

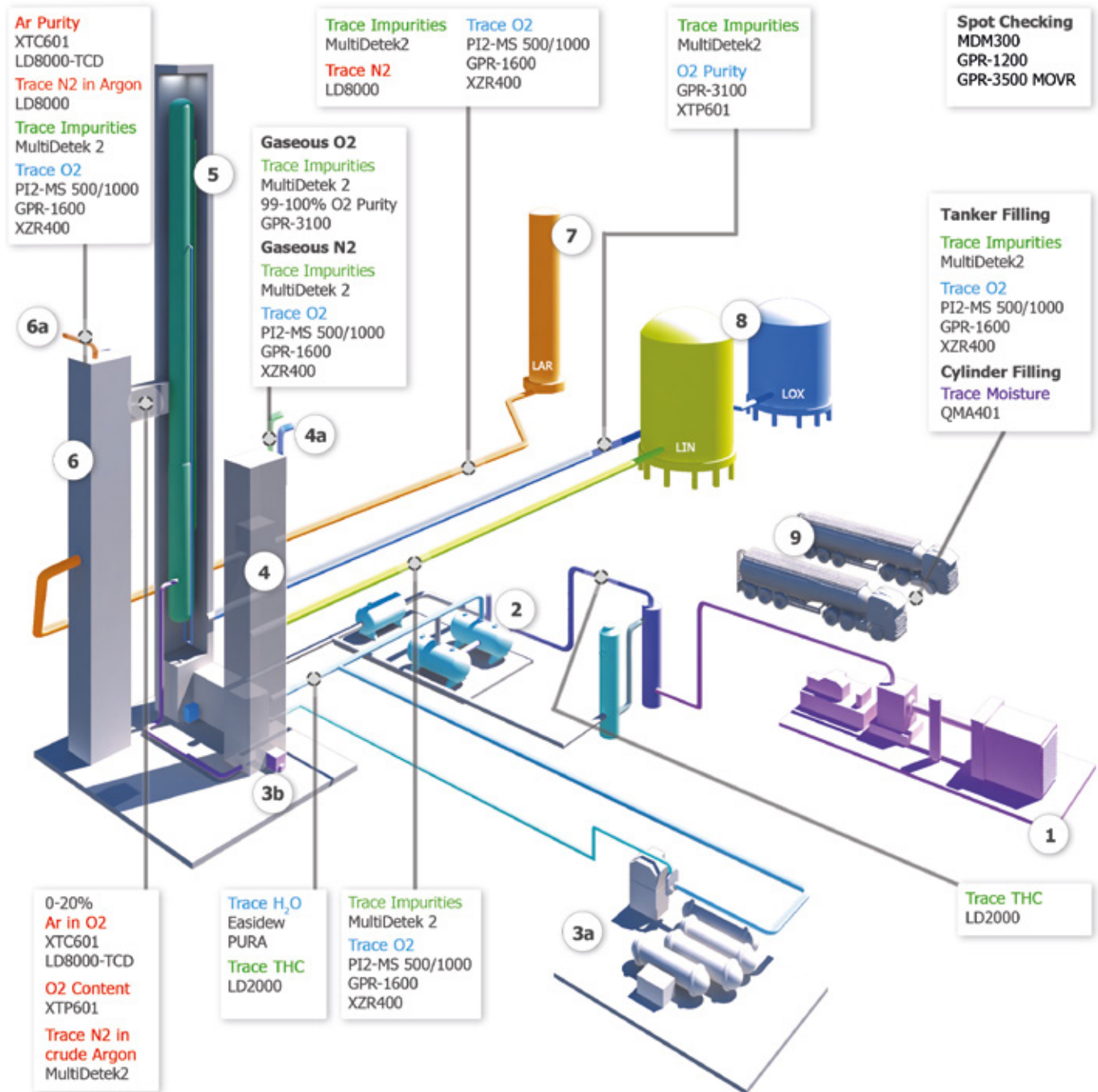
Analyzers for Cryogenic Air Separation Quality

Monitoring gas quality and purity
in air separation plants

Benefit from Trace Oxygen, Moisture, and Impurities Measurements with High-precision Analyzers and Gas Chromatographs

Ensuring the purity of O₂, N₂ and Ar produced through cryogenic air separation is a major concern. Reliable gas analyzers capable of detecting impurities down to parts per trillion are essential to ensure the ultra-high purity levels often required. As well as careful monitoring, an understanding of gas supply systems and materials is also essential to avoid contamination or leaks.

