

NATURAL GAS SOLUTIONS

Real-Time Measurement for Unparalleled Safety and Product Quality Control

Analyzer solutions to reduce natural gas process downtime, ensure safe operation, and meet stringent product quality requirements.



AMETEK PROCESS INSTRUMENTS

Natural gas is an important part of the world's energy supply. From feedstock for production processes to generating electrical power, the transportation, distribution, storage, and processing of natural gas has a global impact.

Natural gas must meet specific requirements as it relates to heating value, hydrocarbon dew point, and the concentration of various contaminants. The quality of natural gas can be impacted by contaminants, such as water vapor, sulfur-based compounds, heavier hydrocarbons, and carbon dioxide. These contaminants adversely affect the natural gas heating content, promote the formation of acids that damage mechanical infrastructure, and facilitate hydrate formation which limits gas flow in pipelines. All of these can result in damage to key components, increase maintenance costs, and cause unplanned downtime.

With over 50 years of experience in natural gas measurement technology, AMETEK Process Instruments can provide the optimal analyzer solutions for the measurement of moisture, sulfur (as hydrogen sulfide), carbon dioxide, hydrocarbon dew point temperature, oxygen, gas composition, heating value, and specific gravity. Once our analyzers are installed, our global team of field service engineers provides local support for start-up, commissioning, and maintenance.

We serve applications across the natural gas value chain, including:

- Gas dehydration
- Gas sweetening
- Custody transfer
- Transmission pipelines
- Underground storage
- Hydrocarbon processing (LPG & NGL recovery)
- LNG production

Our analyzers are considered the industry-standard, and are known for high reliability. Our technical sales and service teams provide strong applications and service expertise to ensure the right solution is engineered to meet the needs of your process.

AMETEK, Inc.

A business unit of the Process and Analytical Instruments division of AMETEK, Inc., we are part of a global corporation with a growth plan founded on four key strategies: Operational Excellence, Strategic Acquisitions, Global & Market Expansion and New Products.

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NATURAL GAS DEHYDRATION

Most operators of natural gas pipelines establish a tariff or contract limit on the moisture content allowed in the pipeline. The dehydration process removes water vapor in natural gas using several different methodologies, such as compression, phase separation, absorption with a deliquescent solid or liquid desiccants and adsorption with solid desiccants.

Moisture measurement is critical to optimize the drying process and to ensure that the natural gas is dried to the correct specification. This measurement is normally performed at the outlet of the drying process, whether that is a glycol contactor tower or a molecular sieve bed.

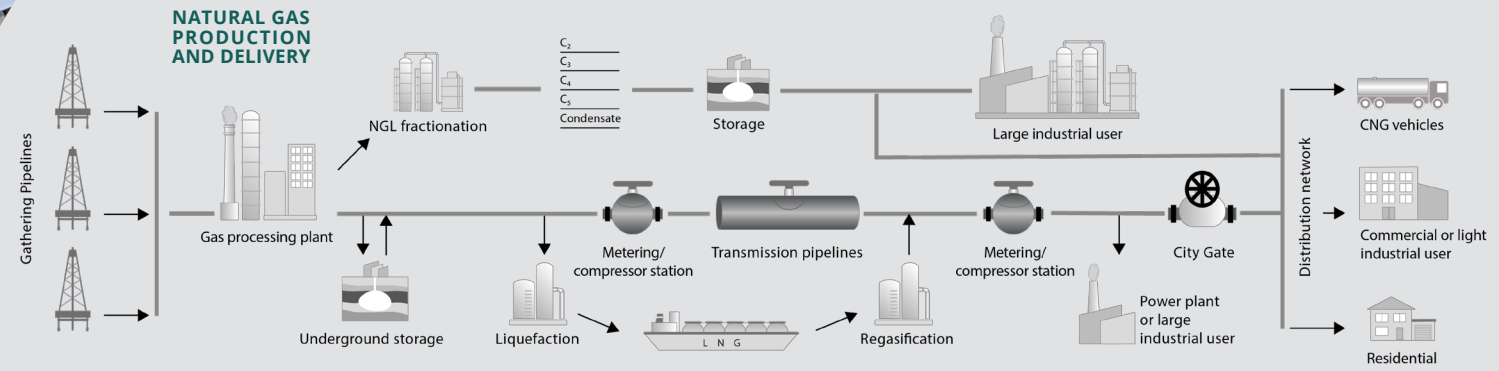
Key considerations:

Moisture or water vapor in natural gas:

- Promotes hydrate formation – ice-like combustible solids that block or obstruct the flow of gas in pipelines
- Causes freezing, which damages mechanical infrastructure or restricts flow of natural gas
- Increases gas transportation and compression costs
- Promotes formation of corrosive acids in the presence of hydrogen sulfide (H₂S) and carbon dioxide (CO₂)
- Reduces the heating content of the natural gas

AMETEK ADVANTAGE

- Multiple moisture measurement technologies using quartz crystal microbalance (QCM), tunable diode laser absorption spectroscopy (TDLAS), or electrolytic (P₂O₅) to meet the application requirements
- Rapid speed-of-response to both wet-up and dry-down conditions, allowing users to quickly observe an upset and minimize process downtime
- QCM's built-in verification system ensures accurate, reliable moisture measurements
- The TDLAS measurement is immune to contaminants such as glycol or methanol, reducing total cost of ownership
- Excellent measurement accuracy and lower detectable limit



PRODUCT SOLUTIONS

MEASURES: H₂O

5100HD

The 5100HD, using TDLAS technology, can be configured with one or two absorption cells. This makes it an ideal choice to measure the moisture content at both the inlet and outlet of the dryer with a single analyzer. The 5100HD features an integrated sample system that can be heated to 150°C (302°F) for applications where hydrocarbon condensation is problematic. Additionally, the sealed moisture reference cell ensures the 5100HD provides continuous online verification of the optical system's performance and offers high specificity and sensitivity for the analyte of interest.

