Fast, safe, and easy nutrient analysis

Thermo Scientific Gallery and Gallery Plus discrete analyzers – for complete and simultaneous nutrient analysis of drinking water, wastewater, and soil samples
Nutrient analysis: Protecting public health and the environment

The importance of accurate nutrient analysis
Determining nutrient levels in drinking water, wastewater, and soil samples is critical for protecting aquatic habitats and maintaining clean and safe drinking water supplies. Utility companies and environmental laboratories must regularly measure elemental phosphorus and nitrogen in sewage water, along with a range of other pollution indicators, to ensure discharge streams are compliant with regulatory standards. Wastewater nutrient analysis can also be used for the assessment of population-level infection, including SARS-CoV-2 surveillance, by providing important biomarker indications for population size.

Environmental issues:
- Algal blooms
- Oxygen depletion
- Toxin build-up

Health problems:
- Blood disorders
- Birth defects
- Thyroid issues

The limitations of traditional wet chemistry methods
Traditional wet chemistry techniques, including titrations, flow injection analysis, and other colorimetric techniques, have been used for many years to undertake nutrient analysis of drinking water, wastewater, and soil samples. However, these approaches are slow, labor-intensive and often unreliable, involving hazardous reagents that add substantial costs for waste disposal.

<table>
<thead>
<tr>
<th>Time-consuming</th>
<th>Labor-intensive</th>
<th>Unreliable</th>
<th>Wasteful</th>
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<tbody>
<tr>
<td>Tests are sequential and involve complex manual methods, resulting in lengthy workflows.</td>
<td>Wet chemistry methods require highly-skilled technicians to operate equipment, perform analyses, and regularly maintain instruments.</td>
<td>Multiple manual steps can add significant sources of error, reducing overall measurement accuracy.</td>
<td>Workflows require large quantities of reagents and produce high-volume waste streams, increasing the testing cost-per-sample.</td>
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Automated, high-throughput nutrient analysis for cost-effective results

Laboratories require accurate, efficient, and easy-to-use techniques for nutrient analysis. The Thermo Scientific™ Gallery™ and Gallery™ Plus discrete analyzers are an integrated, automated platform for nutrient analysis that provide a faster, safer, and more reliable replacement to traditional wet chemistry methods for the measurement of:

- Orthophosphate
- Total phosphorous (TP)
- Ammonia
- Nitrites
- Total oxidized nitrogen (TON)
- Total Kjeldahl nitrogen (TKN)
- Nitrates

The Gallery and Gallery Plus discrete analyzers allow nutrient determinations to be run in parallel with both photometric and electrochemical measurement techniques, including pH, conductivity, hexavalent chromium, chloride, and sulfate analyses. By enabling high-throughput measurement of over 20 parameters simultaneously, the analyzers streamline workflows to reduce total run times and increase analytical efficiency. The unique low-volume cuvette design and precision liquid-handling capabilities also accommodate microliter sample and reagent volumes, helping laboratories minimize reagent use and waste to reduce cost-per-analysis.

As fully-automated platforms, the Gallery and Gallery Plus discrete analyzers ensure every test is performed according to precise, predefined workflows. These workflows require no user intervention once the pre-mixed, ready-to-use reagents are loaded into the instrument. Automation not only improves the reliability and sensitivity of results compared with manual wet chemistry techniques, it also boosts laboratory productivity by freeing staff to walk away and work on other tasks. By eliminating the need to handle hazardous reagents, the Gallery systems’ automated workflows also better protect the health and safety of laboratory teams. Each test is validated to fulfill the United States Environmental Protection Agency (U.S. EPA) and international regulatory requirements for environmental and drinking water analysis, supporting consistently compliant results.

