Diamond SPECTRUM

PART OF TAAWON GROUP

PRODUCT CATALOG

ENERGY & PETROCHEMICALS

CHOICE OF EXCELLENCE

www.taawon.com

ABOUT DIAMOND SPECTRUM

Welcome to Diamond Spectrum, a member of Taawon Group – Your Premier Partner in Laboratory Solutions!

At Diamond Spectrum, we specialize in providing an unparalleled range of high-end laboratory solutions, consumables, and disposables. Our commitment revolves around delivering excellence, compatibility, and exceptional value and support.

Discover a world of reliable solutions tailored to elevate your laboratory experience. Diamond Spectrum is here to redefine standards and exceed expectations in the pursuit of scientific excellence.

OUR VISION

To be the leading partner in advancing laboratory and industrial technologies across the region, recognized for empowering innovation with a comprehensive range of reliable, cutting-edge systems and solutions.

OUR MISSION

Our mission is to empower our customers' success by delivering superior-quality laboratory and industrial equipment, with high customer satisfaction rate, enabling measurable improvements in their operational performance each year

TAAWON GROUP JOURNEY

Since its establishment, Taawon Group has grown from a local supplier into a trusted regional leader in laboratory and scientific equipment. Over the years, we have expanded our portfolio, forged global partnerships, and introduced pioneering technologies to the Middle East market. Today, our legacy is built on decades of expertise, innovation, and unwavering commitment to customer success.

2008

Taawon Founded in Jordan

2009

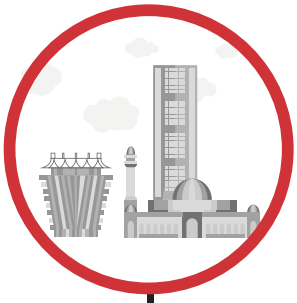
Diamond Spectrum Founded in Saudi Arabia

2013

Altayf Althahabi (TTSL) Founded in UAE

2019

Companies incorporated under Taawon Group



2021

Diamond Spectrum Founded in Bahrain

ASSOCIATION & GROUP COMPANIES

Taawon
Jordan

Diamond Spectrum - DS
Saudi Arabia

Altayf Althahabi - TTSL
United Arab Emirates

Diamond Spectrum - DS
Bahrain

4000 + customers

100 + employees

4 countries

7 offices

APPLICATIONS & INDUSTRIES

Taawon Group offers a comprehensive portfolio of laboratory, industrial, and scientific solutions designed to meet the highest industry standards and regulations in a wide variety of sectors.

Pharmaceuticals

Energy & Petrochemicals

Chemicals

Food, Beverage &Feed

Academia & Research

Nano technology

Material Testing

IVF and Life Science

Warehouse Monitoring

TABLE OF CONTENT

Petro & Energy Analysis	1
PAC Distillation	2
PAC Cold Properties	3
PAC Elemental Analysis	4
PAC Fuel Analysis	5
PAC Hot Properties	7
PAC Viscosity	9
Laboratory Balances	11
Mettler Toledo Analytical Balances	12
Mettler Toledo Precision Balances and Scales	15
Mettler Toledo Microbalances	16
Mettler Toledo Moisture Analysis Solutions	17
Mettler Toledo Test Weights	18
Mettler Toledo Software for Laboratory Weighing	19
Analytical Instruments	21
Mettler Toledo Titration Solutions	22
Mettler Toledo Portable pH Instruments	23
Mettler Toledo Benchtop pH Instruments	24
Mettler Toledo Portable Density Measurements	25
Mettler Toledo Benchtop Density Measurements	25
Mettler Toledo UV/Vis Spectrophotometry	26
Mettler Toledo Portable Refractometer / Brix Meter	27
Mettler Toledo Benchtop Refractometer / Brix Meter	27
Mettler Toledo Melting Point Instruments	28
Mettler Toledo Dropping / Softening Point Instruments	29
Mettler Toledo Thermal Analysis Excellence	30
Mettler Toledo Laboratory Software Solutions	32
C-Therm Thermal Conductivity	33
Liquid Handling Solutions	35
Mettler Toledo Pipettes	36
Automated Lab Reactors In-Situ Analysis, & Modeling Software	37

TABLE OF CONTENT

Mettler Toledo Instruments for Chemical Synthesis, and R&D	38
Separation & NIR Solutions	40
Buchi Separation Instruments	41
Elemental & TOC Measurement	44
Teledyne VOC & TOC Analytics	45
Teledyne QuickTrace Mercury Analyzers	46
Atomic Spectroscopy	47
Horiba Elemental Analysis	48
Horiba Particle Analysis	49
Horiba Microscopy and Imaging	51
Horiba Spectroscopy	52
Electron & X-ray Microscopy Solutions	55
Tescan Scanning Electron Microscopes (SEM)	56
Tescan Focused Ion Beam-Scanning Electron Microscopes (FIB-SEM)	58
Tescan Micro-computed tomography (microCT)	59
Tescan 4D STEM	60
Metallography Preparation	61
Buehler Sectioning & Cutting	62
Buehler Mounting	63
Buehler Grinding & Polishing	64
Buehler Etching	65
Buehler Hardness Testing	66
Materials Testing Systems	68
Instron Universal Testing Systems	69
Instron Dynamic Testing Systems	71
Instron Rheology and Impact Testing Systems	73
Materials Testing Instruments	74
Rtec Mechanical Testing Solutions	75
Operational Environment Control Systems	78
Binder Standard incubation and Plant Growth	79
Binder Drying and Tempering	80

PAC

Petro & Energy Analysis

Petro & Energy Analysis

Distillation

Atmospheric Distillation

- Atmospheric distillation, represented by the OptiDist 2, is considered the industry benchmark for determining the boiling range characteristics of petroleum products. This automated analyzer is designed to perform high-precision testing that correlates with standard methods like ASTM D86.

Micro-Distillation

- Micro-distillation technology, such as the OptiPMD, offers a next-generation laboratory solution for rapid distillation analysis using significantly smaller sample volumes. This method is particularly valuable for high-speed testing and scenarios where sample quantity is limited.

Vacuum Distillation

- Vacuum distillation, performed by instruments like the HDV 632, is a fully automated process used to determine the boiling range of heavy petroleum products that might otherwise decompose if distilled at atmospheric pressure. By reducing the pressure within the system, the analyzer can boil heavy components at lower temperatures.

AC SIMDIS Analyzer

- The AC SIMDIS (Simulated Distillation) Analyzer is a gas chromatography-based solution that accurately determines True Boiling Point (TBP) data for a wide range of petroleum samples. Developed by AC Analytical Controls, these analyzers can process everything from light naphtha to heavy crude oil

CNS SIMDIS for Crude Oil

- The CNS SIMDIS for Crude Oil is an advanced analyzer capable of simultaneously determining the boiling range distribution of Carbon (C), Nitrogen (N), and Sulfur (S) within crude oil and its final products.

Petro & Energy Analysis

Cold Properties

Cloud Point

- Cloud Point refers to the specific temperature at which the smallest observable cluster of hydrocarbon crystals first appears in a liquid specimen of petroleum product or biodiesel fuel. This phenomenon occurs as the sample is cooled under prescribed laboratory conditions, creating a "cloudy" appearance.

Pour Point

- The Pour Point is defined as the lowest temperature at which movement of a petroleum test specimen is still observed when tested under specific, prescribed conditions. This measurement indicates the temperature at which the fuel or oil loses its flow characteristics and becomes semi-solid.

Cold Filter Plugging Point (CFPP)

- Cold Filter Plugging Point (CFPP) represents the lowest temperature at which a fuel will provide trouble-free flow through specific fuel systems. It is an industry-standard test used to estimate the temperature at which fuel filters in vehicles or equipment are likely to become blocked by wax crystals.

Freeze Point

- Specifically relevant to aviation fuels, the Freeze Point is the temperature at which solid hydrocarbon crystals—which originally formed during cooling—completely disappear as the fuel temperature is allowed to rise. The freeze point focuses on the disappearance of these crystals under specified test conditions

Wax Appearance

- Wax Appearance, often referred to as Wax Appearance Temperature (WAT), is the temperature at which the very first wax crystals begin to form as a petroleum product is cooled. It serves as an early warning indicator for the onset of crystallization within the fluid.

Petro & Energy Analysis

Elemental Analysis

Sampling Device

- The ACCURA is a high-precision sampling system designed to bridge the gap between volatile hydrocarbon streams and analytical instruments. Handling gaseous and pressurized liquid samples (such as LPG or LNG) is notoriously difficult because light components can easily escape, leading to inaccurate data. The ACCURA automates the injection process, maintaining the sample under constant pressure to ensure that the chemical composition remains unchanged from the pipe to the detector, thereby significantly increasing the reliability of gas chromatography and elemental analysis.

Total Elemental Combustion Analyzer

- The ElemeNtS analyzer is a premier solution for detecting trace levels of Total Sulfur and Total Nitrogen within a single, streamlined process. By subjecting a sample to high-temperature combustion, the instrument converts these elements into oxides, which are then detected via Ultraviolet Fluorescence and Chemiluminescence. This dual-detection capability is vital for refineries and chemical plants that must adhere to stringent environmental regulations and quality standards, as even minute amounts of sulfur or nitrogen can impact product quality and environmental compliance.

Petro & Energy Analysis

Fuel Analysis

FTIR Fuel Analyzer

- A mid-infrared spectrometer that uses chemometric models to rapidly quantify chemical composition (aromatics, oxygenates) and physical properties (octane/cetane).

Heater Tube Scanner

- An automated ellipsometer that measures the nanometric thickness and volume of carbonaceous deposits on tubes following thermal stability testing.

Jet Fuel Thermal Oxidation Tester

- A high-temperature stability instrument that simulates engine stress to measure the deposit-forming tendencies of aviation turbine fuels.

Diesel Thermal Oxidation Tester

- A specialized thermal stability system used to evaluate the oxidation and "coking" tendencies of diesel and biodiesel blends under heat.

Diesel Cloud, Pour, Viscosity & Density

- An integrated analyzer that utilizes optical sensors and an oscillating U-tube to measure four key cold-flow and physical parameters in a single cycle.

Petro & Energy Analysis

Fuel Analysis

Full Composition

- A comprehensive GC analysis—such as Detailed Hydrocarbon Analysis (DHA)—that identifies and quantifies every individual component within a complex hydrocarbon mixture (paraffins, olefins, naphthenes, aromatics).

Boiling Point Distribution

- Also known as Simulated Distillation (SimDist), this method uses gas chromatography to determine the true boiling point (TBP) range of a sample based on component elution order, serving as a high-resolution alternative to physical distillation.

Trace Analysis

- Highly sensitive GC techniques used to detect and quantify impurities or additives at sub-ppm (parts per million) or ppb (parts per billion) levels, critical for catalyst protection and regulatory compliance.

Percent Level Analysis

- Standard GC methods designed for high-concentration quantification (typically 0.1% to 100%), used to determine the bulk purity of refinery streams, gases, and final blended products.

Petro & Energy Analysis

Hot Properties

Cetane Ignition Delay

- Determines the Derived Cetane Number (DCN) of diesel fuels by measuring the time interval between fuel injection and the onset of combustion in a constant volume combustion chamber.

Pensky Martens

- A closed-cup flash point method used to determine the lowest temperature at which petroleum product vapors ignite under standardized conditions, typically for diesel, heating oil, and lubricants.

Tag & Abel

- Specialized flash point methods for volatile liquids; Tag is used for low-viscosity liquids with flash points below 93°C, while Abel is primarily used for petroleum products in the -30°C to 70°C range.

Small Scale

- A rapid flash point technique (Setaflash) designed for small sample volumes (typically 2-4 mL), providing fast equilibrium or go/no-go results for quality control.

Cleveland Open Cup

- Measures both flash and fire points of petroleum products (except fuel oils) by exposing the sample to an open environment to determine the temperature where sustained combustion occurs.