3050-OLV/DO/SLR with AMEVision

The 3050 series utilizes AMETEK's proven QCM technology. These analyzers include a built-in verification system to provide operators with increased confidence in the measurement.

The 3050-OLV combines quartz crystal accuracy with online verification in a cost-competitive package, ideal for measuring low-to-moderate moisture concentrations at the outlet of the tri-ethylene glycol dryer.

The 3050-DO is specifically designed to monitor the very low moisture levels typically exiting a molecular sieve dryer, offering excellent accuracy and low detection limits in this very low moisture content application.

The 3050-SLR is also designed for applications with low moisture concentrations, delivering high accuracy and sensitivity.

PRODUCT SOLUTIONS

MEASURES: H₂O

5100

Using TDLAS technology, the 5100 delivers fast-response and accurate moisture measurements at the outlet of the natural gas dehydration process. The 5100 features a single absorption cell and integrated sample system in a compact, cost-effective package.

The analyzer uses a sealed reference cell containing the target analyte. The use of the reference cell enables the 5100 to line-lock on the correct wavelength ensuring accurate measurements. The line-lock feature also allows the analyzer to continuously verify its optical performance, delivering high specificity and sensitivity for the analyte of interest.



NATURAL GAS SWEETENING

Hydrogen sulfide (H₂S) and carbon dioxide (CO₂) must be removed from the natural gas, in a process referred to as natural gas sweetening. H₂S in "sour gas" (natural gas with a high H₂S concentration) is reduced or removed in a contactor using amine solutions, such as monoethanolamine or diethanolamine. Sweet natural gas, with low H₂S concentration, exits the top of the contactor while the rich amine containing the absorbed sulfur compounds exits the bottom of the contactor.

Most commonly, CO₂ is removed with H₂S in the amine scrubbing process. CO₂ can also be removed from natural gas using:

- 1) Solid adsorbents in pressure/temperature swing adsorption processes
- 2) Membranes
- 3) Cryogenic separation

Measurement of the concentrations of both H₂S and CO₂ in the sweetening process is necessary, both before and after treatment of the natural gas stream.

Key considerations:

- H₂S and CO₂ promote corrosion through the formation of acids in the presence of moisture
- H₂S and CO₂ cause stress cracking in the pipelines
- H₂S is a highly toxic and flammable compound that is a continuous risk for personnel safety
- Risk of being "locked-out" of pipeline network if concentration of H₂S or CO₂ exceeds tariff or contract limit

AMETEK ADVANTAGE

- **Optical (fast-response), low-level, interference-free detection of H₂S**
- **No need for scrubber to detect low concentrations of H₂S or CO₂**
- **Ability to measure H₂S, carbonyl sulfide (COS), and methyl mercaptan (CH₃SH) in one analyzer**
- **Field-proven non-dispersive, dual-beam hollow cathode ultraviolet (UV) photometric technology**
- **No reagents or disposables used in measurement**
- **The tunable diode laser absorption spectroscopy (TDLAS) CO₂ measurement requires no calibration or re-zeroing of analyzer and is immune to contaminants, reducing total cost of ownership**

