

MASTERSIZER



OPENING THE DOOR ON PARTICLE SIZING



MASTERSIZER



Malvern Instruments seeks innovation, not only in product design and development but in every area of business. As many of our systems are used in highly regulated environments, product validation and R&D traceability are key commitments to our customers. We have therefore invested to achieve ISO9001 with TickIt accreditation. Malvern Instrument trained specialists are available on the ground in more than 50 countries of the world to assist with applications development and to advise on and analyze difficult samples. Our laboratory facilities in North and South America, Europe and Asia routinely run thousands of customer samples each year.

Our innovative approach to customer service is illustrated by the development of after-sales remote diagnostics. Malvern Instruments' service specialists can access and control instruments via modem links in order to minimize downtime and improve payback.

In many industries, particle size analysis has become a key QC parameter. The need to obtain data as close to the production line as possible, and to react to that data as quickly as possible, is becoming increasingly important.

Malvern Instruments applies its expertise to meeting this challenge through continued research and applications development.

For a full description of all Malvern Instrument's products and services contact your nearest office.





THE MASTERSIZER 2000 — TAKING THE ALCHEMY OUT OF ANALYSIS

2000

The Mastersizer 2000

- Measures a wide range of sample types
- For the pharmaceutical, chemical, food, mining and minerals, plastics, petrochemical and allied industries
- Rapid and reliable particle sizing
- A wide choice of sample dispersion units
- User-to-user reproducibility assured with SOPs
- Expert advice and software Wizards
- Materials from 0.02 µm to 2000 µm on one system
- High resolution and increased sensitivity
- Full QSpec validation documentation

Across industries and around the globe, speed and flexibility are paramount — particularly in product development. The expert individuals that make this possible need the support not just of capable staff, but of sophisticated instrumentation to increase their effectiveness.

At the same time, regulatory compliance demands more rigour in measuring those parameters linked to product performance. Traceable analyses, repeatable measurement, and systems validation — all are essential.

Laser diffraction — the technique pioneered and advanced by Malvern Instruments — has always provided a powerful analytical approach to particle sizing. With the Mastersizer 2000, we have not simply enhanced the sensitivity and resolution. Multi-level software and ergonomically designed hardware have finally optimized the measurement process. More than ever, making a measurement is truly routine, repeatable, and reliable.

Applications and methods support is in-built. A software Wizard guides the operator through each stage of a measurement. Training time for new users is reduced. The requirement for troubleshooting support of less experienced users by key personnel is minimized.

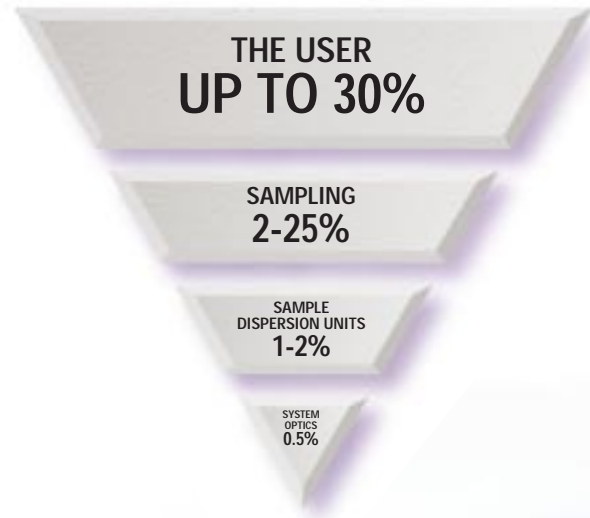
By providing for software driven Standard Operating Procedures (SOPs), the Mastersizer 2000 eliminates user variability. By implementing SOPs you can disseminate methods globally and ensure that different users at different sites can get the right result every time.

Hardware lifecycle documentation, validated software and comprehensive documentation provide for the essential validation requirements of users in the pharmaceutical industry and similar regulated environments.

A redesigned optical system has removed the need for adjustments and re-configuration between samples. Mastersizer 2000 uses an integrated optical system to cover the full range from 0.02 µm to 2000 µm.

The same system works for all types of samples. To change the sample dispersion unit, you can simply swap cell cassettes. The Mastersizer 2000 automatically recognizes the new sample dispersion unit and is ready to run a sample.