Petro & Energy Analysis

Hot Properties

Micro Carbon Residue Tester

- Quantifies the amount of carbon residue left after evaporation and pyrolysis of a petroleum sample under nitrogen atmosphere, serving as an indicator of coke-forming tendencies.

Evaporation Loss

- Determines the mass of oil lost by evaporation when heated at 250°C under a constant flow of air, a critical parameter for engine lubricant performance and oil consumption.

Ring & Ball

- An automated tester used to determine the softening point of bitumen, resins, and adhesives by measuring the temperature at which a material can no longer support a standardized steel ball.

Vapor Pressure

- Measures the volatility of automotive/aviation gasoline and light distillates by determining the pressure exerted by vapor in equilibrium with the liquid in a closed system.

Gum Test

- Quantifies the "existent gum" or evaporation residue in aviation and motor fuels to evaluate the potential for induction system deposits and fuel degradation during storage.

Petro & Energy Analysis

Viscosity

Viscometer and Density Meter

- A high-throughput, mini-analyzer that measures density and kinematic viscosity of transparent and opaque liquids using a dual-capillary system. It is designed for rapid processing with automated sample loading and cleaning to maximize laboratory productivity.

Freeze, Viscosity & Density

- An integrated jet fuel analyzer that performs freeze point, kinematic viscosity, and density measurements in a single cycle in under 15 minutes. It utilizes a high-speed cooling system to meet the rigorous safety and performance standards required for aviation turbine fuels.

Multirange Viscometer

- A fully automated instrument that utilizes two multi-range capillaries to determine the direct kinematic viscosity of a wide variety of transparent and opaque liquids. It allows for simultaneous testing of different samples across a broad temperature range without manual capillary changes.

Houillon Viscometers

- High-capacity automated systems that use a modified Houillon capillary method to determine kinematic viscosity in lubricating oils, used oils, and fuels. These units are specifically optimized for high-volume laboratories requiring fast results and minimal sample consumption.

Petro & Energy Analysis

Viscosity

High Pressure Viscosity Sensors

- Specialized sensors engineered for PVT (Pressure-Volume-Temperature) oil analysis, core analysis, and R&D under extreme pressure conditions. These sensors provide real-time data on fluid behavior in deep-well or high-pressure reservoir environments.

Marine Fuel Viscosity, Density & Cold Properties

- A dedicated system designed for IMO 2020 compliance that measures viscosity, density, and cold-flow properties specifically for marine fuel oils. It ensures that heavy fuel oils and blends meet the precise specifications required for maritime engine reliability.

ViscoLab PVT

- A high-pressure viscometer designed to analyze fluid samples at elevated temperatures and pressures, typically used for reservoir fluid characterization. It features a piston-driven measurement system that can handle small sample volumes while maintaining high precision.

Diesel Cloud, Pour, Viscosity & Density

- A four-in-one analyzer that quantifies cloud point, pour point, viscosity, and density of diesel fuels in a single run under 25 minutes. It combines optical phase-change detection with oscillating U-tube technology to provide a complete cold-weather operability profile.

METTLER TOLEDO

Laboratory Balances

Laboratory Balances

Analytical Balances

XPR Balances

- The XPR series spans from ultra-micro to high-capacity precision, covering capacities from as low as a few grams up to 64 kg.
- Micro-analytical models feature readabilities down to 0.0001 mg with typical repeatability of 0.00015 mg at 5 % load.
- Analytical models (e.g. XPR106DUH, XPR205) achieve readabilities of 0.005 mg to 0.01 mg with minimum weights (k=2, U=1 %) starting from ~0.6 mg.
- Integrated quality assurance functions like GWP Approved, StatusLight, and LevelControl actively monitor weighing conditions and enforce process tolerances.
- StaticDetect detects electrostatic charge on sample or container and issues warnings, and can be paired with ionizing modules to eliminate static effects.

XPR Essential Balances

- XPR Essential balances offer connectivity via Ethernet, 3 × USB-A, and USB-B ports for flexible data handling.
- The analytical models include a 7-inch color touchscreen (glove-compatible) for intuitive control and input.
- They feature motorized draft-shield doors that open with one touch to streamline sample access.
- Built-in quality assurance includes StatusLight, LevelControl, and MinWeigh warning to enforce process boundaries.
- Analytical versions use a hanging weighing pan with high-performance load cell for precise weighing of small samples.

Laboratory Balances

Analytical Balances

MX Balances

- MX balances feature the SmartPan weighing pan that reduces air-draft effects and accelerates stabilization.
- They include FACT (Fully Automatic Calibration Technology) for internal self-adjustment to maintain accuracy over environmental changes.
- MX models offer connectivity via USB, Ethernet, and optional Bluetooth for data transfer and system integration.
- Quality assurance tools such as StatusLight, routine test guidance, and user management support compliance workflows.
- Precision variants can deliver readabilities down to 0.01 mg, making them suitable for demanding analytical applications.

MR Balances

- MA balances cover a weighing range from 50 g up to 5 kg with readabilities as fine as 0.00001 g
- They employ a MonoBloc™ load cell and internal automatic weight adjustment for sustained high precision
- Touch control interface with guided menus and automatic calculations streamline routine weighing tasks
- Strong metal base and durable outer housing provide chemical resistance and ease of cleaning
- Communication options include USB-A and RS232, along with passcode protection to guard settings against unauthorized changes

Laboratory Balances

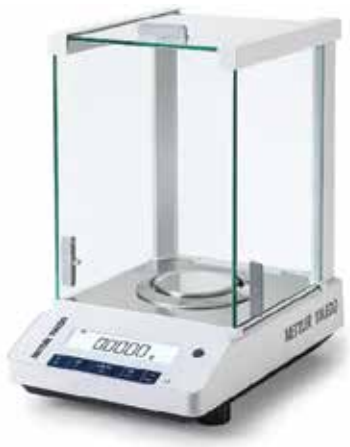
Analytical Balances

MA Balances

- MA balances support capacities from 50 g up to 5 kg with readabilities as fine as 0.00001 g
- They employ a MonoBloc™ weighing cell for reliable measurement stability
- The user interface offers built-in applications and automatic calculations to streamline weighing workflows
- The housing is constructed with a strong metal base and chemical-resistant outer shell to withstand harsh lab conditions
- Communication is enabled via USB-A and RS232 interfaces, with password protection to secure configuration settings

LA Balances

- LA balances provide readabilities down to 0.0001 g with capacities from 80 g to 4 kg
- They use a precise electromagnetic force compensation (EMFC) load cell for fast and stable weighing
- Built-in functions include dynamic weighing and piece counting to simplify common workflows
- The balances offer RS232 communication for printer, secondary display, or PC interface
- They incorporate metal base construction, overload protection, and setting locks to ensure durability and process integrity



Laboratory Balances

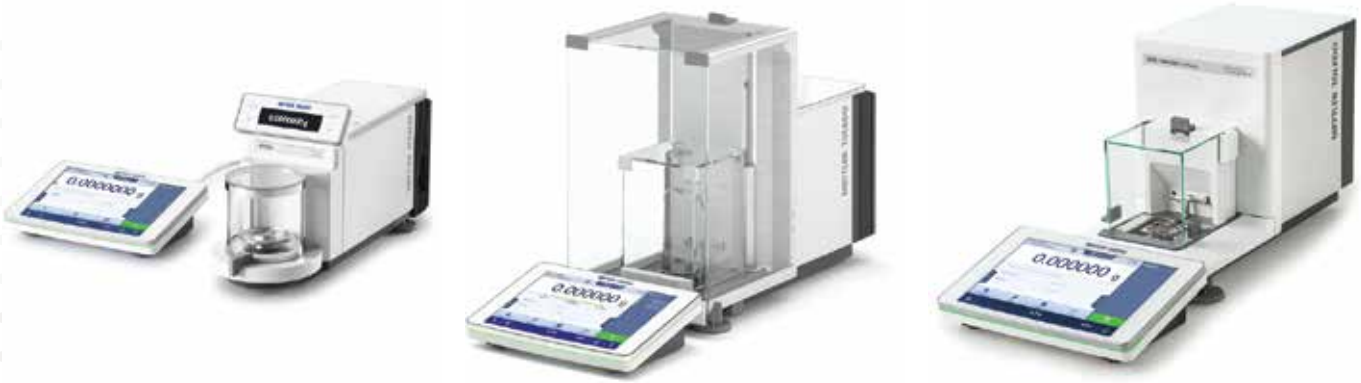
Precision Balances and Scales

- Precision balances support capacities from 120 g up to 64 kg and readabilities between 1 g and 0.1 mg
- Lower-readability models incorporate draft shields while high-capacity models use large weighing pans to accommodate bulk loads
- The SmartPan / SmartPan Pro weighing pan reduces air-draft influence, doubling speed and improving repeatability
- Connectivity options include RS232, USB, and LAN interfaces, with optional Bluetooth/WLAN support
- Construction features include metal housings, overload protection, smooth surfaces, and rounded edges for durability and ease of cleaning
- Many models offer built-in weighing applications (e.g. formulation, dynamic weighing, piece counting) to streamline processes
- Precision balances may include LevelControl which issues warnings when the balance is not properly leveled
- The MinWeigh function ensures sample weights below the minimum accuracy threshold are flagged (displayed in red) and not released
- Some balances support glove mode for operation while wearing disposable or reuseable gloves
- Capacities above 10 kg are supported by large platform models with 0-3 decimal place readability suitable for heavy and bulky items

Laboratory Balances

Microbalances

- Capacity up to 52 g with readability down to 0.1 µg, enabling measurement of samples as low as 30 µg
- High-performance weighing cells with exceptional repeatability and low minimum weight capability
- Built-in quality assurance via Tolerance Profiles and audit-proof monitoring of weighing status
- SmartView terminal design allows separation of the display from the weighing chamber for ergonomic placement
- Draft shield is cylindrical with all-round visibility and automatic (touchless) door operation
- Compact footprint minimizes space usage and supports installation in confined environments
- Intuitive touchscreen interface with guided method library and easy operation for repetitive tasks
- Internal results notepad automatically records all measurement parameters and results
- Easy removal and cleaning of draft shield components and weighing pan without tools
- Optional electrostatic ionizer modules and StaticDetect support detection and mitigation of sample charging



Laboratory Balances

Moisture Analysis Solutions

- Moisture analyzers use the loss on drying (thermogravimetric) method, combining a balance and halogen heating unit for moisture measurement.
- These analyzers deliver rapid and precise moisture content determination through advanced weighing technology and precise temperature control.
- The QuickPredict feature enables prediction of final results early, reducing measurement time for certain models.
- Connectivity is enabled via USB, Ethernet, and RS232 interfaces, supporting data transfer and integration into lab systems.
- Routine checks are simplified via SmartCal, a quick 10-minute performance test to verify overall instrument function.
- The Method Wizard assists in creating custom drying methods directly on the instrument for reproducible protocols.
- Multiple instruments (up to five) can be managed via EasyDirect™ Moisture PC software, centralizing data for visualization and storage.
- ID management supports sample tracking via barcode reader integration for some analyzer models.
- Robust construction with durable housing allows operation even under harsher industrial or laboratory conditions.
- User management and auto-lock features enforce method control and compliance in user workflows.