PRODUCT SOLUTIONS

MEASURES: H₂S, COS, CO₂, CH₃SH

931

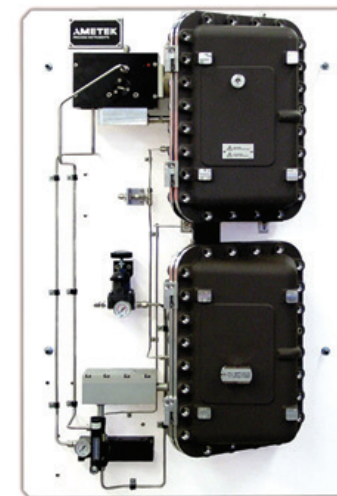
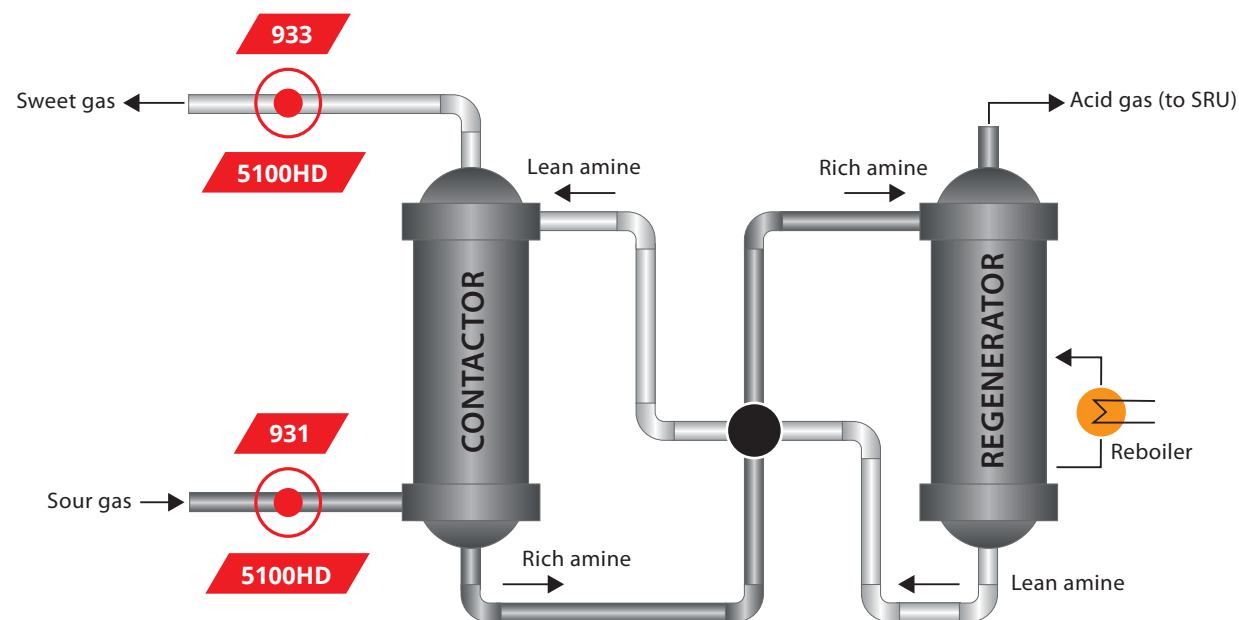
The 931 analyzer measures percent-level H₂S in the natural gas at the inlet to the amine contactor and features an optional heated cell to avoid any hydrocarbon or water condensation. The analyzer incorporates an optional infrared sensor for CO₂ measurement and is fully integrated, with analyzer and sample system in a single package. The 931 has no moving parts and uses high-resolution UV technology in a dual-beam, dual-wavelength configuration with reliable, accurate H₂S measurements.

5100HD

Using TDLAS technology, the 5100HD provides highly accurate measurements of H₂S concentrations from ppmv to percent levels with virtually no maintenance. With the ability to be configured with a second absorption cell, the 5100HD can also measure percent levels of CO₂ at the inlet to the amine contactor. The analyzer is immune to interference from other compounds in the natural gas by using a sealed reference cell, allowing the 5100HD to continually verify the optical performance and remain on the correct wavelength for the target analyte.

933

The 933 utilizes a proprietary frontal elution chromatography sampling technique, to separate and detect H₂S, COS and CH₃SH at concentrations well below 100 parts per million by volume (ppmv), to as low as single digit ppmv ranges at the outlet of the amine contactor. By measuring H₂S, COS and CH₃SH, the 933 can provide a better understanding of the total sulfur content in natural gas. With no disposables or reagents, the 933 is a fully integrated analyzer and sample system, designed for long-term, unattended operation.



TRANSMISSION PIPELINES & CUSTODY TRANSFER

Natural gas is transported from the gas processing plant to underground storage sites, industrial users – such as chemical and petrochemical plants, power plants and liquefaction plants – and city gate metering stations via a large network of pipelines. As the natural gas travels along the pipeline, it passes through metering points (stations) where the natural gas is sold from one party to another.

This point is referred to as a custody transfer point. A custody transfer measurement is considered a fiscal measurement and is critically important to understand the heating value of the natural gas and the amount of gas being transferred. Gas quality measurements include moisture content, concentration of sulfur compounds - hydrogen sulfide (H₂S), carbonyl sulfide (COS), and methyl mercaptans (CH₃SH) - hydrocarbon dew point temperature and specific gravity.

Key considerations:

- Ensuring gas quality compliance with tariff or contract limits for moisture, sulfur-based compounds, hydrocarbon dew point temperature, and specific gravity
- Accurately measuring gas composition, heating value, and relative density to comply with contractual requirements for fiscal accounting
- Protecting the pipeline from increased pressure drop, reduction in line capacity, and damage to equipment

AMETEK ADVANTAGE

- **Multiple measurement capabilities from a single manufacturer, including both H₂O and H₂S analyzers, manual and automatic hydrocarbon dew point temperature analyzers, gas chromatograph (GC) and gravitometer, reduces overall cost of ownership**
- **Rapid speed-of-response to changes in concentrations on critical gas constituents, allowing users to quickly assess gas quality and maintain pipeline flow**
- **Highly accurate measurements ensure gas quality parameters meet pipeline or tariff requirements**

PRODUCT SOLUTIONS

MEASURES: H₂O, HCDP, BTU, C1 to C6+

Chanscope II

Building on the chilled mirror operating principle, the Chanscope II incorporates an eyepiece for viewing the dew point temperature under lighted and magnified conditions. Additionally, the unit features a digital temperature readout where the dew point temperature is digitally superimposed above the mirror and is seen while looking through the same eyepiece, ensuring accurate readings by the user.

241CE II

For installations where a continuous measurement of hydrocarbon dew point temperature is required, AMETEK offers the automated 241CE II three-stage chilled mirror analyzer. The automated operation eliminates any bias in the readings. Additionally, the 241CE II features a fully integrated sample system package, including proprietary multi-stage filtration specifically designed to protect the analyzer from common natural gas contaminants.