The Gallery and Gallery Plus discrete analyzers have a simplified workflow with full automation. Samples and reagents are inserted, the analysis protocol is imported, and the technician can walk away while the discrete analyzer runs the tests and generates reports.
Combining simple operation with advanced technology

Automate labor-intensive and time-consuming multi-parameter wet chemical analysis with a single instrument

**Unique disposable Thermo Scientific™ DECACELL™ cuvettes**
- 10 independent DECACELL cuvettes are mounted together for discrete analysis
- Reduced sample and reagent volumes (just 2–240 µL) for low waste generation and a reduced cost-per-analysis

**High-throughput analyzer**
- Perform simultaneous photometric and electrochemical measurement techniques, including pH and conductivity
- Up to 350 photometric tests per hour
- Up to 67 ECM tests per hour

**Xenon source lamp**
- Long-life materials
- Energy-efficient design for cost savings
- Sensitive to the parts per billion (ppb) level

**Wide range of filters**
- 12 different filters available, delivering up to 20 different chemical parameters-per-sample
- Wide wavelength coverage: 340–880 nm

**Automatic analysis**
- Automated calibration and validation from a single stock standard
- Automatic dilution for over-range samples
- Automatic start-up and shutdown for ease-of-use

*Gallery discrete analyzer*

The Gallery discrete analyzer includes a combined sample and reagent disk for a maximum capacity of 90 samples and 30 reagents, with the ability to run up to 200 tests per hour.
The Gallery Plus discrete analyzer can accommodate 108 samples and 42 reagents in separate sample and reagent disks, with the capability to run up to 350 tests per hour.

**Improved traceability**
- Bi-directional LIMS connection for easy and secure data transfer
- Easy sample table import and workflow-based operation, for all user levels
- Built-in barcode readers for samples and reagents

**Robust analyzer**
- Minimal moving parts means less maintenance
- Automated mixing that delivers proven, reproducible results
- Calibration curve stability

**Flexible design**
- Existing methods can be modified
- Up to four different reagents can be added to a method
- Easy-to-implement Alternate Test Protocol (ATP) and new methods
- Variable incubation temperature from 25–60 °C

**Optional electrochemical measurement (ECM) module**
- Integrated parallel pH and conductivity measurements:
  - pH range: 2–12
  - Conductivity range: 20–112 µS/cm

**Ready-to-use reagent kits**
- Improves safety by simplifying reagent handling, avoiding exposure to highly corrosive and hazardous chemicals
- More than 40 different chemistries to choose from
- Only µL of consumption per test for low cost and wastage
- Bar-coded reagent vials include lot, expiration data, and vial size data for:
  - Easy and reliable identification
  - Real-time reagent monitoring

**Streamline SARS-CoV-2 wastewater surveillance**
- High-throughput testing for chemical and biomarkers
- Saves time by automating colorimetric and enzymatic measurements of multiple analytes simultaneously
- Ready-to-use reagents simplify workflows for enhanced speed, safety, and accuracy
- Follows internationally approved DIN, ISO, and U.S. EPA standard methods for regulatory confidence
Overcoming total oxidizable nitrogen (TON) measurement challenges

Measurement of TON is required for the accurate determination of nitrate concentration in drinking water and wastewater. TON measurement methods based on cadmium reduction coils have been used by laboratories for many years. However, these approaches have several limitations. Cadmium is a carcinogenic heavy metal, and the coil used in TON analyses must be replaced every few measurements to reduce the risk of harmful exposure.

Regeneration of the column also requires the handling of additional hazardous chemicals, producing waste that must be carefully disposed of at significant cost to laboratories. These processes, as well as downstream analyses using flow injection or colorimetric analyzers, involve time-consuming, manual steps that are also a source of measurement inaccuracies.

Limitations of traditional cadmium reduction coil methods

- Carcinogenic health risk
- Costly waste disposal
- Time-consuming, manual methods
Safer enzymatic methods for TON measurement

The Gallery and Gallery Plus discrete analyzers support new National Environmental Laboratories Accreditation Conference (NELAC) and EPA-approved enzymatic reduction methods for safer TON measurements. These methods use nitrate reductase to convert nitrate to nitrite, before Griess reagents are used to produce an intensely colored compound that can be quantified by spectrophotometry.