Laboratory Balances

Test Weights

- Test weights from 50 µg up to 5 tons cover the full calibration range for balances and scales
- Supplied in OIML and ASTM classes to meet different levels of metrological accuracy
- Available as single weights, weight sets, reference weights, and microgram weights for various application
- Manufactured from stainless steel (austenitic) with corrosion resistance for long-term stability
- Knob weights, wire weights, and sheet weights are offered for fine and micro ranges, some with adjusting cavities
- Weights come with or without calibration certificates, supporting traceability where required
- Heavy-capacity and crane weights include stackable cast iron or stainless steel designs for ton-scale calibration
- Weight sets range from 1 mg up to 5 kg (or more) in various combinations to support stepwise calibration
- Accessories such as tweezers, forks, gloves, and cleaning cloths are provided for proper handling and maintenance
- METTLER TOLEDO's GWP® Recommendation service helps select the correct weight class and value for routine verification tasks

Laboratory Balances

Software for Laboratory Weighing

Laboratory Balances

Software for Laboratory Weighing

LabX Balance Software

- LabX Balance enables centralized control of instruments, tasks, and users across a network
- SOP guidance is displayed directly on the balance terminal to enforce correct procedures
- Automatic data transfer eliminates manual transcription by sending results directly into the LabX database
- Users can define differential weighing sequences and templates to match regulatory and process requirements
- LabX supports audit-proof user management, electronic signatures, and traceable workflows

EasyDirect Balance Software

- Collects weighing data from up to 10 balances via RS232 or Ethernet.
- Records results automatically in the background for continuous logging.
- Exports data in CSV, XLSX, XML, or PDF formats.
- Provides control charts and statistical analysis for trend monitoring.
- Includes access protection to secure results and instrument settings.

Moisture Analyzer Software

- Connects up to 5 moisture analyzers in one database.
- Transfers data via USB, Ethernet, RS232.
- Supports OneClick method launch with user guidance.
- QuickPredict speeds up moisture results.
- Enables sample ID tracking with barcode support.

METTLER TOLEDO

Analytical Instruments

Analytical Instruments

Titration Solutions

Titrators

- Control the addition of titrant to determine analyte concentrations by tracking reaction endpoints with high precision
- Modular platforms allow integration with autosamplers, multiple burettes, and sensors to broaden application capabilities

Karl Fischer Titrators

- Specifically designed to measure water content in solids, liquids, and gases using volumetric or coulometric techniques
- Support water determinations from low ppm levels up to 100 % content in samples

High-throughput Titration Systems

- Include carousel autosamplers (e.g. Rondolino) to automate sample throughput for general titration tasks
- Reduce manual intervention and increase consistency across titration processes

Titration Sensors

- Robust electrodes and probes optimized for pH, redox, ion-selective, or conductivity titration endpoints
- Designed for durability and accuracy in diverse sample matrices, ensuring precise endpoint detection

Analytical Instruments

Portable pH Instruments

Seven2Go

- Offers portable measurement of pH, conductivity, dissolved oxygen, and ion concentration in one handheld unit.
- Designed with waterproof/dustproof protection (IP67) and supports storage of up to 200 measurements.
- Features temperature measurement capability with resolution 0.1 °C across range –5 °C to 105 °C.

SevenGo Duo

- Multiparameter, handheld meter supporting pH, conductivity, ion concentration, and dissolved oxygen in one instrument.
- Operates in dual-channel mode, enabling simultaneous measurement of two parameters or samples.
- Engineered for routine field and lab use with ruggedness and ease of operation in varied conditions.

FiveGo

- Portable field meter engineered to measure pH, conductivity, ORP, and dissolved oxygen for water, soil, and food samples.
- Built with IP67 waterproof/dustproof rating and an intuitive menu for quick measurement workflows.
- Offers pH measurement resolution of 0.01 and accuracy of ±0.01 across the full 0–14 pH range.

Analytical Instruments

Benchtop pH Instruments

SevenDirect

- Benchtop meter that measures pH, ion concentration, and conductivity with built-in GLP support.
- Designed for intuitive operation, featuring automatic sensor recognition and calibration reminders.
- Some models (e.g. SD20) include ORP measurement capability and use a sensor arm (EasyPlace) for consistent probe positioning.

SevenExcellence

- Multi-channel benchtop pH system supporting measurements of pH, conductivity, dissolved oxygen, redox, and ion concentration.
- Enables precise, simultaneous measurements with modular sensor inputs.
- Provides high flexibility for complex analytical workflows through parameter expandability.

NineFocus

- Modular multiparameter benchtop system allowing up to four electrochemical measurements (e.g. pH, redox, conductivity, DO) in one unit.
- Designed to handle ultra-low volume samples with high precision.

FiveEasy

- Benchtop meter engineered for pH/mV or conductivity measurements in routine analytical tasks.
- Compact design intended to provide reliable, accurate performance in a simple and economical format.
- Suitable for laboratories needing straightforward, robust pH or conductivity testing without additional functionalities.

Analytical Instruments

Portable Density Measurements

- Portable density meters use the oscillation tube (U-tube) method to measure liquid density accurately.
- They support derived parameters such as specific gravity, Brix, and concentration, converting density into meaningful units.
- Built-in temperature compensation ensures accurate readings despite sample temperature variation.
- Many models are handheld or pocket-sized, enabling measurement in the lab or field.
- Results precision is high, with three-digit resolution in density measurements.
- They can store hundreds of measurement records, enabling data logging and traceability.
- Bright, backlit displays and intuitive menus aid readability and usability in varied lighting.

Analytical Instruments

Benchtop Density Measurements

- Benchtop density meters use oscillation tube (U-tube) technology to determine liquid density and related metrics.
- They support derived scales such as specific gravity, concentration, and Brix based on the measured density.
- Automatic temperature control (or temperature compensation) is integrated to maintain measurement accuracy across varying thermal conditions.
- These instruments interface with LabX software for workflow control, data storage, and regulatory compliance.
- The “Excellence” line of benchtop density meters is positioned as an all-rounder solution for many sample types with high accuracy.
- Firmware and software features support data handling, method management, and result export in lab environments.
- These meters are engineered for stable operation in laboratory conditions, maintaining repeatability and precision across replicates.

Analytical Instruments

UV/Vis Spectrophotometry

EasyPlus UV/VIS

- Dual-beam optical design with reference detector ensures stable baseline and accurate measurements.
- Uses exchangeable XPathHolder™ cuvette carousels covering multiple path lengths, with PathDetect™ to verify selected path.
- Offers 3-in-1 functionality: spectrophotometry, color measurement (30 built-in color scales), and water analysis.
- Equipped with a xenon flash lamp (in "UV" version) for broadband UV/Vis coverage and long lamp life.
- Wavelength range spans 190 nm to 1,000 nm (for UV model), with wavelength accuracy of ±1.5 nm and resolution ≤ 0.5 nm.
- SmartLid™ enables automatic start of measurement upon closing, streamlining routine workflows.

UV/VIS Excellence

- Wavelength range from 190 to 1,100 nm, giving broad UV/VIS coverage
- Resolution better than 1.5 (toluene in hexane) with wavelength accuracy ±1.0 nm and repeatability < 0.15 nm
- Compact size (≈ 208 × 255 × 228 mm) and weight (~6.4 kg) suitable for benchtop use
- Employs FastTrack™ technology (xenon flash lamp and CCD array) for full spectrum scans in about 1 second
- No moving optical parts, enhancing mechanical stability and reducing maintenance
- Complies with pharmacopeia spec (e.g. stray light, photometric accuracy) for regulated environments

Analytical Instruments

Portable Refractometer / Brix Meter

- Measures refractive index and Brix (% w/w) with high resolution and repeatability in field or lab settings.
- Automatic temperature compensation is built in to correct readings based on sample temperature.
- Has a compact, handheld design optimized for portability and ease of use in on-site or at-line measurements.
- Offers predefined calibrations and user methods, allowing quick switch between measurement scales.
- Equipped with data logging memory, capable of storing multiple readings for later review or transfer.
- Supports digital interface connectivity (e.g. USB or similar) for exporting data to PCs or lab systems.

Analytical Instruments

Benchtop Refractometer / Brix Meter

- Uses oscillation-tube (U-tube) technology to determine refractive index and related concentration values.
- Supports derived scales such as Brix, specific gravity, and concentration conversions based on refractive index.
- Offers automatic temperature compensation to correct measurements across varying sample temperatures.
- Designed to provide fast refractive index readings in routine laboratory workflows.
- Compact, space-saving benchtop form factor optimized for routine lab use.
- Integrated software and user interface facilitate method setup, data handling, and repeatable measurement procedures.

Analytical Instruments

Melting Point Instruments

Melting Point

- The MP80 system automatically measures melting, boiling, cloud point, and slip melting point in a single instrument.
- It supports simultaneous measurement of multiple samples (e.g. up to six) to increase throughput.
- The maximum operating temperature of the MP90/MP80 class reaches 400 °C, enabling analysis of high-melting compounds.

Slip Melting Point

- Slip melting point (SMP) refers to the temperature at which a solid (e.g. fat or wax) rises in a tube when the outer surface melts under hydrostatic force.
- The instruments on the METTLER TOLEDO melting point product line support automated slip melting point determination alongside melting, boiling, and cloud point measurements.

Boiling Point

- The MP80 / Excellence systems support automatic boiling point determination as part of their multi-point thermal analysis capability (melting, boiling, cloud, slip).
- Boiling point is measured under controlled heating ramps and detection algorithms to identify the transition temperature consistent with pharmacopeial methods.
- These instruments run parallel measurements on multiple samples, enabling simultaneous boiling point analysis along with other thermal points.

Cloud Point

- Cloud point is one of the thermal transition parameters that the MP80/Excellence melting point systems can measure, along with melting, boiling, and slip melting points.
- In cloud point determination, the instrument monitors light transmittance or turbidity changes as the sample is heated to detect the onset of phase separation.

Analytical Instruments

Dropping / Softening Point Instruments

Melting Point

- Modern systems support fully automated dropping point and softening point tests on one instrument, handling multiple samples without manual intervention.
- The DP70 model can evaluate two samples simultaneously up to a maximum temperature of 400 °C.
- The DP90 variant operates across a broader range (–20 °C to 400 °C), enabling both sub-ambient and high-temperature dropping or softening analyses.
- These instruments use video imaging and digital image analysis to detect the first drop or flow front during heating, providing automation and precision.
- The systems comply with recognized standards such as IP 396 (for grease dropping point tests)
- Performance is optimized for both dropping and softening point determination, giving more flexibility in thermal characterization of substances.

Slip Melting Point

- Softening point determination is integrated with dropping point analysis in the same instrument, allowing simultaneous measurement of both transitions.
- Instruments like the DP70/DP90 can measure softening point over a temperature range up to 400 °C (or down to –20 °C in DP90) for high-temperature materials.
- The softening point is detected by video imaging and digital image analysis, observing the first sign of sample deformation or flow under heating.
- Softening point analysis follows recognized test standards, ensuring compliance with industry thermal testing methods.
- Some systems support parallel analysis of two samples, so softening point can be measured for two specimens simultaneously under identical conditions.

Analytical Instruments

Thermal Analysis Excellence

Differential Scanning Calorimetry (DSC)

- METTLER TOLEDO's thermal analysis line includes DSC systems as one of its core techniques, alongside TGA, TMA, and DMA.
- Their DSC offerings span variants like standard DSC, high-pressure DSC, and ultra-fast (chip) DSC, enabling analysis of materials under different pressures and fast thermal cycles.

Dynamic Mechanical Analysis (DMA)

- DMA characterizes viscoelastic and mechanical properties of materials under oscillatory stress, capturing modulus and damping behavior.
- METTLER TOLEDO's DMA systems offer a wide frequency range (0.001 to 1000 Hz) and support simultaneous thermal measurement (SDTA) for combined analysis.

Hot Stage Microscopy

- Hot-stage microscopy enables visual observation of thermal transitions (e.g. melting, crystallization) while the sample is heated or cooled.
- The HS84 system combines microscopy with simultaneous DSC heat flow measurement, providing complementary thermal and visual data.

Thermogravimetry (TGA)

- Thermogravimetric Analysis (TGA) tracks mass change (loss or gain) of a sample as it experiences controlled temperature, time, and atmosphere variations.
- METTLER TOLEDO's TGA instruments include advanced models such as TGA/DSC 3+ that provide exceptional weighing performance with continuous data acquisition up to 50 million points.

Analytical Instruments

Thermal Analysis Excellence

Fast Scanning Calorimeter

- The Fast Scanning Calorimeter (Flash DSC) supports ultra-high heating and cooling rates, enabling rapid thermal transitions analysis.
- It is capable of measuring under oxygen-free (inert) conditions for precise thermal behavior characterization.