PRODUCT SOLUTIONS

MEASURES: H₂O, HCDP

Bureau of Mines Dew Point Tester

The Bureau of Mines Dew Point Tester uses chilled mirror technology to measure the dew point temperature of any gas. As a primary standards instrument, this portable analyzer requires no calibration and meets ASTM D1142. The cost-effective Dew Point Tester can detect the dew point temperature of both water and hydrocarbon, making it an excellent tool for verifying online instruments.



TRANSMISSION PIPELINES & CUSTODY TRANSFER

PRODUCT SOLUTIONS

MEASURES: Specific gravity, H₂O

Ranarex Gas Gravitometer

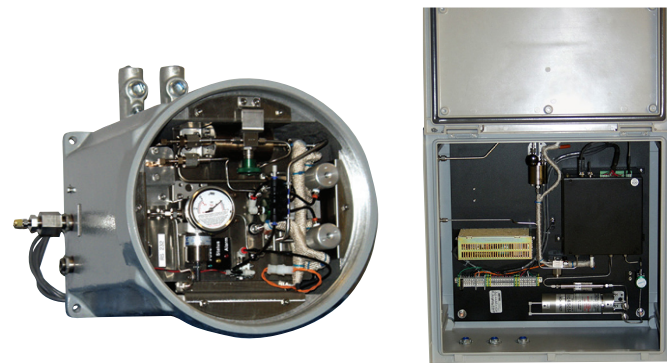
The durable Ranarex Gas Gravitometer is simple to use and operate. Free of span drift and minimal zero drift, the analyzer delivers continuous, fast-responding measurement of specific gravity. With over 90 years of specific gravity measurement experience, AMETEK has designed the Ranarex Gas Gravitometer to be easy to maintain with a completely mechanical construction. The analyzer can be operated on a floor, bench or wall-mount configurations and can be powered by standard AC power supply or a vehicle inverter for remote operation.



3050-OLV/SLR

Utilizing proven quartz crystal microbalance technology to measure trace levels of moisture in pipeline natural gas, the 3050-OLV features an internal moisture generator, allowing users to quickly confirm analyzer performance on schedule or on demand by comparing to a known moisture standard. The cost-competitive 3050-OLV is not unfavorably affected by the presence of methanol, can be used in sour gas containing hydrogen sulfide (H₂S), and is not impacted by carbon dioxide (CO₂).

The 3050-SLR is ideal for measurements of very low moisture concentrations, typically well below 100 parts per million by volume (ppmv). With a built-in zero module and internal moisture generator, the 3050-SLR can automatically zero itself and compares its moisture measurement with the NIST-traceable known value of the internal moisture generator. This verification capability ensures confidence in an accurate and reliable moisture reading of the process gas.



PRODUCT SOLUTION

MEASURES: H₂O, H₂S, COS, CH₃SH

5100

Utilizing tunable diode laser absorption spectroscopy technology to deliver fast-responding, accurate moisture measurements, the 5100 features a single absorption cell and an integrated sample system in a compact, cost-effective package. The analyzer uses a sealed reference cell containing the analyte gas for continuous verification of the optical system's performance and offers high specificity and sensitivity. The 5100 provides accurate measurements of the moisture content needed in a natural gas custody transfer station.



933

The 933 utilizes a proprietary frontal elution chromatography sampling technique to separate and detect H₂S, carbonyl sulfide (COS), and methyl mercaptans (CH₃SH), at concentrations well below 100 ppmv to as low as single digit ppmv ranges, in natural gas pipelines. The 933 can also measure 0 to 5 ppmv H₂S when required, as well as percent levels of CO₂. With no disposables or reagents, the 933 is a fully integrated analyzer and sample system, designed for long-term, unattended operation.



UNDERGROUND STORAGE

When natural gas is not immediately needed, or if production exceeds demand, the gas is stored underground. Storage facilities include depleted oil or natural gas reservoirs, salt caverns, and aquifers.

Gas quality measurements – including water vapor (H₂O), hydrogen sulfide (H₂S), hydrocarbon dew point temperature and gas composition – are typically made during injection into the facility and, more commonly, during extraction of the natural gas.

Measurements of H₂O and H₂S ensure that any storage gas inventory already present is not contaminated, and that the storage facility is not adversely affected.

When gas is extracted, the gas quality must be measured prior to transfer into the transportation pipeline network, to ensure the gas meets the necessary contract or tariff requirements for H₂O and H₂S.

Key considerations:

- High concentrations of either H₂O or H₂S can contaminate the underground storage facility
- High storage pressures can cause condensation
- During extraction, it is important to ensure the gas meets tariff or contract requirements for the transmission pipeline
- Reliable, accurate analysis of gas quality during peak demand periods

AMETEK ADVANTAGE

- Multiple measurement capabilities from a single manufacturer simplifies purchasing and servicing processes
- Rapid speed-of-response to changes in moisture content during high demand withdrawals, allowing users to optimize gas extraction process and avoid being “locked-out” of a pipeline
- No need for scrubber to detect low concentrations of H₂S or carbon dioxide (CO₂)
- Ability to measure H₂S, carbonyl sulfide (COS), and methyl mercaptan (CH₃SH) in one analyzer
- Field-proven non-dispersive, dual-beam hollow cathode ultraviolet (UV) photometric technology
- No reagents or disposables used in measurement

PRODUCT SOLUTIONS

MEASURES: H₂O, H₂S, COS, CH₃SH, CO₂

5100

The 5100 uses tunable diode laser absorption spectroscopy (TDLAS) technology, delivering fast-responding, accurate moisture measurements. The analyzer features a single absorption cell and integrated sample system in a compact, cost effective package. The 5100 uses a sealed reference cell containing the analyte gas for continuous verification of the optical system's performance and offers high specificity and sensitivity.