Cryogenic Air Separation Plant



- 1. Air feed, filter, compressor and liquid H₂O removal
- 2. Molecular sieve – H₂O, CO₂ & HC removal
- 3a. Booster compressor
- 3b. Turbo expander
- 4. Heat exchange cold box
- 4a. Gaseous O₂ + N₂ pipeline to customers
- 5. Cryogenic distillation tower
- 6. Argon cold box (purifier)
- 6a. Gaseous Ar pipeline to customers
- 7. Liquid argon (LAR) storage
- 8. Liquid nitrogen (LIN) & liquid oxygen (LOX) storage
- 9. Tanker / cylinder filling

Expertise in Products for High Purity Gas Quality Control

We offer a range of analyzers that help specialty gas companies monitor their systems for contamination from moisture ingress as well as O₂, N₂ and other gases in ranges down to parts per trillion. We bring together years of experience in serving this highly specialist and demanding application making it easier for you to find the exact mix of products for each measurement point. Our purity and trace impurity analyzers monitor air intake and preliminary purification, post distillation quality control plus storage and distribution.

Benefits

- Reliable measurements of trace impurities down to parts per trillion
- A complete measurement and analysis solution from a single supplier
- Multiple trace impurity measurements possible with a single analyzer system: LDetek LD8000 MultiGas

Measurement Parameters

- Trace Moisture – LDL of 1 ppb_v with Pura
- Trace O₂ – LDL <100 ppt achievable with PI2-UHP analyzer
- Trace Gases – LDL down to <100 ppt with MultiDetek2 and LD8000
- Trace Hydrocarbons – LDL down to <100 ppt with MultiDetek2 and LD8000

Selected Served Applications

- Measuring O₂ product purity from air separation process
- Measuring the oxygen and moisture content during gas cylinder certification for specialty mixes including welding gas
- Monitoring ppm level oxygen in N₂ transported via pipelines and tanker trucks
- Measuring PPB levels of O₂ in cryogenically produced ultra-high purity (UHP) N₂
- Measuring Low O₂ ppm in N₂ and Ar generated
- Monitoring trace moisture for pre-cooling purification

Product Selector

Application/Service	Purpose of Measurement	Measurement	Measured Gas / Background Gas	Analyzer Options
Measuring the O ₂ deficiency or oxygen enrichment in control rooms and storage areas	To ensure safety – either from risk of asphyxiation or from explosion	<19.5...20.0 %O ₂	Air, N ₂	• GasSenz
Measuring O ₂ product purity from air separation process	Confirming the quality of pure O ₂	98...100 %	Air	• GPR-3100
Measuring the oxygen content during gas cylinder certification for specialty mixes including welding gas	Ensuring cylinder gas quality	0...10 ppm to 95 %O ₂	Varies	• XZR400 • GPR-1600 • GPR-2600 • GPR-1200 • GPR-2000 • GPR-1200 MS
Monitoring ppm level oxygen in N ₂ transported via pipelines and tanker trucks	Confirming the quality of pure nitrogen and detecting leaks in the transportation system	0...10 ppm O ₂	N ₂ , Ar	• XZR400 • GPR-1600 • GPR-1200 • GPR-1100
Measuring PPB levels of O ₂ in cryogenically produced ultra high purity (UHP) N ₂	Confirming the quality of UHP nitrogen	0...50 ppb O ₂	N ₂ , Ar	• P12-UHP 50/100 • GPR-1200 MS
Measuring low O ₂ ppm in N ₂ and Ar	Quality assurance in pure gases	0...500 ppb O ₂	N ₂ , Ar	• PI2-UHP 50/100 • PI2-MS 500/1000 • GPR-1200 MS
Monitoring trace moisture for pre-cooling purification	Protecting equipment and ensuring quality	0.1...2,000 ppm _v	Air	• Easidew • Pura
Measuring moisture content for cylinder filling	Ensuring quality of gas	0.1...2,000 ppm _v	N ₂ , Ar, O ₂	• QMA401
Measuring N ₂ in pure Argon after purification	Ensuring quality of gas	0...1 ppm, 0...10 ppm, 0...100 ppm	Ar	• LD8000
Measuring trace impurities for quality control	Ensuring quality of gas	0...100 ppb to 0...10 ppm	N ₂ , Ar, O ₂	• MultiDetek 2
Measuring hydrocarbon in air intake	Removal of impurities prior to cooling	0...10 ppm, 0...100 ppm	Air	• LD2000
Measuring hydrocarbons in oxygen for safety and quality purpose	Removal of impurities prior to cooling	0...1 to 0...1000 ppm	O ₂	• MultiDetek 2 • LD2000