High Pressure Differential Scanning Calorimetry

- High Pressure DSC instruments allow precise control of pressure, atmosphere type, and purge gas flow rates during thermal analysis
- The HP DSC 2+ variant uses advanced sensors (FRS 6+ and HSS 9+) to ensure high performance under elevated pressure conditions

Simultaneous Thermal Analyzer (TGA/DSC)

- Simultaneous TGA/DSC instruments measure mass changes (TGA) and heat flow events (DSC) in a single run, allowing direct correlation of thermal and mass transitions.
- The TGA/DSC 3+ model supports modular sensor configurations (SDTA, DTA, DSC) and built-in gas flow control to analyze samples under defined atmospheres.

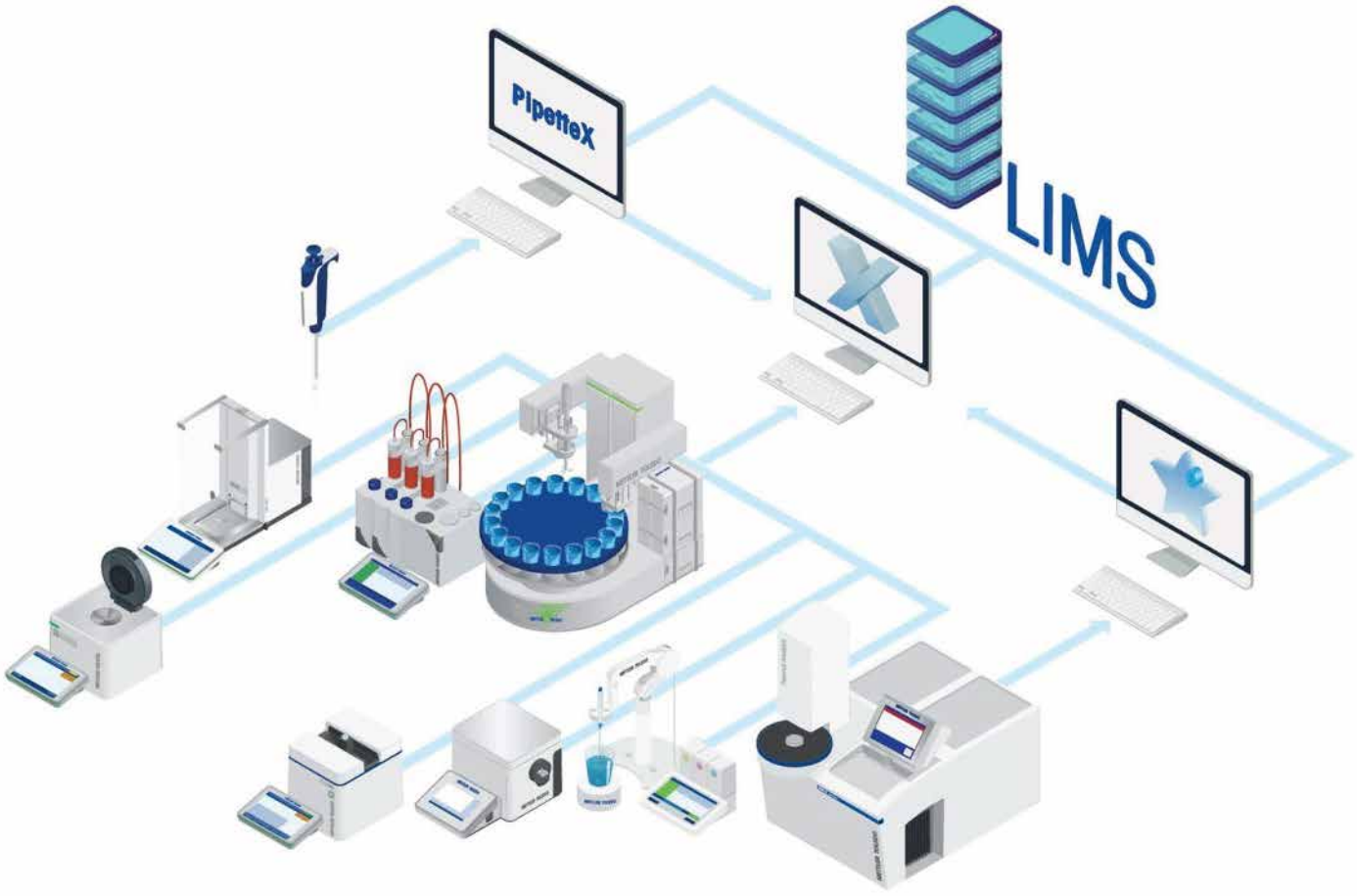
Thermomechanical Analysis (TMA)

- TMA (Thermomechanical Analysis) quantifies dimensional changes (expansion, contraction, deformation) of a material as a function of temperature.
- METTLER TOLEDO's TMA/SDTA 2+ system features Swiss precision mechanics and supports extended temperature ranges (–150 °C to 1,600 °C) with variable applied forces (e.g. in DLTMA mode).

Analytical Instruments

Laboratory Software Solutions

- The Lab Software suite works to centralize control over laboratory instruments, data, workflows, and user roles.
- LabX is a core platform that manages multiple METTLER TOLEDO lab instruments in a unified software environment.
- LabX supports instrument method downloads, result collection, and audit trail generation for regulatory compliance.
- EasyDirect is a simpler software tool focused on automatic data transfer from instruments to a PC to improve data management.
- The lab software solutions are designed to enhance the performance of laboratory instruments by enabling smarter data handling and workflow orchestration.
- These software products support electronic data management, reducing manual entry and transcription errors in the laboratory.
- Lab Software supports central resource allocation and usage monitoring across lab instruments and workstations.
- The platform also underpins laboratory compliance, providing features like audit trails, versioning, and traceable records.



C-THERM TECHNOLOGIES Lt

Thermal Conductivity

Thermal Conductivity

Trident Thermal Conductivity Instrument

- The Trident instrument supports three transient thermal conductivity measurement methods (MTPS, TLS Needle, and Flex TPS) in a single modular platform.
- Its MTPS sensor is single-sided and provides fast, precise measurements of both thermal conductivity and effusivity with a typical measurement pulse of 1–3 seconds.
- The TLS Needle probe is designed for robust performance with granular, viscous, or paste samples, following ASTM D5334/D5930 standards.
- The Flex TPS configuration uses a double-sided sensor to simultaneously derive thermal conductivity, diffusivity, and specific heat capacity, conforming to ISO 22007-2.
- A Hot Wire (THW) probe is also supported for rapid testing of liquids and powders, operating under the ASTM D7896-19 method.
- Trident supports a wide thermal conductivity measurement range from ~0.01 to 500 W/m·K, covering materials from insulators to metals.
- It includes temperature compensation and a software system that performs data acquisition, analysis, and method control integrated in one interface.
- The system handles a broad temperature operating range from –50 °C to +200 °C, with optional extension up to 500 °C for certain sensors.

RAININ

Pipetting 360+

Liquid Handling Solutions

Liquid Handling Solutions

Pipettes

Single Channel Pipettes

- Available in both manual and electronic formats with Universal-fit or LTS tip compatibility, designed for ergonomic and durable daily use.
- Deliver precise micro- to milliliter volume transfer, with optimized mechanics for smooth operation and reduced user fatigue.

Multichannel Pipettes

- Provide consistency across 8 or 12 channels, ensuring synchronized volume delivery in plate workflows
- Offered in manual, electronic, and adjustable spacer variants to adapt to varying lab format needs.

High-throughput platforms

- Instruments like the 96-channel semi-automated systems streamline 96-/384-well plate workflows with improved speed and accuracy.
- Designed to combine efficiency and ease of use for repetitive plate-based pipetting without full robotic complexity.

Repeater pipettes

- Manual versions (AutoRep) support dosing ranges from 2 µL up to 5 mL and allow multiple aliquots per aspiration cycle.
- Electronic types (NanoRep) enable precise, repeat non-contact dispensing down to sub-microliter volumes.

Electronic multichannel adjustable spacer pipettes

- The E4 XLS Adjustable Spacer models support three volume ranges (5-50 µL, 20-300 µL, 100-1200 µL).
- They allow continuous nozzle spacing adjustment to transition between tubes and plate formats efficiently.

METTLER TOLEDO

Automated Lab Reactors In-Situ Analysis, & Modeling Software

Mettler Toledo AutoChem

Instruments for Chemical Synthesis, and R&D

Particle Size Analyzers

- The particle size analyzers provide inline measurement of particle size, shape, and count during processes.
- Their measurement range spans 0.5 µm to 2 mm, covering fine particles to coarse suspensions.

FTIR and Raman Spectrometers

- ReactIR and ReactRaman spectrometers are in-situ tools that monitor reaction progress by measuring molecular changes during the reaction.
- They provide real-time spectral data on molecular structure, composition, and kinetics directly within the process medium.

Chemical Synthesis Reactors

- The EasyMax and OptiMax reactors are automated platforms that execute reaction recipes with precise control over temperature, stirring, dosing, and data collection.
- They support reaction volumes from about 1 mL up to 1 L and temperature ranges from –90 °C to 180 °C, enabling broad synthetic chemistry conditions.

Online HPLC Analysis with DirectInject-LC

- The DirectInject-LC system converts conventional HPLC into an online technique, enabling near real-time reaction and crystallization monitoring.
- It performs fully automated sampling and injection, reducing manual intervention and improving data timeliness.

Mettler Toledo AutoChem

Instruments for Chemical Synthesis, and R&D

Automated Reactor Sampling System

- The EasySampler system performs automated, unattended sampling by taking reaction samples in situ, quenching them, and diluting them for offline analysis.
- It enables scheduled sampling and sampling triggered by process parameters, and is compatible with various chemistries including slurries and air-/moisture-sensitive reactions.

Reaction Calorimeters

- Reaction calorimeters quantify the heat released or absorbed by a chemical or physical reaction to monitor energetics and safety.
- The RC1mx model enables measurement of heat profiles, conversion, and heat transfer under realistic, process-like conditions.

RX-10 Reactor Control System

- The RX-10 control system automates jacketed laboratory reactors including heating, cooling, stirring, and dosing operations.
- It interfaces with third-party sensors and Process Analytical Technology (PAT) tools to capture and synchronize reaction data via a unified touchscreen controller.

iC Software Suite

- The iC software suite integrates the experimental workflow for automated reactors, enabling users to visualize, interpret, and report reaction data.
- It centralizes data capture from local instrumentation and transforms raw data into meaningful process insights for decision support.

BÜCHI

Separation & NIR Solutions

Separation & NIR Solutions

Separation Instruments

Evaporation

- The Rotavapor® line provides laboratory evaporators with varied flask capacities (50 mL to 5000 mL) and temperature ranges (up to 95 °C for R-80, up to 220 °C for R-300).
- Modular design allows integration of vacuum interface modules and central controller units to regulate pump, condenser, and evaporator in a unified system.
- The footprint-optimized design (for example R-80: up to 1000 mL flask and compact footprint) emphasizes energy efficiency and lab-space economy.

Digestion

- The KjelDigester supports up to 20 sample positions simultaneously, with maximum temperature 450 °C and methods programmable.
- The SpeedDigester series features dual heating chambers with independent control to assure homogeneous heating and avoid foaming of critical samples, with max temperature up to 580 °C.
- Samples can be automatically transferred in rack format into autosampler units for high-throughput nitrogen/protein determination workflows.

Steam Distillation

- Steam distillation is described as a separation process where hot steam is bubbled through the sample mixture, lowering boiling points of components so they can distill at lower temperatures and avoid decomposition of heat-sensitive compounds.
- The technique is heavily used for analytes such as ammonia (from proteins), volatile acids, essential oils, alcohols, sulfite, cyanide, and formaldehyde in food, beverage, environmental and chemical testing.