5100HD

The 5100HD, using TDLAS technology, can be configured with one or two absorption cells, providing measurements of both H₂O and H₂S in a single analyzer package. The analyzer is immune to interference from common natural gas contaminants, such as glycol or methanol, by using a sealed reference cell, allowing it to continually remain on the correct wavelength for the target analyte. The 5100HD features an integrated sample system that can be heated to 150°C (302°F) for situations where hydrocarbon condensation is problematic.

933

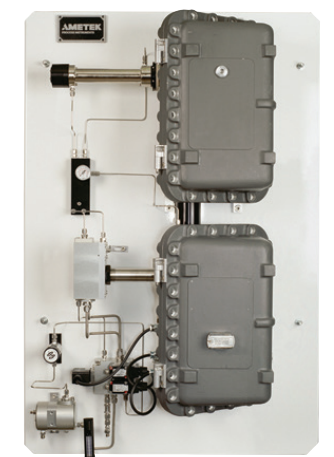
The AMETEK 933 utilizes a proprietary frontal elution chromatography sampling technique to separate and detect H₂S, COS and CH₃SH at concentrations well below 100 parts per million by volume (ppmv), to as low as single digit ppmv ranges, in natural gas pipelines. This analyzer can also measure percent levels of CO₂. With no disposables or reagents, the 933 is a fully integrated analyzer and sample system, designed for long-term, unattended operation.

PRODUCT SOLUTIONS

MEASURES: H₂O

3050-OLV

Utilizing proven quartz crystal microbalance technology, the 3050-OLV measures trace levels of moisture when extracting gas from the storage facility. The analyzer features an internal moisture generator, allowing users to quickly confirm analyzer performance following long periods of downtime when gas is not flowing from the storage facility. The cost-competitive 3050-OLV provides excellent accuracy and reliability of the moisture content during peak demand periods.



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HYDROCARBON PROCESSING (LPG & NGL RECOVERY)

Natural gas contains liquids that must be removed following extraction. Natural gas liquids (NGLs) are generally removed from the natural gas using an absorption process, similar to dehydration of natural gas. To extract the lighter molecular weight compounds, such as ethane or propane, from the natural gas, a cryogenic expansion process is utilized. The temperature of the natural gas is decreased using refrigerants and the gas is then expanded in an expansion turbine. Following extraction from the gas, NGLs are separated in the fractionation process where NGLs are heated to each individual component's boiling point. Moisture measurements in the absorption, turbo expansion, and NGL fractionation processes are required.

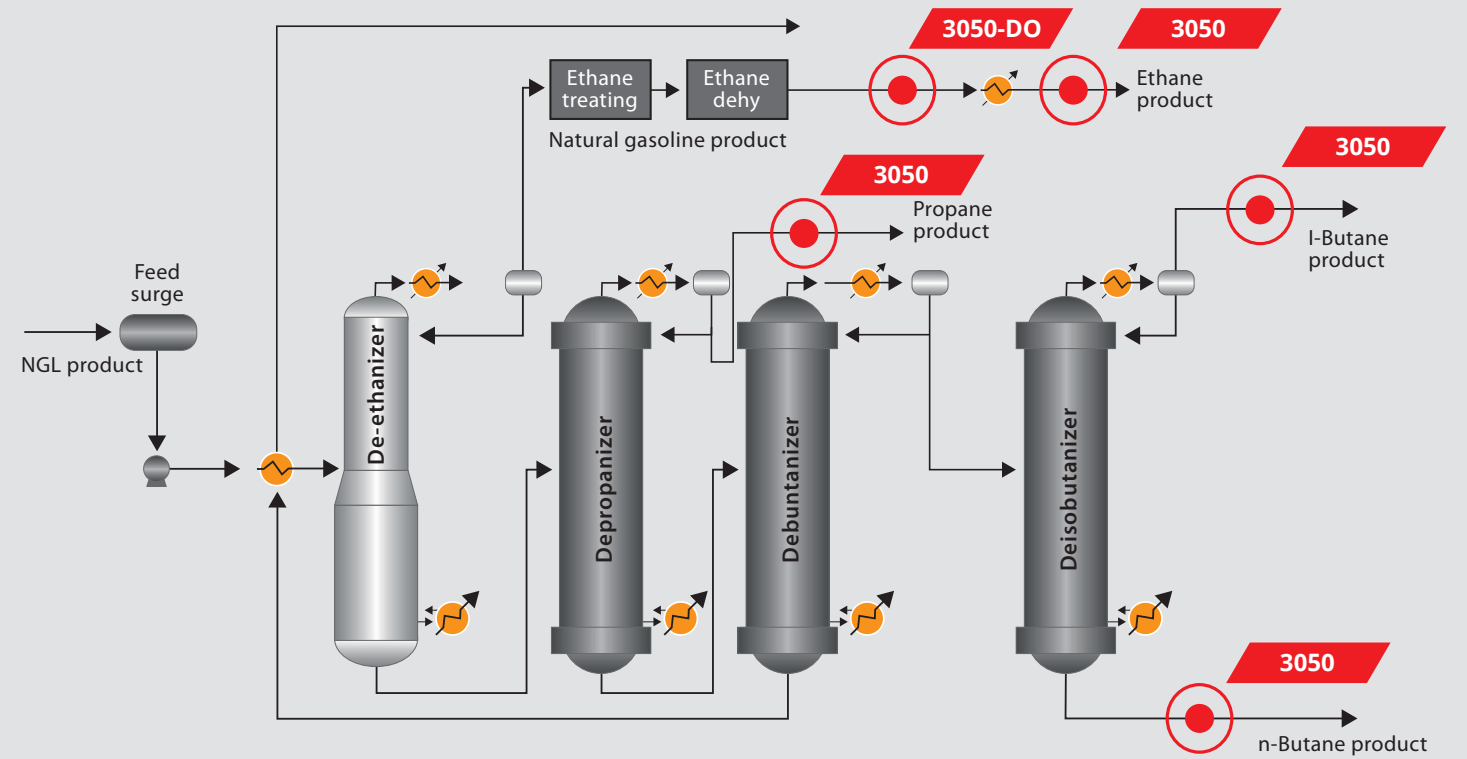
Key considerations:

- Monitor and optimize the dehydration process to prevent "breakthrough" in the molecular sieve dryer
- Protect the expansion turbine from damage
- Ensure final product quality specifications are met

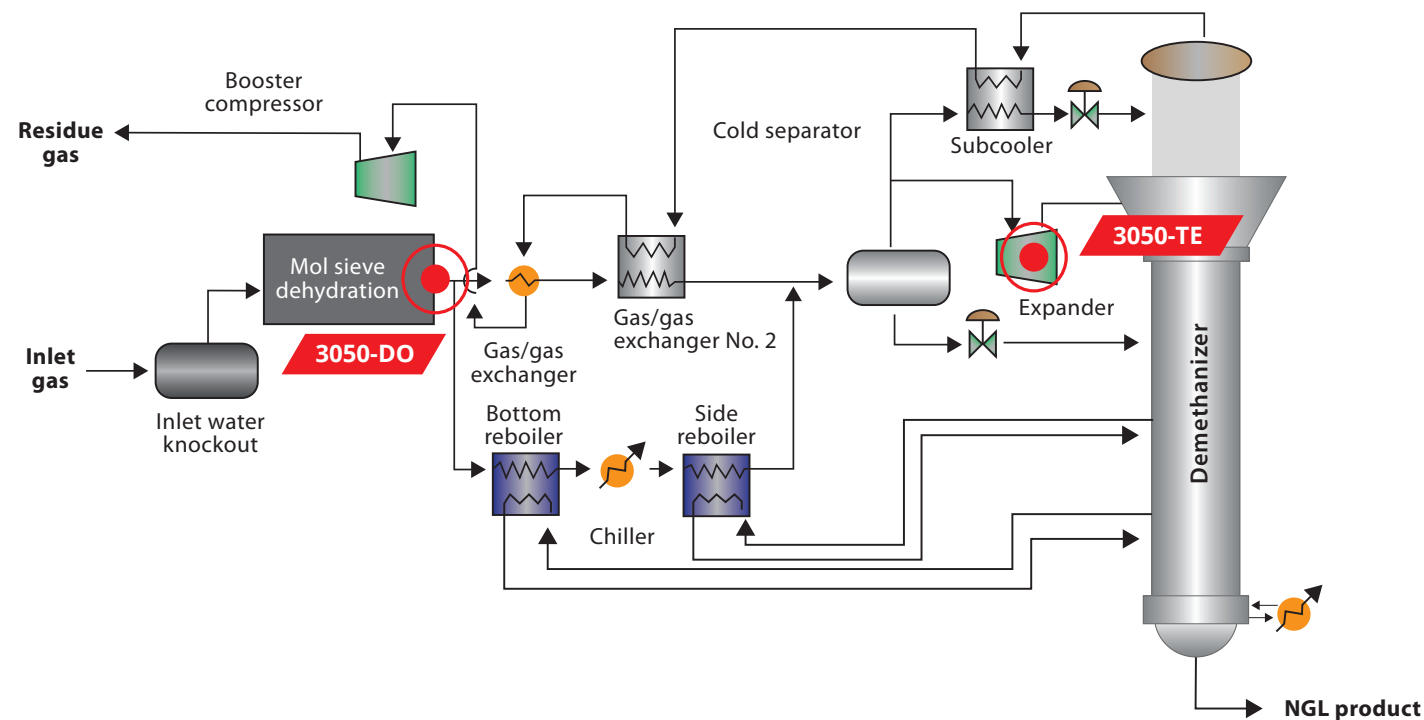
AMETEK ADVANTAGE

- Rapid response time to changes in moisture concentration, allowing users to optimize dryer generation on a demand vs. time basis
- No need for a purifier to detect low concentrations of water (H₂O)
- High accuracy across measurement range
- Built-in verification system, with both a zero and span point, demonstrates analyzer performance, giving users confidence in the measurement

FRACTIONATION PROCESS



DEHYDRATION AND TURBO EXPANSION PROCESS



PRODUCT SOLUTIONS

MEASURES: H₂O

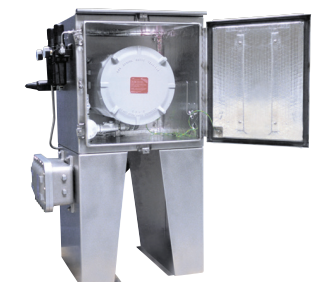
3050-DO

The 3050-DO, using AMETEK's proven quartz crystal microbalance (QCM) technology, is specifically designed to monitor the very low moisture levels typically exiting a molecular sieve dryer. The analyzer offers excellent accuracy over a wide operating range, allowing it to monitor both the low moisture levels under normal process conditions and the higher moisture levels during "breakthrough" upsets on the dryer. The rapid speed of response to both wet-up and dry-down conditions allows a user to see the upset quickly, make a process correction, and return to operation with minimal downtime.