Application/Service	Purpose of Measurement	Measurement	Measured Gas / Background Gas	Analyzer Options
Measuring Oxygen content of feed to crude argon	Control of process	80-100 %	O ₂	<ul style="list-style-type: none"> • XTP601
Measuring Argon content of feed to crude argon	Control of process	0-20 %	O ₂	<ul style="list-style-type: none"> • LD8000-TCD • XTC601
Measuring Argon purity on the outlet of crude argon	Ensuring quality of gas	90-100 %	Ar	<ul style="list-style-type: none"> • LD8000-TCD • XTC601

Trace Gas and Impurity Measurements

LDetek MultiDetek 2 – Compact Gas Chromatograph

Based on LDetek’s patented plasma emission detector technology, this stand-alone gas analyzer is the ideal flexible and customizable solution.

- Sub ppb trace measurements
- A single analyzer for trace measurement of multiple impurities
- Plug & Play, user friendly configuration
- Ethernet connectivity for remote control

LDetek LD8000 – Online PPB Trace Nitrogen Analyzer

The LD8000 is an online analyzer to monitor trace N₂ in Ar/Crude Argon.

- Unique plasma emission detector design based on a duty cycle-controlled system
- PPB sub-system integrated
- Range identification relay
- Bypass sample flow control to ensure high purity

LDetek LD2000 – Trace Total Hydrocarbons Analyzer

The LD2000 is an easy to use instrument that offers the ideal solution for total hydrocarbon measurements. Its compact design and small footprint make it easy to install alongside other equipment.

- LDetek Flame Ionisation Detector (FID) design offering low maintenance
- Bootloader integrated for software update via Ethernet
- 3U cabinet

LDetek LD8000 TCD - Binary Gas Analyzer

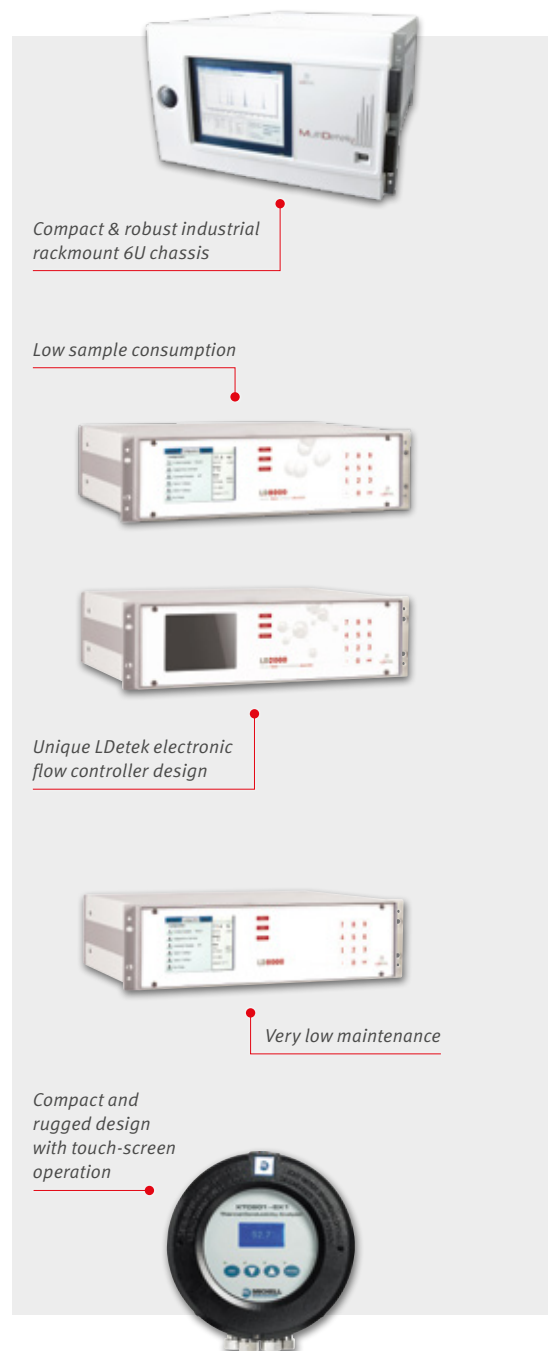
Offers direct and continuous measurements of a gas component in a binary gas mixture using a Thermal Conductivity Detector (TCD).

