry. Process automation on multiple levels across the total value chain greatly contributes to plant profitability. In particular, process analyzers play an essential role in reducing production costs, enhancing product yields, increasing plant safety, and ensuring compliance with local emission regulations. They fulfill vital tasks in various areas of the plant and maximize efficiency and uptime of many process units.

Process control

Process optimization and control are aimed at maximizing product yields while reducing waste and staying within the operational limits of the plant. These are key factors to daily plant productivity. Process analyzers provide valuable information about the stream composition along the chemical value chain. Their data is integrated into the distributed control system to allow closed loop control.

Quality contol

Quality control ensures that feedstock material, as well as finished products, meet the required purity specification. Quality control is essential to plant profitability as off-spec products have a negative impact on the selling price. Process analyzers are used to measure main products at concentrations close to 100% or trace impurities at ppm level with high accuracy.

Emission monitoring

Certain chemical substances are considered pollutants as they can potentially cause environmental problems. Typically, these substances are generated in combustion processes and vented as flue gas through the stack. To comply with local emission regulations, many plants use Continuous Emission Monitoring Systems (CEMS) and Data Acquisition Systems (DAS) to monitor pollutants.

Safety and protection

Human safety and asset protection are top priorities for any plant operation. All hydrocarbons are flammable and pose a potential risk of explosion in the presence of O_2. Other substances may be highly corrosive or toxic. Online analyzers measure process streams or ambient air to detect critical process conditions or leakages. Reliable, quick analyses are crucial to prevent plant shutdowns and accidents.

Metering

The safety and protection of industrial sites and their assets, as well as, personnel is always the highest priority. Endress+Hauser makes sensors for fence line monitoring to detect unwanted intruders for safe plant operation.

Gas supply and metering

As a global market leader for emission monitoring systems, Endress+Hauser offers a broad product portfolio of continuous gas analyzers using state-of-the-art technologies. Over the last decade, we have successfully increased its market share in process applications with a special focus on the chemical, petrochemical and refining industry. The unique flexibil-ity in analytical methods, which include cold/dry extractive, hot/wet extractive, and in-situ technologies, allows us to provide tailor-made solutions for many different applications. Apart from analyzers for gases and liquids, we offer dust measuring devices for emission monitoring of wet and dry dust as well as ultrasonic gas flowmeters. Endress+Hauser is able to provide complete solutions ranging from small sample handling systems to analyzer cabinets and large shelters. Also, we provide the full spectrum of local services, including system engineering, commissioning, field service, technical support, repairs, training, and maintenance contracts. With a global presence and 50 local subsidiaries, Endress+Hauser is close to its customers.

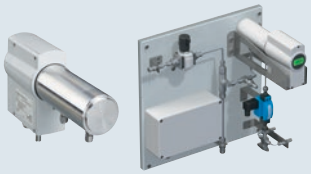
Flagship products

GM32
In-situ gas analyzer for emission monitoring of: NO_x, SO_2, NH_3 via UV principle.

GM35
In-situ gas analyzer for emission monitoring of: CO, CO_2, H_2O, N_2O via NDIR principles.


GM700
In-situ gas analyzer for emission monitoring of: NH_3, NH_3/H_2O, HCl, HCl/H_2O, HF via TDLAS principle.

TRANSIC100LP
In-situ or extractive gas analyzer for O_2 at percent levels via TDLAS principle.

GMS800
Cold/dry extractive gas analyzer for emission monitoring and process applications. Wide range of components. Technologies: NDIR, UV-RAS, NDUV, FID, thermal conductivity, paramagnetic oxygen, electrochemical O_2.

MCS300P
Hot/wet extractive gas analyzer for process applications. Wide range of components via IR and VIS principle.


DUSTHUNTER
Dust measuring device for dry gases via transmission and scattered light principle.

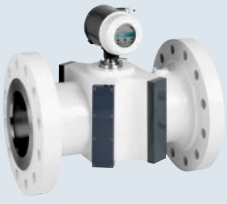
FWE200DH
Dust measuring device for wet gases via scattered light principle.



FLOWSIC100 and FLOWSIC100 Flare-XT
Ultrasonic flow measuring device for continuous emission monitoring in stacks, flare gas monitoring and process gas measurements.


FLOWSIC500
Ultrasonic gas flow measuring device for custody and allocation metering of natural gas.

FLOWSIC600 and FLOWSIC600-XT
Ultrasonic gas flow measuring device for custody and allocation metering of natural gas, steam, nitrogen, ethylene and other industrial gases.


Most of the devices are available in Ex-version.