Laser diffraction particle sizing as a technique is now ready for universal application.

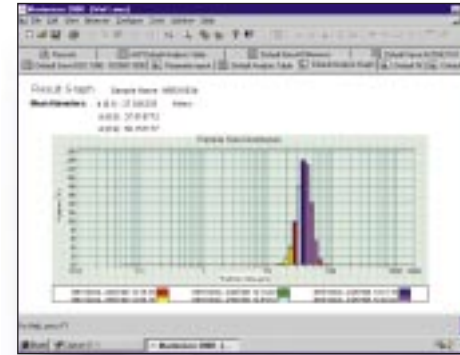


Results variation arises whenever operators are allowed to make arbitrary choices

Companies with global operations require comparable results from site to site. In the laboratory, this must start with fully automated, easy to use systems which deliver clear information. Building on that, the uncertainty of individual user approaches must be eliminated. That means standardization of operational procedures.

The choice of instrumentation is vital. Only with rugged hardware and fully integrated software, can methods and results be standardized and disseminated. Instrument suppliers play an increasingly important role.

The Mastersizer 2000 makes particle size analysis simpler without compromising the integrity and reliability of results.



Sample handling control

Variations in sample handling often lead to variation of results. With the Mastersizer 2000, fully automated sample dispersion units control all aspects of sample handling, eliminating the third major source of results variation.

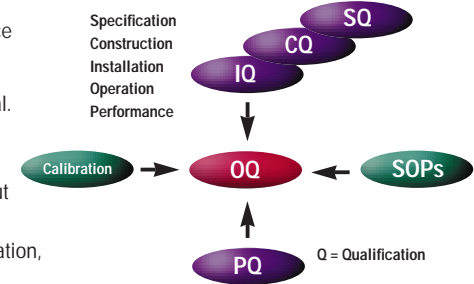
Robust measurement is essential. The new Rapid Align feature constantly optimizes the optical integrity of the system — without user involvement. With a single optical bench and lens configuration, measurement of materials from 0.02 µm to 2000 µm on multiple consecutive samples is possible without adjustment.

From Monday morning to Sunday night, the Mastersizer 2000 delivers repeatable results.

Validation support

As a leading instrument supplier to highly regulated industries, Malvern Instruments supports the validation process with a comprehensive package. Quality is designed into the product from the outset, and followed throughout construction, installation, operation, performance and ongoing customer support.

Full lifecycle documentation, viewable as part of the QSpec contract, provides complete traceability for the design, production and functionality of Mastersizer 2000 hardware.



Software is also designed in accordance with lifecycle concepts to provide functional traceability.

Key features of the QSpec validation package include IQ/OQ documentation, escrow contracts, and a QSpec logbook as a primary record for presentation at regulatory audit.



Using Standard Operating Procedures (SOPs) throughout a company's worldwide operations ensures the same results on the same samples — all around the globe

Standardization of methods

When measurements are performed on an instrument, there are a number of variables that must be standardized to guarantee the consistency that enables informed decisions to be made about the quality of particulate materials. Operator procedures are the main source of variation.

In other words, if two people perform the same measurement, they can each have different ideas about how it should be done. As more people are called upon to make the same measurement, the degree of variation can increase dramatically.

When the measurement is to be performed across several national boundaries and in several languages and across different time zones, the benefits of standardization are obvious.

System features including Wizards lead the user through the measurement process from first principles. With a new sample, this eases methods development.

The system provides for step-by-step establishment of multiple Standard Operating Procedures (SOPs) for different samples. A library of standard SOPs is supplied for many routine analyses.

All measurement variables are recorded in the software to provide full traceability.

MAKING MEASUREMENT ROUTINE — STEP BY STEP

SETTING UP A STANDARD OPERATING PROCEDURE

SOPs are easily established with a Wizard — a step by step decision making tool providing advice at every stage.

In fifteen minutes you can establish a detailed SOP for global applications. They can be as tightly or loosely defined as you wish. Once established, SOPs can be named, saved and disseminated.

Sampler Selection

A choice of sample dispersion units is presented on screen. Advice screens guide you through the choice of wet or dry dispersion, aqueous or solvent-based, to suit a particular sample.