- Large scale measurement
- 4-20 mA as standard
- Micro valve for very low dead volume and fast purging time

Michell XTC601 – Binary Gas Analyzer

A robust on-line binary gas analyzer for measurement of percentage argon in oxygen.

- Accuracy of better than ±2% range
- IP66 rated enclosure
- Low cost of ownership due to minimal maintenance



Trace Oxygen and Oxygen Purity

Analytical Industries Inc PI2-UHP 50/100 – For Ultra-high Purity Gases

Accurate and stable measurements of oxygen down to low parts per billion – with an LDL of less than 100 ppt.

- Cost-effective and reliable electrochemical sensors with 12 months life
- Heated sample system for measurement integrity – negating the diurnal temperature effect
- Auto-calibration system with true zero feature via O₂ scrubber

Analytical Industries Inc PI2-MS 500/1000 – For Ultra-high Purity Gases

Accurate and stable measurements of oxygen down to parts per billion.

- Cost-effective and reliable electrochemical sensors with 12 - 24 months life
- Easy to maintain, simple to operate
- Optional auto calibration system with true zero feature via O₂ scrubber

Analytical Industries Inc GPR-1600/2600/3100 – For Industrial Gas

Monitor gas produced or used in industrial processes where trace oxygen from low parts per million to pure O₂ must be precisely measured.

- High accuracy (± 0.02 ppm in lowest range)
- Long sensor life up to 24 months in $< 1,000$ ppm O₂
- Integrated bypass valve (for GPR-1600)

Michell Instruments XZR400 – Oxygen Analyzers for Industrial Gas

Monitor gas produced or used in industrial processes where trace oxygen from low parts per million to pure O₂ must be precisely measured in gases with no hydrocarbons present.

- High accuracy (± 0.02 ppm in lowest range)
- Long sensor life regardless of oxygen content
- Optional integrated Easidew sensor

Michell Instruments XTP601 – Oxygen Analyzer

A robust, linear and stable oxygen analyzer housed in an IP66 rugged casing.

- Intrinsic error (accuracy) is better than ± 0.2 %O₂
- Calibration intervals up to 6 months
- Outputs include RS485 and two 4-20 mA (following NAMUR NE 44 standard)

Analytical Industries Inc GPR-1200/GPR-3500 – Portable Purity and Trace Oxygen Analyzers

An economical and reliable portable analyzer for accurate measurements of trace oxygen.

- Measurement ranges from 0...10 ppm up to 0...100 %O₂
- Accuracy of better than 2 % of range
- 24-32 months sensor life span (in normal use)

Analytical Industries Inc GPR-1100/2000 – Portable Oxygen Analyzers

Suitable for trace oxygen measurements from 0.1 ppm through to purity applications at 100 % oxygen, these rugged portable instruments share the same advanced sensor technology the Analytical Industries Inc online process oxygen analyzers.

- Measurement ranges from 0...1000 ppm up to 0...25 %O₂
- Up to 5 ranges per model with manual or auto-ranging feature
- Rugged design, proven to last in field operation
- Up to 30 days battery life (40 hours with pump)



Trace Moisture

Michell Pura – Pure Gas Trace Moisture Transmitter

Rugged, self-contained hygrometer to measure trace moisture content in ultra-high-purity gases.