3050-TE

The 3050-TE, also based on QCM technology, is capable of measuring moisture concentrations below 0.1 parts per million by volume, making it ideal for monitoring the turboexpander and other cryogenic processes. The 3050-TE provides excellent accuracy and rapid speed of response along with a very low detectable limit of moisture commonly found in these applications. Additionally, the analyzer offers a built-in verification system, including a zero module and moisture generator, to provide operators with increased confidence in the performance.



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LIQUEFIED NATURAL GAS (LNG) PRODUCTION

When natural gas cannot be transported in its gaseous state in a pipeline, the gas is converted to a liquid, called liquefied natural gas (LNG), in a process called liquefaction. To convert the natural gas from a gas to a liquid, the natural gas is dehydrated using molecular sieve dryers and is then cooled by lowering the temperature to approximately -162°C (-260°F) using refrigerants. The liquefaction process requires the natural gas to be free of impurities, such as water vapor (H₂O), hydrogen sulfide (H₂S) and carbon dioxide (CO₂), prior to the conversion from gas to liquid.

Key considerations:

- Monitor and optimize the dehydration process to prevent “breakthrough” in the molecular sieve dryer
- Prevent formation of ice during the refrigeration process
- Prevent formation of corrosive acids due to presence of moisture with H₂S and CO₂

AMETEK ADVANTAGE

- **Rapid response time to changes in moisture concentration, allowing users to optimize dryer generation on a demand vs. time-basis**
- **High accuracy across measurement range**
- **Built-in verification system, with both a zero and span point, demonstrates analyzer performance, giving users confidence in the measurement**



PRODUCT SOLUTIONS

MEASURES: H₂O

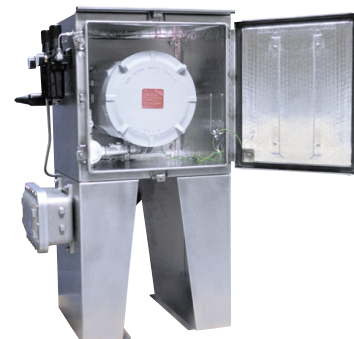
3050-DO

Specifically designed to monitor the very low moisture levels typically exiting a molecular sieve dryer, the 3050-DO analyzer offers excellent accuracy over a wide operating range, allowing it to monitor both the low moisture levels under normal process conditions and the higher moisture levels during “breakthrough” upsets on the dryer. The rapid speed of response to both wet-up and dry-down conditions allows a user to see the upset quickly, make a process correction, and return to operation with minimal downtime.



3050-TE

The 3050-TE is based on quartz based microbalance technology and is capable of measuring moisture concentrations below 0.1 parts per million by volume (ppmv). The ideal choice for monitoring the cryogenic refrigeration processes, the 3050-TE provides excellent accuracy and rapid speed of response along with a very low detectable limit of moisture commonly found in this application. Additionally, it offers a built-in verification system, including a zero module and moisture generator, to provide operators with increased confidence in the performance.



PRODUCT SOLUTIONS

MEASURES: H₂S, CO₂, COS, CH₃SH

933

The 933 utilizes a proprietary frontal elution chromatography sampling technique, to separate and detect H₂S at concentrations well below 100 ppmv, to as low as single digit ppmv ranges. It can also measure ppmv levels of carbonyl sulfide and methyl mercaptans. The 933 has no disposables or reagents and is designed for long term unattended operation. The analyzer can also measure percent levels of CO₂.



5100HD

AMETEK's 5100HD can be configured with one or two absorption cells, making it an ideal choice to measure both H₂S and CO₂. The analyzer uses non-contact tunable diode laser absorption spectroscopy technology to provide highly accurate measurements from ppmv to percent levels for H₂S and CO₂, with virtually no maintenance. The 5100HD features an integrated sample system, and the sealed moisture reference cell ensures the unit provides continuous verification of the optical system's performance and offers high specificity and sensitivity.



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PORTABLE MEASUREMENTS

In some cases, it is not economically feasible to install fixed analyzers at a site. In other cases, verification with another device is needed to confirm satisfactory operation of a fixed analyzer. AMETEK Process Instruments offers several portable analyzers for moisture and hydrocarbon dew point measurements and gas composition.

PRODUCT SOLUTIONS

MEASURES: H₂O

303B

The 303B utilizes electrolytic P₂O₅ technology for trace moisture measurements in the parts per million by volume (ppmv) range. The 303B can measure moisture concentrations in the low ppmv range and does not require calibration. The analyzer features a digital display and adjustable flow control system, and can be operated using AC, external DC or internal battery power. Lightweight with an optional carry bag, the 303B is built for NEC Division 2 hazardous areas, making it an excellent choice for portable moisture measurements in natural gas.



5100P

The 5100P, using tunable diode laser absorption spectroscopy, is built-for-purpose for water vapor measurement in natural gas and is an ideal tool for verifying fixed installation meters. The analyzer provides excellent accuracy and rapid speed of response to changes in moisture content, minimizing time to attain equilibrium and improving operator efficiency. The 5100P is immune to glycol or methanol contamination in natural gas and features an internal reference to ensure reliable optical system performance. The analyzer operates on an internal battery pack and is certified for use in Class I, Division 2 or ATEX Zone 2 hazardous areas. Data is stored on an internal data logger which can be downloaded via USB.