Result

Choose the type of analysis including measurement range, sample and dispersion type by selecting from a database complete with optical properties of sample types.

Documentation

Define the procedure for sample identification. The sample identifier — including source of the sample, its location and sample number — may be input by the user or pre-set.

Report

Select the report format from standard options or from those that have been created with the Custom Report Designer. You can then define formats for file saving and exporting to other software packages.

Measurement

Set the length of measurement time, and number of measurements per sample, as well as pauses between individual measurements, to run automatically. Alarm sensitivity can be adjusted to cover upper and lower limits on diameter, as well as cleanliness and alignment.

Sampler Settings

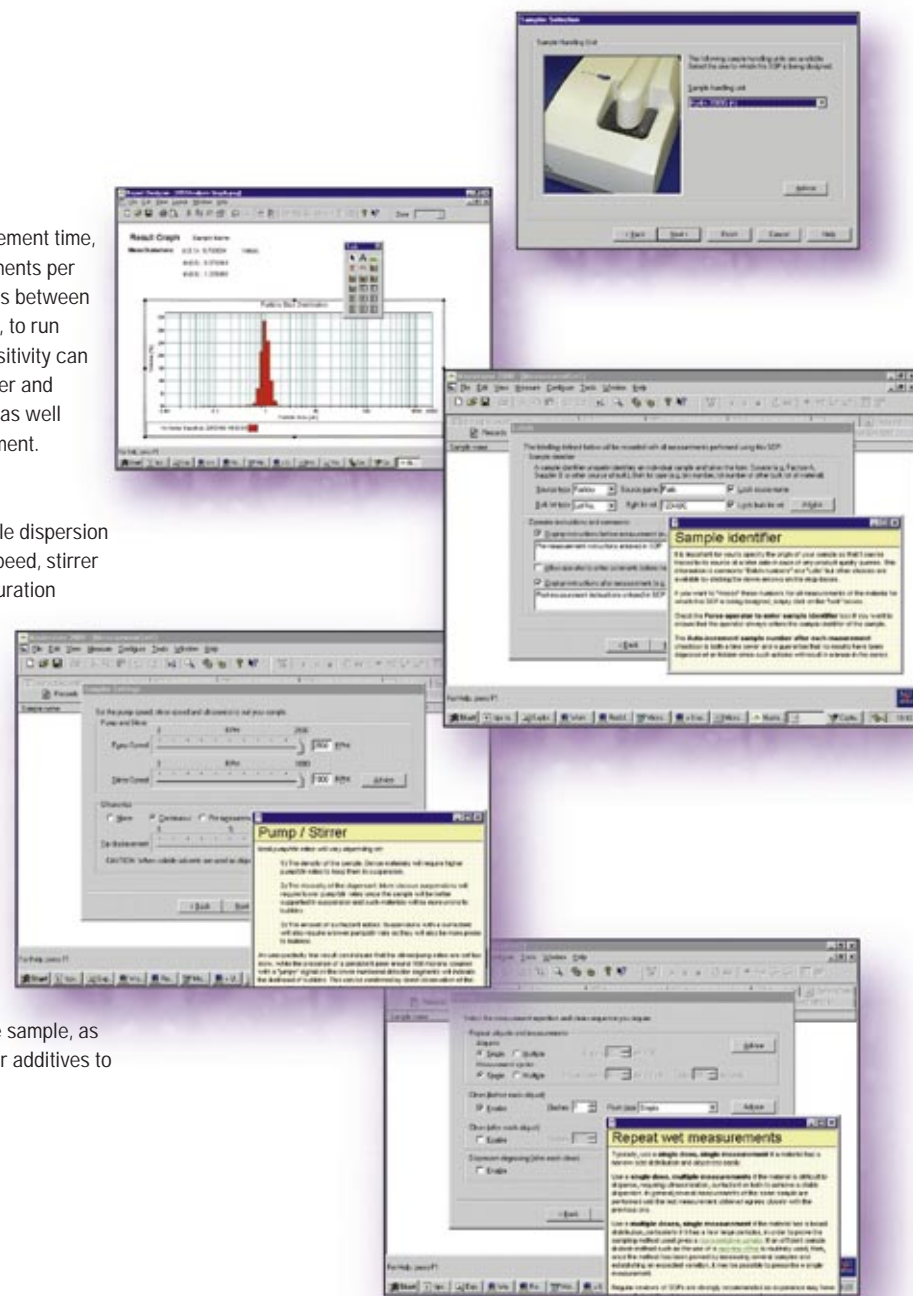
Depending on your sample dispersion unit, you can set pump speed, stirrer speed, and ultrasonics duration and intensity.