Separation & NIR Solutions

Separation Instruments

Chromatography

- The "Pure Chromatography Systems" support both flash and prep-HPLC separations in one compact automated platform, with UV and ELSD detection.
- Cartridges are prefilled in sizes from 4 g to 5000 g, and columns include IDs from 4.6-70 mm and particle sizes 5-15 µm for scalability.
- Systems include safety features such as closed fraction collector bay, leak and pressure sensors, front-accessible column holders, and are designed to operate even outside a fume hood.

Extraction

- The UniversalExtractor supports six distinct extraction positions allowing individual process control for simultaneous operations of different extraction methods.
- The FatExtractor is designed for fast, compliant fat extraction with interchangeable glass assemblies and supports Soxhlet, Randall or Twisselmann techniques.
- Extraction instrument categories include pressurised solvent extractors and solvent extractors offering method reproducibility, high-speed heaters, and advanced process control.

Encapsulation

- Encapsulation is achieved via spray-drying techniques, turning aqueous or organic solutions/emulsions into dry powder particles in a single step,.
- In spray drying for encapsulation, the process allows control over particle size, and morphology (spherical, hollow, wrinkled).
- The encapsulation capability is leveraged in drying systems that incorporate designed interfaces and process parameters such as inlet temperature, feed rate, and airflow to tailor final product characteristics.

Separation & NIR Solutions

Separation Instruments

Incineration

- Incineration equipment is offered under the "Auxiliaries for Incineration" product type, which supports sample ashing and pre-incineration for analytical workflows.
- Example: The Wet Digester functions as a pre-incineration unit with a programmable heating ramp and wide temperature range up to 600 °C for improved reproducibility.
- These auxiliary units integrate into digestion/incineration workflows, supporting labs in preparing samples for quantitative elemental or ash-content analysis.

Melting Point

- The Melting Point system from BÜCHI offers determination of melting and boiling points for three samples simultaneously, with temperature range from 10 to 400 °C and compliance with USP, JP, Ph. EU standards.
- Automatic Melting Point systems provide real-time video display, automated melting/boiling point detection, ±0.3 °C accuracy up to 250 °C, and repeatability ±0.1 °C at 0.5 °C/min heating rate.
- Features include IQ/OQ qualification documentation, sample loader automation, and software for method/results management tailored to GLP/GMP environments.

Drying

- Spray drying is described as a process where a liquid feed is atomised into fine droplets, exposed to a hot drying gas, evaporating the solvent to form dry powders.
- Freeze drying (lyophilization) is based on sublimation under reduced pressure, preserving structure by avoiding liquid phase formation.
- Drying and evaporation instruments include the rotary evaporators with flask size range 50-5000 mL, lift mechanism (manual or automatic) and temperature range 20-220 °C.

TELEDYNE

Teledyne LABS

Elemental & TOC Measurement

Elemental and TOC Measurement

VOC & TOC Analytics

Fusion

- Photochemical oxidation with UV-persulfate chemistry is used, coupled with an NDIR detector employing Static Pressure Concentration (SPC) for enhanced sensitivity.
- Analytical modes supported include TOC (NPOC), TC-IC, TC, IC, with a detection limit down to 0.2 ppb and a maximum measurable concentration of about 4,000 ppm.
- Typical analysis time is 4–8 minutes per TOC measurement, with triplicate runs completed in 12–22 minutes.
- Auto-calibration , auto-dilution (Intellidilution), leak checks, self-cleaning cycles, and performance diagnostic tools are built in.

Torch

- Uses a combustion furnace (680 °C to 1000 °C) with a proprietary catalyst and clam-shell opening for easier access and maintenance
- Employs NDIR detection with Static Pressure Concentration (SPC) for CO_2 measurement, along with halogen scrubber to remove interfering halogens
- Analytical modes include TOC (NPOC), TC-IC, TC, and IC, with a detection limit down to 50 ppb and a maximum measurable concentration of 30,000 ppm
- Features such as autosampler (75-position), mass flow controller, auto-calibration, Intellidilution, and self-cleaning sample handling.

Lotix

- Uses catalytic combustion oxidation in the 680 °C – 1000 °C range, with NDIR detection and Static Pressure Concentration (SPC) technology.
- Measures TOC (NPOC), TC-IC, TC, and IC with a concentration range of 0–20,000 ppm using a single 0.5 mL injection; detection limit is 50 ppb.
- Typical triplicate TOC analysis time is 13–15 minutes; precision is ≤ 2 % RSD under standard conditions.
- Includes features such as pressurized sample delivery, solenoid-actuated acid dosing (50 µL ± 5 %), self-cleaning sample pathways, 30-position autosampler, real-time data viewing and more.

Elemental and TOC Measurement

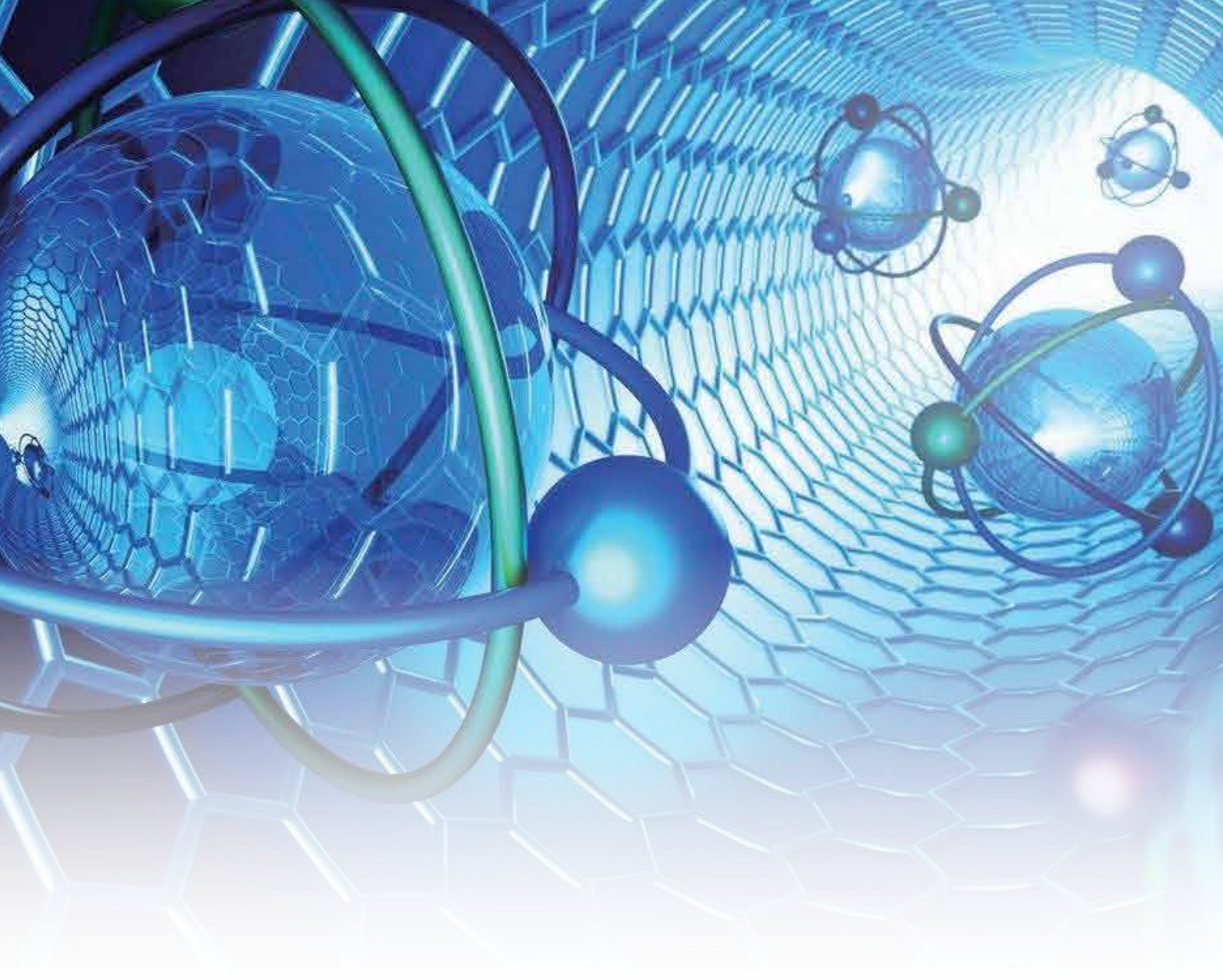
QuickTrace Mercury Analyzers

QuickTrace M-7600 CVAA Mercury Analyzer

- The M-7600 CVAA analyzer achieves detection limits below 0.5 ng/L (instrument detection limit) with a dynamic range from < 0.5 ng/L to > 500 µg/L.
- It uses a double-beam optical design for superior baseline stability and includes an ozone-free, low-vapor-pressure mercury excitation lamp.
- Features a 12-roller, 4-channel peristaltic pump, enabling sample volumes from 0.5 mL up to > 20 mL.
- Supports a "high capacity mode" with analysis times under 60 seconds per sample.
- Includes a non-foaming Gas Liquid Separator (GLS) with overflow prevention and built-in smart rinse, contamination control, and over-range protection.
- Dimensions: 46 cm (H) × 20 cm (W) × 56 cm (D), weight ~35 lbs (16 kg); supports TCP/IP connectivity, autosampler integration, and multiple regulatory mercury methods.

QuickTrace M-8000 CVAF Mercury Analyzer

- The M-8000 uses the cold vapor atomic fluorescence (CVAF) technique, offering ultra-trace mercury detection with an instrument detection limit (IDL) ≤ 0.05 ng/L.
- It supports multiple analysis modes (triple mode) including no enrichment, single, or double gold amalgamation, conforming to EPA 1631 and EPA 245.7 methods.
- The dynamic concentration range spans from ≤ 0.05 ng/L up to > 400 µg/L, with linearity over four orders of magnitude.
- It includes a non-foaming Gas Liquid Separator (GLS) with overflow prevention, automatic end-of-run and inactivity standby routines, and smart rinse/contamination control features.
- The system uses a 12-roller, 4-channel peristaltic pump and accommodates sample volumes from 0.5 mL up to > 50 mL.
- Physical dimensions are 20 cm (H) × 48 cm (W) × 60 cm (D), weight approximately 16.8 kg, with interface options of RS-232 or USB.



HORIBA Scientific

Atomic Spectroscopy

Atomic Spectroscopy

Elemental Analysis

Glow Discharge Optical Emission Spectroscopy (GDOES)

- Provides ultra-fast elemental depth profiling from nanometers to ~150 µm.
- Uses glow discharge plasma to sputter and analyze all elements, including light ones.
- Delivers simultaneous surface and bulk composition with high depth resolution.

Inductively Coupled Plasma - Optical Emission Spectroscopy (ICP-OES)

- High-sensitivity elemental analysis for liquids and complex matrices.
- Full wavelength coverage (120–800 nm) with <5 pm UV resolution.
- Vertical torch design ensures stable plasma and tolerance to high-salt samples.

Carbon/Sulfur & Oxygen/Nitrogen/Hydrogen Analysis

- Combustion (C/S) and inert-gas fusion (O/N/H) analyzers for ppm-level precision.
- Combines IR and thermal conductivity detection for trace quantification.
- Provides rapid, repeatable analysis across metals, ceramics, and semiconductors.

X-ray Fluorescence Spectroscopy (XRF)

- Non-destructive elemental analysis of solids, powders, and liquids.
- Detects concentrations from 100 % down to ppm with minimal prep.
- Supports macro and micro modes for rapid screening and elemental mapping.

Atomic Spectroscopy

Particle Analysis

Dynamic Light Scattering

- Determines particle size from nanometers to submicron via Brownian motion.
- Uses intensity fluctuations of scattered light to calculate hydrodynamic diameter.
- Ideal for nanoparticles, colloids, and protein solutions.

Static Light Scattering

- Measures size distribution from light intensity vs. angle using Mie theory.
- Covers nano- to millimeter-scale particles in dry or wet dispersion.
- Provides fast, high-accuracy results with adjustable optical parameters.