Petroleum refining

Refineries process crude oil to fuels of higher value such as LPG, gasoline, kerosene, and diesel. The main process steps involve the separation of the hydrocarbon feedstock by distillation, subsequent conversion (cracking, reforming, isomerization), treatment (e.g. hydro-desulfurization), and final blending of finished products. Refineries are challenged by a complex and rapidly changing market environment: different crude qualities, product slate flexibility, low sulfur requirements, stringent emission limits, and price volatility. Continuous adaptation and optimization are essential to stay in the game and be profitable. Endress+Hauser offers field-proven products and solutions for process as well as emission applications.

Flare metering

Flare stacks can be found in every refinery as an integral part of the safety and waste gas system as they allow controlled venting for large volumes of combustible components during upset conditions. By their nature, pressure, volume flow, and composition of flare gases can change considerably in short periods of time. Modern ultrasonic gas flow meters are able to tackle this challenge with a broad dynamic range covering low-flow conditions as well as gas velocities beyond 120 m/s. Also, these flow meters can measure steam and natural gas.

FLOWSIC100 Flare-XT mass flow measuring device

www.endress.com/flowsic100-flare-xt

Hydrogen generation

Hydrotreating, hydrocracking, and isomerization units consume large quantities of hydrogen. Therefore, most refineries have their own hydrogen generation unit on-site. Production of hydrogen is a multi-step process and includes steam reforming, shift conversion, CO_2 removal, and subsequent purification. Each process step needs to be thoroughly controlled to guarantee maximum yield and product quality. Extractive gas analyzers are reliable, cost-efficient and easy-to-use solutions to monitor H_2 and critical impurities like CO, CO_2, and CH_4.

GMS800 extractive gas analyzer

www.endress.com/gms800

Oxidation of mercaptans (Merox©)

Mercaptans are undesirable components in finished petroleum products as they adversely affect their quality.These sulfur compounds are removed by the Merox process which consists in the oxidation of mercaptans. For that purpose, the mercaptans are extracted and then oxidized by excess air to form alkyl disulfides. Typically, process gas analyzers monitor the oxidation process by measuring the oxygen level in the excess air vent downstream of the disulfide separator.

TRANSIC100LP laser oxygen transmitter

www.endress.com/transic100lp

Petrochemicals and base chemicals

The production of petrochemicals and base chemicals covers a wide range of feedstock materials, chemical processes, and final products. The resulting bulk chemicals are primarily used as feedstock for many other, more specific synthesis routes. Feedstock availability, large-scale production, global competition, and low margins are important characteristics of this market. Due to the high reactivity of the chemicals involved the plant equipment has to meet special requirements. While hydrocarbons are highly flammable, inorganic compounds may be extremely corrosive, explosive or toxic. Endress+Hauser is able to provide suitable solutions for hazardous areas to ensure safe and reliable operation.

Olefins production

Ethylene and propylene are key building blocks for plastics. They are produced by cracking ethane or naphtha at high temperatures in large cracker furnaces. The complex product mixture is separated in a cryogenic section at elevated pressures. The subsequent splitting and analytical monitoring of the H2, C1, C2, C3 and C4 fractions pose particular challenges. Classical continuous gas analyzers and process photometers are becoming an attractive alternative to GC and MS techniques as they are rugged, easy to operate, and can eliminate cross-interferences.

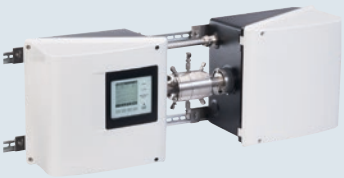
GMS800 extractive gas analyzer

www.endress.com/gms800

Chlorine chemistry

Chlorine is an important feedstock utilized in the production of intermediate chemicals such as EDC or VCM. It is produced by electrolysis of an aqueous solution of rock salt (NaCl) releasing highly reactive gases: chlorine and hydrogen. Analyzers have to rapidly detect any diffusion of hydrogen traces into chlorine to avoid an explosion. In the production of EDC and VCM, small amounts of moisture need to be detected to prevent corrosion of piping and reactors. In these processes, analyzers greatly contribute to plant safety and operational availability.

MCS300P extractive process gas analyzer

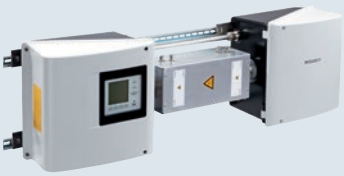


www.endress.com/mcs300p

Sulfuric acid production

Sulfuric acid is an important bulk chemical with major use in the fertilizer industry. Its production via SO_2 and SO_3 as intermediates involves highly corrosive components. These oxides and their acids have elevated dew points posing an analytical challenge after extraction from the process. For process control and emission monitoring, state-of-the-art hot/wet techniques offer a reliable and superior solution compared to the traditional cold/dry extractive approach. Typical applications are the analysis of SO_2/O_2 at the converter – SO_2, SO_3 and H_2SO_4 at the stack with MCS200HW