The Gallery and Gallery Plus systems automate the entire process, delivering high-throughput results without pH adjustment of preserved samples or time-consuming cadmium packing or regeneration steps. Convenient, ready-to-use reagents eliminate the need to handle hazardous chemicals, improving safety, and removing a source of experimental error. The improved reproducibility afforded by the fully-automated platforms ensures robust measurements even when working with challenging matrices, such as saline, in compliance with 40 CFR Part 141.23, 40 CFR Part 141, and NECi–N07-0003 regulatory standards. This greener enzymatic method also removes costs associated with hazardous waste disposal, further reducing costs-per-analysis.

Advantages of enzymatic TON method

Green chemistry  No sample preservation or pH adjustment  Cost saving
Optional integrated ECM module: For parallel pH and conductivity testing

Electrochemical pH and conductivity measurements provide crucial insight for a wide range of environmental and industrial testing applications. The Gallery and Gallery Plus discrete analyzers support an optional electrochemical measurement (ECM) module that is available as an integrated add-on. The ECM module simply slots into place to provide simultaneous pH and conductivity testing in parallel to the full range of photometric measurements. The ECM module’s two electrodes work in series to enable up to 67 electrochemical tests to be completed per hour, alongside up to 350 photometric tests.

Water

**Measure pH to:**
- Protect equipment from acid corrosion
- Detect viral activity

**Measure conductivity to:**
- Quantify total dissolved solids
- Protect against scale build-up
- Ensure environmental discharge standards are met
- Create detailed inorganic profiles for regulatory compliance

Soil

**Measure pH to:**
- Determine soil reaction (i.e., soil acidity/alkalinity) to optimize crop yields
- Assess microbial activity

**Measure conductivity to:**
- Determine soil salinity
- Assess nutrient mobility

The high sensitivity and versatility of the ECM module allows testing of a wide variety of samples and matrices. pH and conductivity measurements are automatically verified using National Institute of Standards and Technology (NIST) traceable standards and comply with the latest regional and international regulatory standards.

Using the Gallery or Gallery Plus discrete analyzers with the built-in ECM module to perform parallel, automated electrochemical measurement of pH and conductivity, laboratories can save time, increase throughput, and decrease the cost-per-analysis.

By integrating the ECM module into the standard photometric workflows offered by the Gallery and Gallery Plus discrete analyzers, laboratories can access all the measurements they need for comprehensive drinking water, wastewater, and soil analysis in a single, easy-to-use system. Watch our video demonstration to see how the ECM module streamlines multi-parameter testing workflows to deliver rapid, actionable insight.
Regulatory compliance with confidence

All Gallery and Gallery Plus system methods for the analysis of nutrients and supporting photometric and electrochemical measurements are compliant with EPA, NELAC, and recognized international standards. Thanks to the discrete analyzers’ automated calibration functionality, robust analytical performance, ready-to-use buffers, and NIST-traceable standards, laboratories can be confident their tests comply with the latest regulatory requirements, and industrial organizations assured that wastewater streams meet permissible nutrient levels.

**Regulatory discrete analyzer — U.S. EPA and international reference methods**

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* third party reagent
Improving throughput, reducing costs, and keeping staff safe with fully-automated workflows

The Gallery and Gallery Plus discrete analyzers provide an easy-to-use, automated solution for high-throughput nutrient analysis, helping laboratories access time and cost savings by simplifying workflows.

**Fast**
- Up to 350 photometric tests per hour
- Up to 67 ECM tests per hour
- Parallel photometric and ECM testing

**Safe**
- Ready-to-use reagents – only few uL per tests
- Operators are not exposed to the harsh chemical preparation
- Green enzymatic method for TON

**Easy**
- Walkaway solution
- Suitable for all user levels
- Automated liquid handling

Samples for nutrient analysis

Ready-to-use reagents and standards

Single instrument
Samples for nutrient analysis
Ready-to-use reagents and standards
Single instrument
Single operator
Fast multiparameter analysis
Productivity Profitability