Molecular Weight

- Uses static light scattering (Debye plot) to determine molecular weight and A_2.
- Applicable for polymers and macromolecules in solution.
- Often integrated with DLS or zeta systems for full molecular characterization.

Zeta Potential

- Measures surface charge via electrophoretic light scattering.
- Indicates dispersion stability and isoelectric point.
- Calculates zeta from measured mobility using standard electrokinetic models.

Atomic Spectroscopy

Particle Analysis

Image Analysis of Particles

- Multi-Stage Digital Processing: The analytical process fundamentally involves three steps: high-quality image acquisition, object/phase detection, and quantitative measurement for parameter extraction.
- Wavelength-Dependent Resolution: The effective size range for particle measurement is determined by the radiation wavelength used for imaging.
- Acquisition Modes Define Technique: Particle image analysis techniques are primarily differentiated by their image acquisition methodology.

Nanoparticle Tracking Analysis

- Analysis involves sequential steps: image acquisition, automated object detection (using algorithms to separate particles), and size/shape parameter extraction.
- Measurable particle size is wavelength-dependent: Optical microscopy is used for particles > 0.5 µm; electron microscopy is required for sub-micron particles.
- Techniques are defined by the acquisition method: Dynamic (particles in flow), Static (particles on a slide), or In-line (real-time process monitoring).

Centrifugal Sedimentation

- Determines size by measuring sedimentation velocity under centrifugal force.
- Uses Stokes' law for high-resolution particle distributions.
- Ideal for dense or polydisperse samples across nano- to micron-scale.

Atomic Spectroscopy

Microscopy and Imaging

Raman Microscopy

- Combines Raman spectroscopy with optical microscopy for sub-micron spatial resolution.
- Provides chemical, structural, and stress mapping in 2D and 3D.
- Non-destructive, suitable for solids, liquids, and microstructures.

Cathodoluminescence

- Detects light emitted from materials under electron-beam excitation.
- Reveals composition, band-gap, and defect distributions at high spatial resolution.
- Integrates with SEM while maintaining full imaging and analysis functions.

Atomic Force AFM-Raman

- Combines AFM topography with Raman chemical mapping on the same area.
- Enables nanoscale analysis through Tip-Enhanced Raman Spectroscopy (TERS).
- Correlates morphology, mechanical, and chemical information simultaneously.

AFM-Raman

- Combines AFM topography with Raman chemical mapping.
- Enables nanoscale resolution via tip-enhanced Raman (TERS).
- Correlates morphology, mechanical, and chemical data.
- Operates in reflection or transmission configurations.
- Suited for nanomaterials, 2D layers, and surface analysis.

Nanoparticle Tracking Analysis

- Analysis involves sequential steps: image acquisition, automated object detection.
- Measurable particle size is wavelength-dependent.
- Techniques are defined by the acquisition method: Dynamic, Static, or In-line (real-time process monitoring).

Atomic Spectroscopy

Spectroscopy

Cathodoluminescence

- Detects photon emission from electron-beam excitation (UV–IR range).
- Maps band-gap, dopants, and defect distribution at nanometer resolution.
- Integrates with SEM for simultaneous imaging and spectroscopy.
- Supports hyperspectral and fast CL mapping modes.

Raman Spectroscopy

- Uses inelastic light scattering to reveal molecular and structural information.
- Provides chemical, phase, and stress mapping at submicron scale.
- Non-destructive and suitable for solids, liquids, and gases.

AFM-Raman

- Combines AFM topography with Raman chemical mapping.
- Enables nanoscale resolution via tip-enhanced Raman (TERS).
- Correlates morphology, mechanical, and chemical data.
- Operates in reflection or transmission configurations.
- Suited for nanomaterials, 2D layers, and surface analysis.

Fluorescence Spectroscopy

- Measures emission spectra, lifetimes, and excitation–emission matrices.
- Detects from UV to NIR with high sensitivity and fast scanning.
- Supports A-TEEM™ simultaneous absorbance and fluorescence.
- Systems include benchtop, modular, and microscopy-based setups.
- Used in life science, environmental, and material studies.

Atomic Spectroscopy

Spectroscopy

Photoluminescence Spectroscopy

- Analyses photon emission from light-excited semiconductors and materials.
- Reveals band-gap, defects, and impurity levels non-destructively.
- Supports macro/micro and time-resolved PL down to picoseconds.
- Covers wide spectral range (UV–IR) with various excitation sources.
- Applied to semiconductors, photovoltaics, and 2D materials.

Spectroscopic Ellipsometry

- Measures polarization changes to determine film thickness and optical constants (n, k).
- Non-destructive and sensitive to sub-nanometer surface or layer variations.
- Uses variable-angle, model-based analysis across UV–NIR range.
- Ideal for semiconductors, coatings, and photovoltaic materials.

Detectors

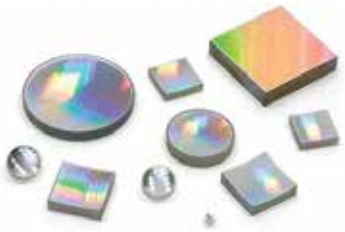
- Include CCD, EMCCD, InGaAs, PMT, and APD types for UV–IR detection.
- Support single- and multichannel configurations for spectroscopy.
- Offer high sensitivity, low noise, and cooling options.
- Enable steady-state, time-resolved, and imaging measurements.
- Integrated into HORIBA and OEM analytical instruments.

Atomic Spectroscopy

Spectroscopy

Diffraction Gratings

- Ruled gratings are manufactured mechanically by a ruling engine that burnishes parallel grooves with a diamond stylus.
- Holographic gratings are produced optically using the interference fringes of two laser beams.
- Holographic gratings offer superior spectral purity, exhibiting significantly less stray light and no ghosts (no periodic ruling errors).



Monochromator and Spectrograph

- A spectrometer separates light into its spectral components and measures the outgoing intensity over a broad spectral range.
- A monochromator isolates a beam of light with an extremely narrow bandwidth for tunable applications.
- A spectrograph disperses light onto a multi-channel electronic detector to record a spectrum over a range in a single acquisition.

X-ray Fluorescence Spectroscopy (XRF)

- Measures emission spectra, lifetimes, and excitation–emission matrices.
- Detects from UV to NIR with high sensitivity and fast scanning.
- Supports A-TEEM™ simultaneous absorbance and fluorescence.
- Systems include benchtop, modular, and microscopy-based setups.
- Used in life science, environmental, and material studies.

Tescan

Electron & X-ray Microscopy Solutions

Electron & X-ray Microscopy Solutions

Scanning Electron Microscopes (SEM)

Tescan VEGA

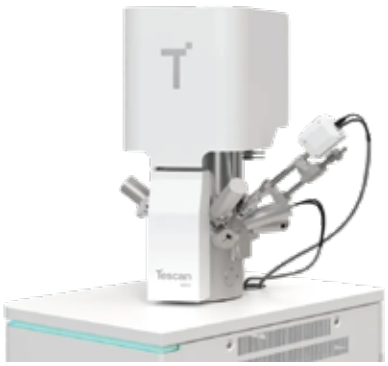
- Tungsten filament SEM with no apertures, simplifying user setup and lowering maintenance burden.
- Uses Wide Field Optics™ and 2× SEM navigation to minimize alignment overhead and speed sample observation.
- Integrates EDS directly in the interface, allowing morphology and elemental analysis in a single environment.

Tescan VEGA compact

- Compact analytical SEM with a large chamber capable of accommodating industrial-scale samples under true high vacuum.
- Employs In-Flight Beam Tracing™ for rapid beam optimization and setting of imaging conditions.
- Uses Essence™ software with EDS overlay tools to correlate morphology and composition within a unified interface.

Tescan MIRA

- FEG-SEM (Schottky source) modular platform suited for high-current, high-resolution imaging.
- Supports multiple techniques (EDS, EBSD, CL, STEM, nanoprototyping) via scalable detector integration.
- Utilizes In-Flight Beam Tracing™ and Wide Field Optics™ to accelerate beam setup and navigation.



Tescan MIRA XR

- Ultra-high-resolution (UHR) SEM platform combining BrightBeam™ optics, Wide Field Optics™, and Dual Essence ™ EDS.
- Offers macro-to-nano automated navigation, beam optimization, and automated column alignment.
- Supports challenging sample types (non-conductive, outgassing) via MultiVac™ and Auto LowVac Aperture.

Electron & X-ray Microscopy Solutions

Scanning Electron Microscopes (SEM)

Tescan CLARA

- Field-free UHR SEM platform optimized for imaging delicate, magnetic, or charging samples with minimal artifacts.
- Incorporates energy-filtered, in-column multi-detector design for simultaneous topography and composition contrast in a single scan.
- Supports modular hardware and open scripting workflows for correlative and in-situ experimentation.

Tescan MAGNA

- Uses TriLens™ immersion optics to maintain sub-nanometer resolution at longer working distances and on tilted surfaces.
- Employs contrast-selective detectors (TriSE™, TriBE™) to produce clear SE/BSE contrast with minimal signal mixing.
- Enables STEM-in-SEM capability, allowing nanoscale characterization without switching instruments.

Tescan TIMA

- Automated mineralogy SEM combining high-throughput SEM-EDS with integrated mineral identification and textural analysis.
- Uses four EDS detectors and spectral summing to detect trace and low-abundance minerals.
- Offers unattended data acquisition, automated classification, and spatial linking of compositional and structural data.

Electron & X-ray Microscopy Solutions

Focused Ion Beam-Scanning Electron Microscopes (FIB-SEM)

Tescan AMBER

- Automated Ga FIB-SEM platform combining BrightBeam™ field-free SEM optics with Orage™ Ga ion beam and full automation of lamella preparation workflows (including lift-out).
- Supports both inverted and planar sample preparation, nanoprototyping, and gentle final polishing (with optional Argonne Gentle Ion Beam for < 200 eV polishing).

Tescan AMBER X

- Universal plasma FIB-SEM combining Mistral™ Xe plasma FIB with BrightBeam™ UHR SEM to handle both bulk volumetric milling and delicate TEM lamella prep.
- Capable of curtaining-free, high throughput milling with Xe while retaining Ga-level precision for sensitive sample prep.
- Facilitates complex multimodal workflows (EDS, EBSD, ToF-SIMS, Raman) in a unified instrument.