- Precision measurement from 0.1...2000 ppm_v
- Low maintenance

Michell Easidew – Industrial Trace Moisture Transmitter

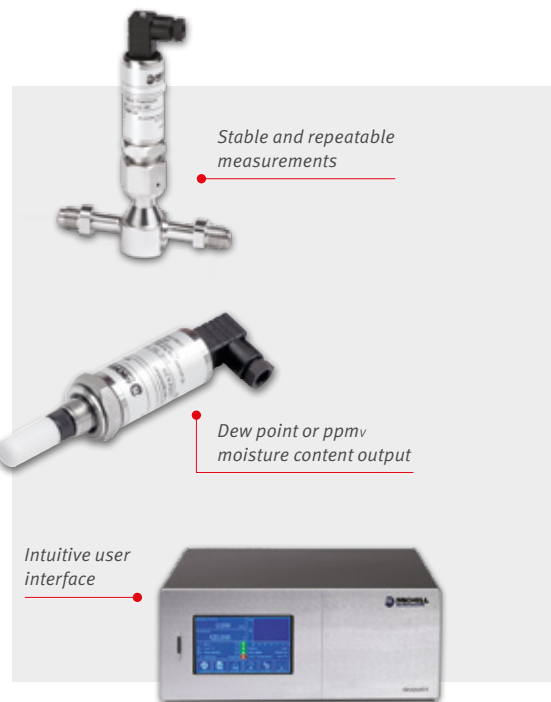
The Easidew sensor is a moisture meter that measures both dew point and moisture content. It is simple to install as it is available with a wide range of process connections and electrical connectors.

- Measurement ranges -110...20 °Cdp (-166...68 °Fdp)

Michell QMA401 – Self-Calibrating Trace Moisture Analyzer

Quartz crystal microbalance sensing technology provides reliable, fast and highly accurate measurements of trace moisture.

- Precision measurement from 0.1...2000 ppm_v
- Low maintenance

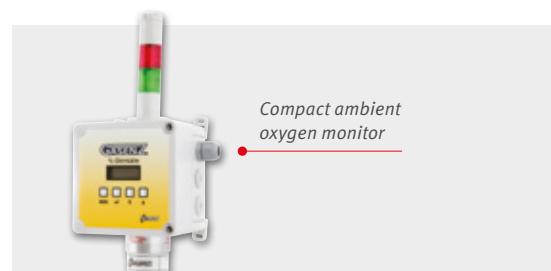


Ambient Monitoring

Ntron Gasenz – Ambient Oxygen Analyzer

The Gasenz ambient oxygen analyzer monitors ambient oxygen levels in work areas to detect oxygen deficiency (to avoid risk of asphyxiation) or oxygen enrichment (to avoid risk of explosion or fire).

- Long life, low maintenance zirconia, electrochemical or optical sensor technology
- Measurement range: 0...25 %O₂
- Audio/ visual alarm indicator



Process Sensing Technologies

We provide an unmatched suite of instruments, analyzers and sensors for precision measurements and monitoring in highly demanding end markets. These range from pharmaceutical/ life sciences, speciality gases, semiconductors, O&G, petrochemicals and power to gas detection, food and beverage and building automation. **Using our products, customers save millions of dollars each year through increased energy efficiency in their processes and reduced process disruptions.** The quality of food, medicines, semi-conductors and thousands of manufactured goods depends on reliable measurements of critical parameters such as humidity, oxygen, CO, N₂, H₂, hydrocarbons, pressure or CO₂ during production, storage and transport. Our products directly improve the profitability of our customers and help them to stay compliant with stringent industry regulations. We own and manufacture the sensing technologies used in the majority of our products. This allows us to remain in a strong leadership position and pass on the benefits of our innovation to our customers.

PST Leading Brands

- **Analytical Industries Inc.** – Electrochemical oxygen sensors and gas-analysis
- **Dynament** – Infrared gas sensors
- **LDetek** – Ultra low range online analyzers
- **Michell Instruments** – Moisture and oxygen sensing and instrumentation
- **Ntron Gas Measurement** – Oxygen sensors and analyzers
- **Rotronic** – Humidity and temperature instruments, monitoring systems
- **SST Sensing** – Oxygen sensors and liquid level switches

Group Facts

- Experts in analyzers & systems to ensure purity of industrial O₂, nitrogen & argon
- 22 Service and sales subsidiaries
- 8 global engineering and manufacturing locations
- 100+ authorized distributors
- 14 proprietary technologies