Select Cycles

Repeat doses and measurements can be selected, together with procedures for cleaning or flushing of the sample dispersion unit, as well as degassing of aqueous or solvent samples before measurement.

Quantities

Define the quantity of the sample, as well as any surfactants or additives to be used.



Effective deployment of skilled personnel is key to efficient operation. Laboratories demand better data and more reliable analysis from their instrumentation — with reduced operator involvement.

By enabling faster and simpler measurement without compromising on accuracy, the Mastersizer 2000 can provide more reliable product development, ensure better control of the manufacturing process, and speed your product to market.

MAKING A MEASUREMENT



8.29 am. The end of the night shift. Your predecessors tidy away their samples — a series of raw pigments and powders they have been analyzing — but they leave the Mastersizer 2000 system up and running.

8.30 am. The start of a new day. Your first sample is a solvent-based marine paint you have just brought up from the manufacturing floor. The sizer is currently set up to measure dry powders — but that's no problem.

You remove the Scirocco 2000 dry powder cell cassette from the sizer and slot in the Hydro 2000S cell cassette for small volume samples.

The instrument recognizes the sample dispersion unit chosen and configures itself accordingly.

You select the appropriate SOP from the menu of options and select "Measure Automatic". Measurement commences.

As defined in the chosen SOP, the Mastersizer 2000 runs five successive measurements of 5 seconds, with 10 seconds pause between each measurement.

In this particular SOP, each measurement includes 10,000 data scans or 'snaps'.

Before each measurement, the instrument runs the defined cleaning routine on the sample dispersion unit, measures the background count, and aligns the optics if necessary.

As the measurement proceeds, the instrument status is displayed on screen.



Within seconds the measurement is complete. The data is automatically printed out in the desired format. The sample dispersion unit is flushed out in readiness for the next user, following the preset cleaning routine.

8.45 am. After running a further selection of paint samples, you want to compare your results with those taken on the night shift, and on previous batches over the past three months.

You key in a database search routine to call up all results on marine undercoat (red), and then further refine the routine to pick out results in a certain size range.

Spotting a trend, you return to the manufacturing area to discuss the results with the production manager.

On leaving, you pass a colleague from the warehouse. She has a batch of fillers that she wants to check.

She logs on and changes over to the Scirocco 2000 dry powder cell cassette. The first cell cassette is placed in the bench-top cassette holder in readiness for the next solvent-based sample.

After selecting the SOP established for her materials, she commences measuring her samples. Advice notes are on hand to guide the user.

The filler is dispersed through the measurement cell at the pre-defined air pressure and feed rate for that material, and the measurement is made.

By the time you return, she has run all her samples and returned to the warehouse, leaving you to repeat your defined SOP on fresh paint samples from production.



FULL FEATURES AND POWER WITH A GUIDING HAND



Sample units can be simply interchanged and set up is automatic

Operators must be confident and in control in order to get the most out of their instrumentation. With some equipment, this can require detailed training and regular supervision.

With the Mastersizer 2000, Malvern Instruments provides fully automated measurement for routine users. Laboratory managers also have the power to develop the system's built-in training routines, procedural safeguards and software guidance.

Even new personnel can be confident as they deal with a variety of sample types, interchange dispersion units and switch from one measurement routine to another.

Software control minimizes time spent on set-up, and operation. Measurement and set-up parameters can be pre-defined, down to the detail of cleaning routines, multiple measurements, and print out of results.

Running a sample can almost be reduced to a single button operation. Training time for new staff is reduced. The requirement for troubleshooting support from key personnel is minimized.

A software Wizard provides advice and assistance wherever required. The establishment of Standard Operating Procedures is straightforward.

For standard samples, repeatable measurements can be carried out in seconds with exactly the same instrument configuration.