Tescan SOLARIS

- Dedicated Ga FIB-SEM configured for fully automated, high-precision TEM sample prep in semiconductor devices
- Incorporates Triglav™ SEM, AutoTEM Pro™ software, and OptiLift™ nanomanipulator for repeatable lamella preparation in planar, inverted or top-down geometries
- Offers AI-driven workflows, precise end-pointing, overnight auto-alignment, and unattended batch processing

Tescan SOLARIS X

- Plasma FIB-SEM platform for high throughput failure analysis and Ga-free sample preparation, combining Mistral ™ Xe plasma FIB with UHR SEM imaging
- Provides artifact-free "TRUE X-sectioning" using Rocking Stage cross-sectioning capabilities in heterogeneous stacks and materials

Electron & X-ray Microscopy Solutions

Micro-computed tomography (microCT)

Tescan UniTOM HR

- Achieves sub-600 nm spatial resolution while enabling high-speed, time-resolved 3D (and 4D) imaging in one instrument
- Permits in-situ/multiphysics experiments via flexible stages, environmental ports, and real-time visualization
- Supports automated batch workflows, rapid reconstruction, and macro-to-micro image correlation

Tescan UniTOM XL

- Handles large samples (up to 60 cm diameter, 100 cm height) for non-destructive 3D/4D imaging while preserving internal fine resolution
- Features multiscale zoom, high-flux X-ray source, and in-situ test capability for composite inspection or QA
- Incorporates automation, volume-of-interest scanning, and high throughput detectors for productivity

Tescan DynaTOM

- Gantry-style architecture allows continuous 4D scanning (≈ 7.5 s per rotation at 12.5 µm voxel) without moving the sample
- Designed for complex in-situ experiments—fixed sample, moving source/detector to avoid sample disturbance or cabling issues
- Offers high-temporal-resolution reconstructions and integrated 4D visualization workflows

Tescan Spectral CT (Add-on for UniTOM XL)

- Captures full X-ray spectrum before and after interaction to provide non-destructive elemental/chemical contrast
- Enhances discrimination in low contrast materials (e.g. polymers, soft tissues) via multi-energy spectral imaging
- Seamlessly integrates with UniTOM XL, enabling one-click switching and compatibility with existing scanning workflows

Electron & X-ray Microscopy Solutions

4D STEM

Tescan TENSOR

- Dedicated 4D-STEM platform that synchronously acquires diffraction patterns and EDS spectra at each scanned pixel (i.e. analytical 4D-STEM)
- Employs beam precession / precession electron diffraction (PED) to enhance diffraction data quality, improving accuracy in orientation, phase, and strain mapping
- Integrated direct electron detector (hybrid pixel DED) tightly synchronized with beam scanning, beam blanking, and precession to maximize throughput and reduce artifacts
- Maintains a near-UHV environment around the sample area to minimize contamination and preserve diffraction fidelity
- Offers "out-of-the-box" STEM, 4D-STEM, and tomography measurement modes with automated workflows and minimal user alignment burden
- Can perform STEM imaging modes (bright field, annular dark field, HAADF) up to gigapixel scale (≈10 Mpx/s), using integrated detectors and automatic alignment
- Enables strain mapping with nanometer resolution and ~0.05 % precision, leveraging precession-enhanced diffraction data
- info.tescan.com
- Supports automated sample navigation and ROI selection: begins with a low-magnification overview then zooms and readjusts acquisition parameters seamlessly in the background

BUEHLER®

Strong Partner, Reliable Solutions

Metallography Preparation

Metallography Preparation

Sectioning & Cutting

Abrasive Cutters

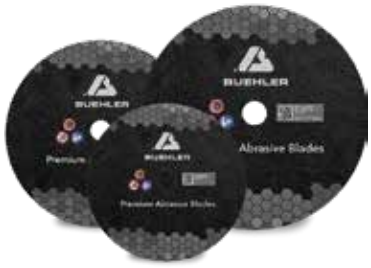
- Available in manual and automatic configurations, designed to achieve both speed and cut quality with consistent performance.
- Support blades from 9" up to 18" (229 mm to 457 mm) in diameter, available as rubber-bonded or resin-bonded blades to optimize cutting performance.

Precision Cutters

- Employ diamond or CBN (Cubic Boron Nitride) blades sized between 3"and 8" (76 mm to 203 mm) for delicate, high-accuracy sectioning.
- Include both manual (gravity-fed) and automatic (3-axis motion, automatic dressing) machines to match precision and throughput needs.

Sectioning Consumables

- Consumables comprise abrasive and precision cutting blades designed to match the operating cutter type and material being sectioned.
- Provide both water-miscible and oil-based coolants / lubricants to manage heat during cutting and prevent thermal damage to specimens.



Sectioning Accessories

- Include vising / clamping systems tailored for both abrasive and precision cutters to firmly secure samples during sectioning operations.
- For precision machines, accessories include flange sets (aluminum or stainless) with diameters from 1.38 to 5 (35 mm to 127 mm) to support sample mounting.

Metallography Preparation

Mounting

Hot Mounting (Compression Mounting)

- Uses a compression mounting press (e.g. SimpliMet 4000) applying high pressure (70–300 bars / 1000–4400 psi) and heat (operating temperatures ~50 °C to 220 °C) to encapsulate specimens in mounting media with minimal shrinkage while protecting sample edges.
- Supports multiple mold sizes (e.g. 1 to 1.5 inch / 25 to 50 mm) and allows dual-sample cycles (via duplex spacer) to increase throughput without lengthening cycle time.

Cold Mounting (Castable / Epoxy / Acrylic Mounting)

- Employs castable mounting systems (epoxy or acrylic) that cure at ambient or low temperatures, ideal for specimens that are heat- or pressure-sensitive.
- Utilizes vacuum systems (e.g. SimpliVac) to draw out entrapped air and improve infiltration of mounting resin into pores or microstructures, reducing voids and improving mount integrity.

Mounting Consumables

- Includes compression (hot) mounting compounds, epoxy systems, and acrylic resins, each formulated to optimize edge retention, low shrinkage, and specimen encapsulation quality.
- Also consists of release agents, pigments, fillers, support clips, and additives (e.g. conductive fillers) intended to customize mounting behavior, ease mold release, and maintain sample alignment.

Mounting Accessories

- Offers a range of mold hardware such as hard and disposable mounting cups, open ring forms, EPDM molds in sizes 1–2 inch / 25–50 mm, and rectangular molds for various geometries.
- Provides specimen support clips (SamplKlip, support clips), pigments, mixing cups, mounting waxes, and filler additives for orienting specimens and enhancing mount properties.

Metallography Preparation

Grinding & Polishing

Semi-Auto Grinder Polishers

- Automates multi-sample processing to enhance throughput while ensuring uniform sample quality and reproducible results across all preparation stages.
- Supports modular automation with up to three Burst dispensing modules for precise delivery of polishing suspensions and lubricants during operation.

Manual Grinder Polishers

- Designed for single-sample or low-volume processing, with reliable control and platens up to 12 (305 mm) in diameter for large surface areas.
- Available in single or dual platen configurations, enabling flexible use for multi-user environments or sequential preparation steps.

Specialty Grinder Polishers

- Includes vibratory polishers such as VibroMet® 2 for removing micro-deformations and achieving ultra-smooth surfaces ideal for SEM or high-magnification analysis.
- Features compact systems like MiniMet® 1000, designed for precise polishing of delicate specimens in laboratories with limited space or specialized containment areas.

Grinding and Polishing Consumables and Accessories

- Consumables include silicon carbide papers, diamond grinding discs, polishing cloths, diamond suspensions, and fine polishing media such as alumina and colloidal silica down to 0.02 µm.
- Accessories comprise specimen holders, platen systems, Burst dispensing modules for automated suspension control, and EnvironMet recirculating systems for coolant filtration and fluid management.

Metallography Preparation

Etching

Electropolishing and Etching Systems

- The system integrates both electropolishing and etching functionality in a single instrument, allowing streamlined sample preparation workflows.
- Electropolishing mode employs controlled electrochemical dissolution to remove a thin surface layer uniformly, producing a glare-free, deformation-free surface suitable for microstructural analysis.
- Etching mode in the same system applies chemical reagents under controlled conditions to reveal grain boundaries and phase contrasts on the polished surface.
- The design includes automatic cleaning cycles to flush residual electrolytes and etchant reagents, minimizing cross-contamination between processes.
- The working chamber is sized to accept typical metallographic specimen formats, enabling practical throughput of standard sample sizes.
- All fluid reservoirs, sample holders, and wetted parts are constructed from chemically resistant materials to withstand exposure to acidic electrolytes and etchants.
- The user interface allows programmable control over process parameters such as voltage, current, time, and etchant selection to tailor cycles for different materials.
- Safety features include system interlocks, effective sealing, and proper containment to manage handling of acids, electrolytes, and byproducts during operation.
- The instrument is described as suitable for metallographic sample preparation, indicating it is intended for materials science, failure analysis, and microstructural investigation workflows.
- The system is built for demanding environments, emphasizing durability in design and components to support frequent usage.
- A large working space is provided to accommodate multiple or larger specimens simultaneously in the polishing/etching chamber.
- The system's construction and features aim to facilitate efficient process transitions between electropolishing and etching, reducing operator intervention and setup downtime.

Metallography Preparation

Hardness Testing

Vickers Knoop Hardness Testing

- Utilizes high-quality optical systems and a load range from 10 gf up to 50 kgf (in suitable models) to provide precise micro to macro hardness measurements.
- Machines incorporate automatic features like autofocus and auto measurement to streamline testing and reduce operator variability.

Rockwell Hardness Testing

- Models such as the Rockwell 574 and RH2150 support both regular and superficial scales across a broad range of loads, complying with standards like ASTM E18 and ISO 6508.
- Rockwell testers employ a depth-based measurement method (minor + major load cycle) with high precision depth detection to yield fast and repeatable hardness values.

Brinell Hardness Testing

- The Wilson BH3000 is designed for high load ranges (up to 3000 kgf) enabling evaluation of large or hard specimens—such as castings or large diameter parts—under heavy indentation loads.
- The instrument features rugged construction, closed-loop control, and integrated hardness calculations to support reliable and durable Brinell measurement.

Universal Hardness Testing

- Universal testers like the UH4000 series allow a single instrument to perform Vickers, Knoop, Rockwell, and Brinell tests via turret interchangeability and software control.
- These testers are configured to execute multiple hardness methods in one workflow and operate under DiaMet software to reduce complexity and enhance flexibility.

Hardness Test Blocks and Accessories

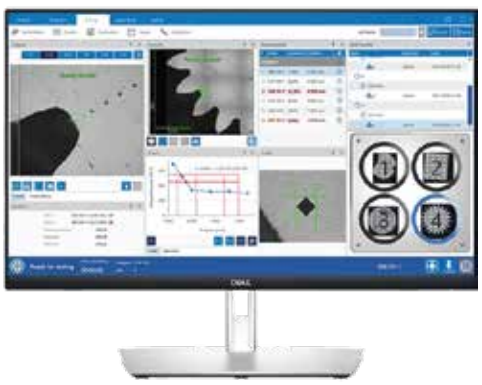
- Test blocks are manufactured with strict control over chemistry, flatness, parallelism, and surface roughness, and they are calibrated in Buehler's ISO/IEC 17025 lab to ensure traceability and repeatability.
- Accessories include certified indenters, sample holders and anvils, and fixtures such as GP-HDT that facilitate direct transfer from preparation (grinding/polishing) to hardness testing without sample re-handling.

Metallography Preparation

Hardness Testing

DiaMet Software

- DiaMet is optimized for a broad set of hardness scales, including Macro-Vickers, Micro-Vickers, Knoop, Rockwell, Superficial Rockwell, Brinell, and K1c fracture assessments, fully aligned with ISO and ASTM standards.
- The Wilson VH3300 automatic Vickers / Knoop system accommodates a six-position turret with a three-indenter design, covering a load range from 10 gf to 50 kgf.
- The VH1102 / VH1202 microhardness testers provide fine resolution testing in low load ranges (0.01–2 kgf) and support integration with DiaMet for automated measurement.
- The VH1150 macro Vickers tester spans 300 gf to 50 kgf in a single instrument, offering motorized turret load selection and optional high-resolution camera for automated readout.
- The Rockwell line (e.g. Wilson 574, RH2150) supports both regular and superficial Rockwell scales, employing high-precision depth measurement to meet ASTM E18 and ISO 6508 standards.
- The Wilson RH2150 is engineered for high volume labs, with extended vertical capacity (10-inch and 14-inch variants), load cell protection, auto-stop clamping, and USB connectivity for data export.
- The Brinell instrument Wilson BH3000 supports a load range from 62.5 kgf up to 3000 kgf, using a closed-loop control system and robust mechanical design for large part testing.
- The universal hardness testing line (UH4000 series) enables Vickers, Knoop, Rockwell, and Brinell tests in one machine with an 8-position turret, laser targeting, and ring light for precise Brinell measurements.
- Hardness test blocks (Rockwell, Brinell, Vickers, Knoop) are manufactured under strict control of thickness, flatness, parallelism, and surface roughness, and are calibrated in Buehler's ISO/IEC 17025 accredited calibration lab.
- Accessories for hardness testing include ISO/ASTM certified indenters, sample holders and anvils, and fixtures such as the GP-HDT that allow direct transfer of specimens from grinding/polishing to hardness testing without re-mounting.