MCS300P extractive process gas analyzer



www.endress.com/mcs300p

Fertilizer

Fertilizers are inorganic bulk chemicals used for agricultural purposes as they provide valuable nutrients for all types of crops. The fertilizer market benefits from steady growth of the global population but has to carefully balance production output with local demand, ensure the right product mix, and deliver a superior quality product. The solid materials are produced in aqueous solution via reaction of ammonia with various acids, mainly nitric, sulfuric, and phosphoric acid. The corrosive and highly reactive nature of the substances involved pose special challeng-es to all plant equipment. SICK offers various dedicated solutions for process and CEM applications in this industry.

Ammonia production

Ammonia is a key material for the production of fertilizers. Its synthesis involves a multi-step process to provide hydrogen which is converted to ammonia under extreme pressure. The high reaction speed and the high material throughput require tight process control at each step. Continuous gas analyzers can monitor H_2, CH_4, CO, CO_2, and NH_3 and offer a great advantage to gas chromatographs due to their fast response time. Because of catalyst poisoning and salt-formation, CO and CO_2 need to be detected at very low ppm levels.

GMS800 extractive gas analyzer

www.endress.com/gms800

Urea production

Urea plants are often in close proximity to an ammonia plant providing the starting materials CO_2 and NH_3. These components react under high pressure forming ammonium carbamate as an intermediate, which slowly decomposes into urea and water. As carbamate solutions are highly corrosive, small amounts of air are continuously added to form a passive oxide layer protecting the metal surfaces. We can offer solutions to monitor the passivation process as well as the emission of dust, ammonia, and water at the stack.

GM700 in-situ gas analyzer

www.endress.com/gm700

Ammonium phosphate production

Mono- and di-ammonium phosphate (MAP, DAP) are pro-duced from reaction of ammonia and phosphoric acid. The resulting solution is concentrated before entering a prilling or granulation process which results in the solid and dry products. The off-gas from this process contains NH_3, HF, and a lot of dust which are typically removed in a wet tail gas scrubber. To comply with emission standards, the residual NH_3, HF, and dust need to be monitored. A special design to deal with heavy salt formation is crucial for the reliable operation of any analyzer system.

FWE200DH dust measuring device for wet gases

www.endress.com/fwe200dh

Utility units

Several service units can often be found within the fence line of refineries and chemical plants. They provide necessary utilities for chemical production, guarantee operational safety in upset conditions, and ensure environmental compliance. Typical tasks and units are power generation, steam generation, heat exchangers, flare stacks, waste incinerators, sulfur recovery units, storage tanks, and waste water treatment systems. Although these secondary processes are not directly related to the chemical production, they are vital for daily plant operation and contribute significantly to the overall production costs. Endress+Hauser can provide reliable solutions which help to maximize unit functionality and availability.

Emission monitoring

Boilers, furnaces, and incinerators are key utilities in every chemical plant and have a big impact on the environment. The quantity and nature of emitted components are regulat-ed by local authorities via emission standards and limits. Therefore, O_2, NO_x, CO, SO_2, NH_3, CH_4, HCl, HF, and others are often required to be monitored on a continuous basis. However, the analytical solutions depend on the fuel type and the combustion process. As a global market leader for emission monitoring systems, we offer a broad variety of in-situ, cold/dry, and hot/wet extractive solutions.

GMS800 extractive gas analyzer

www.endress.com/gms800

Inertization processes

Most feedstock materials and final products in the petrochemical industry are stored in big tank farms. As many of these materials are flammable, any presence of oxygen poses a potential risk of explosion. To prevent the forma-tion of explosive atmospheres, pipes and storage tanks are purged and pressurized with inert gases like nitrogen or CO_2. This inertization or blanketing is typically monitored by an oxygen analyzer to detect residual oxygen. At the same time, the consumption of inert gases and the duration of the inertization process can be reduced to a minimum.

TRANSIC100LP laser oxygen transmitter

www.endress.com/transic100lp

Denitrification ($DeNO_x$) and desulphurization ($DeSO_x$) systems

Energy intensive processes like thermal cracking in an olefin plant and continuous decoking of FCC units in refineries require a high consumption of fossil fuels result-ing in high NOx emissions. To comply with local regulations the NO_x content is often reduced in a $DeNO_x$ system using ammonia. The challenge of this fast process is to inject the right quantity of ammonia to reduce residual NO_x to a minimum while preventing emission of excess ammonia. In-situ analyzers are perfectly suited to monitor NO_x and ammonia slip in this dynamic process.

GM32 in-situ gas analyzer

www.endress.com/gm32

www.addresses.endress.com

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