To make fullest system use easier for the operator, Plug and Play cell cassettes have been developed. Two sample dispersion units can be simultaneously connected. New units can be interchanged with the minimum of fuss. There is no need to set them up. Software recognition of cell cassettes and automatic re-configuration eliminates time-consuming and error prone set-up.

Mastersizer 2000 software runs on either Windows 95™ or Windows NT™.

Particle size data can thus be exported to standard spreadsheet or graphical software for report generation and data transfer.





PERFORMANCE, CHOICE AND FUTURE-PROOF FLEXIBILITY

The unique design of the Mastersizer 2000 contains a number of advances in electronics and engineering, based on the theoretical rigour at the heart of all Malvern Instruments' systems.

The full implementation of the Mie theory moves far beyond the Fraunhofer approximation, which is retained only as a route to the past, and allows total sizing confidence even for suspensions of transparent sub-micron particles. An optimized scattering matrix generator allows calculation from the optical properties on demand, removing the need for pre-calculated matrices.

Continuing the evolution of the Mastersizer series, Malvern has incorporated the latest innovations in laser and diode technology in the Mastersizer 2000.

Reverse Fourier optics have been enhanced by additional forward and back scattering detectors, combined with a new high-stability monochromatic blue light source. The additional shorter wavelength provides improved resolution in the sub-micron region, and also allows measurement of materials from 2000 µm down to 0.02 µm.

This unique wide angle dual wavelength detection system delivers state-of-the-art measurement, providing greater resolution and extended range.

The Rapid Align system uses a combination of quadrant alignment detection and a unique dark field reticle system to automatically maintain perfect optical alignment in all cell conditions — even whilst the sample is circulating.

Full applications support includes documentation and procedures for particular industries, even those with unusual requirements.

For flake and disk-shaped materials, such as micaceous minerals and kaolin, particle size data can be converted into aspect ratios.

With the provision of remote diagnostics, users can have a virtual engineer in their laboratory. Malvern Instruments' specialists can access and control your instrument via modem link in order to minimize downtime and improve payback.

Well-established hardware and proven methodologies are backed up by the experience of Malvern Instruments to ensure that the Mastersizer 2000 is a resilient, effective and minimal-maintenance system.

Sample dispersion choice

The user can choose from a variety of sample dispersion units, for both wet and dry measurement modes, which can be plugged in at a moment's notice and immediately recognized by the system.

For a wide variety of industries including pharmaceuticals, chemicals and paints, products are frequently supplied in different forms from dry powders and tablets to suspensions and aerosols. The Mastersizer 2000 has the flexibility to provide a combination of wet and dry measurement, as well as rapid change from aqueous to solvent-based dispersions.

Many materials are best measured in solvent dispersions. **Hydro 2000S** is an aqueous small volume wet sample handling unit which can perform measurements with 50 to 150 ml of sample. This is particularly appropriate for analysis of high cost materials, common in the pharmaceutical industry.

Fully automated ultrasonication ensures that sample conditioning is consistent from sample to sample.

Complete computer control ensures precise replication of pre-determined sample handling and measurement routines. Draining and filling are also automated. A variable power ultrasonic probe controls de-agglomeration and dispersion without damage.

In the minerals, chemical, metal powder refining and cement industries, measurement on larger sample volumes is often appropriate for quality control of the manufacturing process and finished product. **Hydro 2000G** provides a reliable means of measuring dispersions and emulsions in volumes of up to 1 litre.

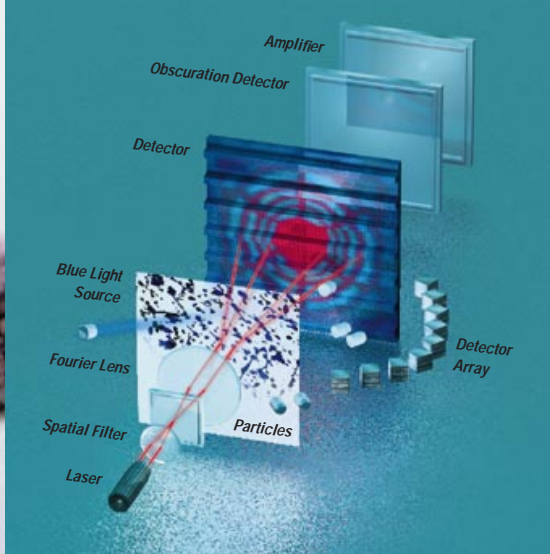
Computer control again regulates measurement parameters and speeds up the measurement procedure.