INSTRON

Materials Testing Systems

Materials Testing Systems

Universal Testing Systems

6800 Series Universal Testing Systems

- Delivers force capacity from 0.02 N to 300 kN with load measurement accuracy of ±0.5% of reading down to 1/1000 of the load cell capacity using 2580 Series cells.
- Features such as auto-positioning, specimen protection, increased axial stiffness, collision mitigation, and compatibility with advanced accessories and automation modules.
- Supports expansion to up to 13 channels plus analog I/O and digital I/O, with removable handset controls and optional smart-close air kit for safer grip actuation.

3400 Series Universal Testing Systems

- Covers force range from 0.025 N to 300 kN, achieving ±0.5% accuracy down to 1/250 of load cell capacity (and ±1.0% down to 1/500).
- Designed for routine mechanical testing and quality control, with features such as collision mitigation, safety coaching, and optional smart-close air grip kit.
- Frame styles include single column and table models, offered in extra height variants to support testing of high elongation specimens.

Automation for Universal Testing Systems

- Provides modular or turnkey automation solutions (e.g. AT2, AT3, AT6, CT6, automated carousel, cobot integration) to automate specimen loading, test execution, and data collection.
- Designed to enhance throughput, repeatability, safety, and workflow efficiency, allowing operators to focus on analysis rather than machine operation.
- Automation modules can integrate with existing systems and accessories, supporting multiple test types (tension, compression, flexure, shear) in one workflow.

Materials Testing Systems

Universal Testing Systems

5980 Series Universal Testing Systems

- Rated for force capacity up to 600 kN, with load measurement accuracy of ±0.5% down to 1/1000 of load cell capacity using 2580 Series cells (and ±0.4% at certain ranges with other cells).
- Built for high strength material testing with increased axial stiffness, compatibility with automation and accessories, removable handset, specimen protection, and automatic gain adjustment.

Industrial Series Universal Testing Systems

- Uses hydraulic drive systems to deliver force up to 2000 kN, with testing spaces and frame stiffness suitable for large, high-strength specimens.
- Load measurement accuracy of ±0.5% down to 1/500 of load cell capacity, featuring specimen protection, automatic gain adjustment, removable handset for ergonomic control.
- Select frames (e.g. DX, HDX) provide dual test spaces enabling tension and compression/bending/shear testing without needing fixture changes when switching modes.

Specialty Systems

- Custom solutions engineered for application-specific requirements, such as the Curved Needle Testing System for puncture and bend testing of surgical needles per ASTM F3014.
- Customization includes frame geometry modifications, specialized safety shielding (light curtains, debris shields), high-speed frames, and tailored fixtures to accommodate unique specimen shapes or test protocols.

Materials Testing Systems

Dynamic Testing Systems

ElectroPuls All-Electric Dynamic & Fatigue Test Systems

- All-electric linear motor systems designed for static and dynamic fatigue testing up to 20 kN without the need for hydraulics, oil, or compressed air.
- Provide high-frequency performance suitable for both tensile and fatigue applications using precise digital control and feedback.

General Purpose Hydraulic Fatigue Systems

- Servo-hydraulic test frames designed for static and dynamic testing, including low-cycle and high-cycle fatigue, fracture mechanics, and durability studies.
- Configurable with various actuator sizes, load capacities, and hydraulic power units to meet a wide range of material and component testing needs.

Low Strain Rate 8862 Servo-Electric Systems

- Designed for low strain rate fatigue and static testing where precise control and smooth motion are required.
- Utilizes servo-electric actuation to eliminate the need for hydraulic infrastructure, minimizing maintenance and energy consumption.

High Strain Rate VHS Systems

- Engineered for testing materials at velocities up to 25 m/s to simulate real-world crash, impact, and ballistic events.
- Uses servo-hydraulic actuation with high acceleration and control response for dynamic testing at elevated strain rates.

Axial-Torsion 8850 Systems

- Combines axial and torsional loading in a single servohydraulic frame for simultaneous tension, compression, and torsion fatigue testing.
- Equipped with biaxial load cells and dual-axis digital control to synchronize multi-directional loading profiles.

Materials Testing Systems

Dynamic Testing Systems

ElectroPuls 16-Station Testing Systems

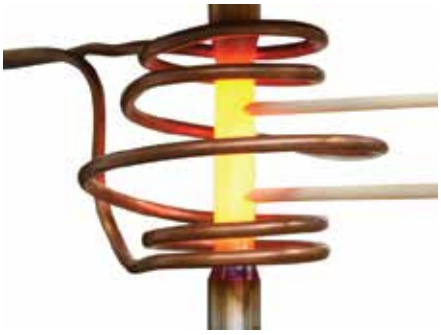
- Multi-station platform allowing up to 16 specimens to be tested in parallel for high-throughput fatigue research.
- Each station features independent control for individual load channels or synchronized test execution.

Biaxial Cruciform Test Systems

- Four-actuator configuration designed for planar biaxial loading of cruciform specimens.
- Enables accurate control of principal strain ratios to evaluate material performance under multiaxial stresses.

High Temperature Fatigue Systems

- Integrates dynamic loading with furnaces or thermal chambers for fatigue and thermo-mechanical testing at elevated temperatures.
- Supports thermal cycling and creep-fatigue interaction studies under controlled environmental conditions.



8800MT Controller / Controller Upgrades

- Digital servo controller providing closed-loop control for up to eight channels in dynamic or static test configurations.
- Offers advanced waveform generation, adaptive tuning, data logging, and limit protection functions.

Materials Testing Systems

Rheology and Impact Testing Systems

Impact Drop Towers & Pendulums

- Designed to evaluate impact resistance of materials and components by applying high-rate loads or shocks to simulate real-world failure modes.
- Provides a critical metric for product safety and lifetime performance under sudden loading conditions.
- Useful in assessing energy absorption, fracture toughness, or brittleness under impact.
- Suitable for testing a wide variety of materials and geometries where sudden load failure is a concern.
- Helps designers and engineers understand how components behave under service or accidental shock loading.

Rheometers and Melt Flow Testers

- Intended to measure rheological properties of thermoplastic materials, capturing how polymer melts behave under shear and flow.
- Enables characterization of melt flow behavior under processing conditions, informing process optimization and material selection.
- Provides data on viscosity, shear response, and flow curves relevant to extrusion, injection molding, or melt processing.
- Supports evaluation of polymer processability by quantifying behavior under temperature and shear rate variations.

HDT & Vicat

- Designed to characterize plastic materials at elevated temperatures by measuring the Heat Deflection Temperature (HDT) and Vicat softening temperature.
- HDT testing determines the point at which a specimen deforms under a specified load as temperature increases.
- Vicat testing identifies the temperature at which a flat indenter penetrates a specified depth under a stated load.
- These thermomechanical tests provide crucial thermal property data for plastics in design and material selection under heat stress.

Rtec instruments

Materials Testing Instruments

Materials Testing Instruments

Mechanical Testing Solutions

Tribometers

- Multi-configuration systems supporting pin-on-disk, reciprocating, block-on-ring, and fretting setups in one instrument.
- Integrated real-time friction/wear measurement with optional 3D non-contact profilometry and environmental control chambers.

Indentation and Scratch Testers

- Provide micro to nano-scale indentation and scratch testing with precise load and depth control.
- Include 3D imaging for post-test visualization of hardness, modulus, and coating adhesion performance.

Fretting Tester

- Generates controlled micro-amplitude reciprocating motion for fretting wear and fatigue studies.
- Supports adjustable load, frequency, and displacement, with optional environmental enclosures.

3D Optical Microscopes

- Use interferometry, confocal, or focus-variation techniques for non-contact surface characterization.
- Measure nanometer-level roughness and provide full 3D topography for wear volume analysis.

Materials Testing Instruments

Mechanical Testing Solutions

HFRR Tester

- High-Frequency Reciprocating Rig operating at 50 Hz for standardized lubricity evaluation.
- Measures friction coefficient and wear scar diameter under controlled temperature and load.

Vacuum Tribometer

- Performs friction and wear testing in high-vacuum environments relevant to aerospace and semiconductor materials.
- Allows precise control of load, speed, and temperature with multiple test geometries.

Twin Roller Tribometer

- Simulates rolling contact conditions using counter-rotating rollers under controlled loads.
- Evaluates rolling wear, traction, and lubricant behavior across variable speeds and temperatures.

Micropitting Rig

- Replicates gear/bearing micro-pitting through controlled load, torque, and lubrication.
- Tracks surface fatigue progression with friction and surface damage measurement.

Materials Testing Instruments

Mechanical Testing Solutions

Air Jet Erosion Tester

- Delivers controlled abrasive air jet for studying particle-induced erosion.
- Adjusts impact angle, velocity, and particle parameters with 3D quantification of erosion depth/volume.

CMP Tester

- Simulates chemical-mechanical planarization with controlled slurry flow, pressure, and platen speed.
- Measures removal rates, pad wear, and friction under realistic CMP conditions.

High-Pressure Tribometer

- Designed to operate under extremely high contact pressures with full control of load and speed.
- Provides real-time friction/wear measurement and integrates 3D imaging for wear characterization.

Hot Hardness Tester

- Measures hardness at elevated temperatures, maintaining stable force and depth accuracy.
- Evaluates thermal softening, creep, and high-temperature mechanical performance.

BINDER

Operational Environment Control Systems

Operational Environment Control Systems

Standard incubation and Plant Growth

Cooling incubators

- Temperature range: from +4 °C (or 0 °C) up to +100 °C (or higher) using compressor or Peltier cooling; APT.line™ pre-heating chamber technology ensures uniformity (e.g., 0.3 K at 37 °C).
- Additional features: adjustable fan speed, inner door made of safety-glass, class 3.1 independent temperature safety device (DIN 12880) with visual/ acoustic alarm, USB data interface.

Standard incubators

- Temperature range from ambient +5 °C up to +100 °C (or specific models +30 °C to +70 °C) with convection type options.
- Convection and control features: adjustable exhaust-air flap, controller with timer functions, inner door of tempered safety glass, class 3.1 independent temperature safety device per DIN 12880.

Growth chambers

- Provide defined climate conditions with temperature and humidity control plus LED lighting modules for plant growth; e.g., temperature range 10 °C to 50 °C (KBF series) or up to +50 °C with humidity 10-90 % RH (KBF PRO series).
- Modular design: basic units (climate chambers) can be retrofitted with LED plant-light modules (16 strip-lights, warm/cool white + dark red phytochrome channel) and optional CO_2 gassing (0.05–1 vol. % CO_2).

Operational Environment Control Systems

Drying and Tempering

Safety drying chambers

- Safety concept meets the DIN EN 1539 standard, with replaceable fresh-air cartridges and symmetrical airflow to handle solvent-containing specimens.
- Temperature range from ambient +10 °C (or +10 °C above ambient) up to approx. +300 °C, with APT.line™ pre-heating chamber technology.
- Silicone- and dust-free stainless-steel inner chamber, 60 mm insulation thickness, 2-point door closure, and defined ventilation exhaust.

Drying and heating chambers

- Situated in gravity convection or forced convection configurations (Series ED, FD, FED etc.), offering temperature ranges from ambient +5 °C (or +7 °C above) up to +250–300 °C, with homogeneous temperature distribution via APT.line™.
- Equipped with USB or Ethernet connectivity for data logging, intuitive controllers (LCD display) and energy-efficient design.
- Adjustable exhaust air flap (in many models), class 2 independent adjustable temperature safety device (per DIN 12880).

Vacuum drying chambers

- Designed for gentle, residue-free drying of materials with solvents (non-flammable: Series VD; flammable: Series VDL with explosion-proof interior), with temperature range from approx. ambient +9 °C up to +220 °C.
- Features include digital display and control of both pressure and temperature, program-controlled drying monitoring with automatic ventilation at end of process, and internal data logger for open-format export (USB/Ethernet).
- Excellent heat transfer via large thermal conducting plates and patented expansion racks, stainless-steel interior.

Diamond SPECTRUM

PART OF TAAWON GROUP

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