PRODUCT SOLUTIONS

MEASURES: H₂O, HCDP, Specific Gravity, BTU, C1 to C6+

Chanscope II

Using a chilled mirror operating principle, the Chanscope II incorporates an eyepiece for viewing the hydrocarbon or moisture dew point temperature under lighted and magnified conditions. Additionally, the unit features a digital temperature readout where the dew point temperature is digitally superimposed above the mirror and is seen while looking through the same eyepiece, ensuring accurate readings by the user.



Ranarex Gas Gravitometer

The portable Ranarex Gas Gravitometer measures specific gravity in a lightweight, easy-to-use package. The analyzer's durable construction and mechanical components mean that there is no fragile glass or electronic parts that can be damaged when moving from site to site. No elaborate setup is required, and the unit can be operated with either a standard AC power supply or a 12-Volt vehicle battery through a DC-AC inverter.

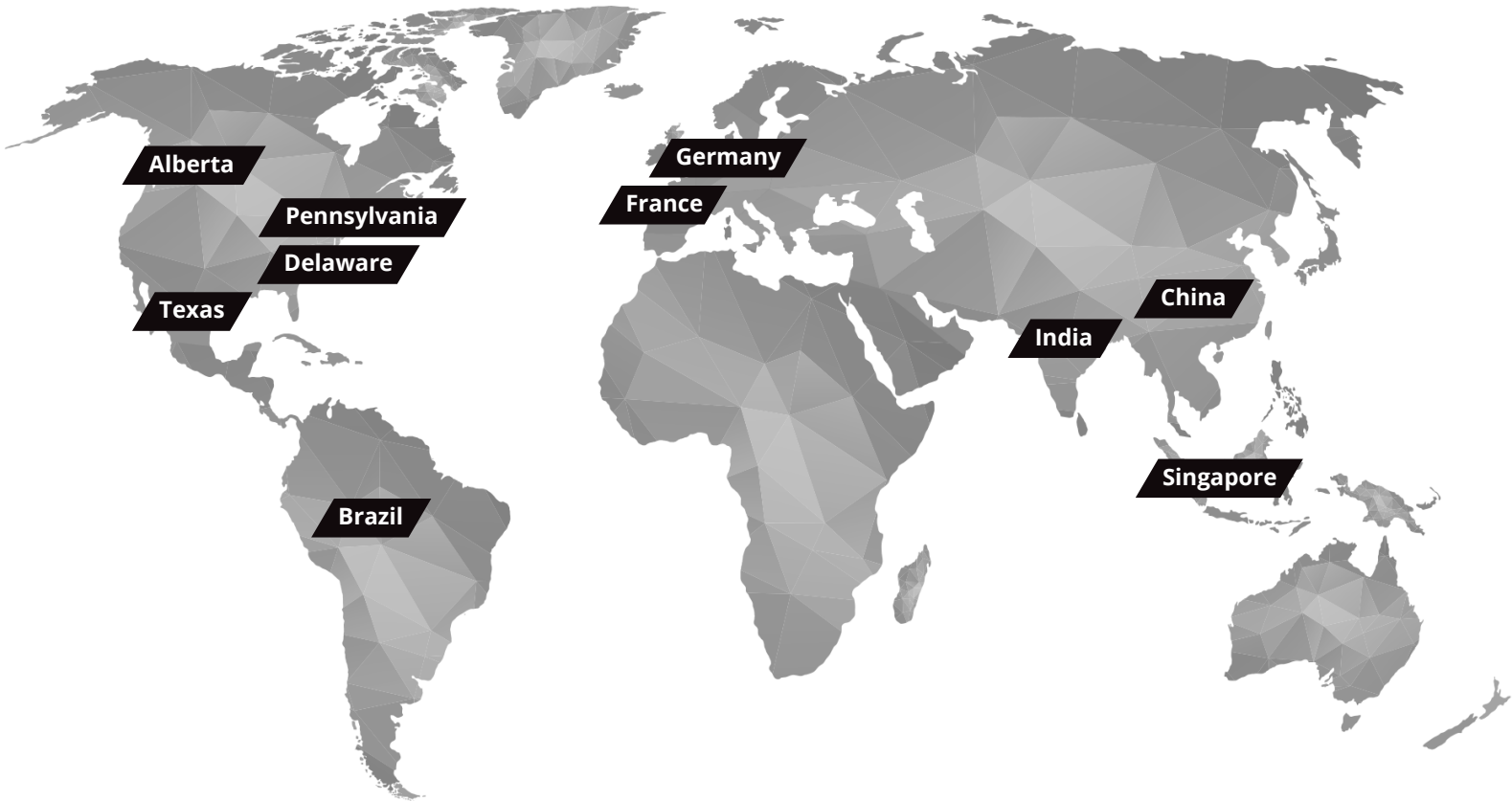


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AMETEK Service Assistance Program plans offer coverage up to 24 hours a day, 365 days of the year.

As worldwide experts in the manufacture of process analyzers and instrumentation, we have supplied solutions to industry since 1962, providing the widest range of analysis technology available.

Through process application consulting, we create custom-designed solutions that meet the needs of your specific application or process.



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