In wet sampling close to the manufacturing process, the **Hydro 2000M** is a low cost manual wet unit that provides maximum convenience. A standard 600 ml beaker can be used as the sample holder. A dip-in probe continuously agitates the sample and automatically circulates it through the measuring system. An ultrasonic probe provides further dispersion control to ensure consistency of results.

Dry powder measurement in industry is an essential quality control on raw materials. The **Scirocco 2000** dry powder unit combines dispersive airflow with vacuum extraction to provide improved reliability and speed for the measurement of a wide range of dry powder materials.

Automation of variable pressure control and feed rates enables the optimum dispersive effect to be created without attrition of fragile crystalline particles.

A hardened ceramic dispersion nozzle minimizes wear even with abrasive and aggressive materials such as minerals and cements.



MASTERSIZER 2000 TECHNICAL SPECIFICATIONS

Optical Unit				
Size Range	Materials in the range 0.02 µm to 2000 µm			
Measurement principle	Mie scattering			
Detection Systems	Red light: Forward Scattering, Side Scattering, Back Scattering Blue light: Wide Angle Forward and Back Scattering			
Light Sources	Red light: Helium Neon Laser Blue light: Solid State Light Source			
Optical Alignment System	Automatic Rapid Align System with Dark field Optical Reticle and Multi-Element Alignment Detector			
Sample Dispersion Unit Interchange System	Sample Dispersion Units automatically recognized, configured and enabled on insertion of measurement cell cassettes into sizer			
Software and Data Processing				
Minimum Specification of PC	Pentium 166MHz, 32Mbytes RAM and CD ROM. Screen resolution 800x600, 256 colour. At least 10Mb of free space is required to operate the software. Requires 2xRS232 comm ports (1 for modem)			
Operating Platforms	Windows 95™ or Windows NT™ 4.0 and above			
Database Utility	Searching, sorting and filtering by search criteria of data records on all parameters of interest			
Custom Report Facility	Custom Report Designer using Drag and Drop selection, positioning and sizing of key report elements			
Creation of Standard Operating Procedures (SOPs) and Automation	Set up by means of SOP Wizard with extensive advice at all stages of SOP creation. A library of SOPs for common materials is built into the software as standard.			
Operating Modes	Automated, using SOPs created in the software. Manual, using on-screen controls and hot keys.			
Sample Dispersion Units, all with Auto ID Cell Cassettes				
Model	Dispersion Type	Typical Applications	Dispersion Mechanisms	Modes of Operation
Hydro 2000G	Wet Capacity: 1000 ml	Minerals, Fillers, Chemicals, Foodstuffs, Emulsions	Continuously variable Ultrasonics, Pump and Stirrer.	Automatic via SOPs. Manual via computer on-screen operating dialogues.
Hydro 2000S	Wet Capacity: 50–150 ml	Solvent-based suspensions, Pharmaceuticals	Continuously variable Ultrasonics, Pump and Stirrer.	Automatic via SOPs. Manual via computer on-screen operating dialogues.
Hydro 2000M	Wet uses standard laboratory beakers from 600–1000 ml	General Purpose	Continuously variable Pump and Stirrer. Available with or without continuously variable Ultrasonics with timer.	Manual via splash-resistant touch pad on unit.
Scirocco 2000	Dry, with controllable airflow, controllable feedrate and interchangeable feed trays automatically sensed by the system	Dry powders pharmaceutical excipients, fillers cement, flour, powder coatings	–	Automatic via SOPs. Manual via computer on-screen operating dialogues.
Weights and Dimensions				
Model	Unpacked weight	Dimensions		
Mastersizer 2000 Optical Bench	31.0kg	Length: 1293mm; Depth: 255mm; Height: 375mm		
Hydro 2000G	13.7kg	Width: 344mm; Depth: 352mm; Height: 330mm		
Hydro 2000S	11.0kg	Width: 352mm; Depth: 355mm; Height: 332mm		
Scirocco 2000	11.7kg	Width: 352mm; Depth: 355mm; Height: 332mm		

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All specifications are subject to change without notice.