

Mastersizer 2000

Essentials

user manual



Mastersizer 2000 Essentials

MAN0393 Issue 1.0 March 2007

English

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Head office:

Malvern Instruments Ltd.
Enigma Business Park,
Groewood Road,
Malvern,
Worcestershire WR14 1XZ
United Kingdom.

Tel + [44] (0)1684-892456
Fax + [44] (0)1684-892789

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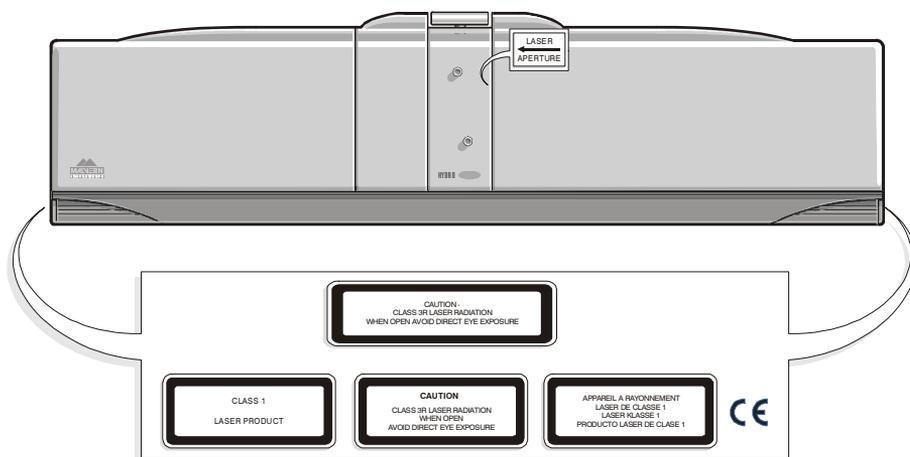
Addendum to manual

Addendum number	ADD0069-1.0
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Manual name	Mastersizer 2000 Essentials

This addendum presents new information on the Mastersizer 2000/2000E from Malvern Instruments.

Laser warning labels

There is an additional laser warning label, shown below, inside the cell area. It is not shown on page 3-3 of the current Essentials manual.



This label is only visible when the cell is removed.

Laser caution statement

The following **Caution** statement replaces the **Warning** statement on page 3-2:



Caution!

The use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

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Introduction to this manual

Introduction to this manual

This manual covers the operation and maintenance of the Mastersizer particle analyser series. It covers the Mastersizer 2000 and Mastersizer 2000E optical benches and their dispersion units, as follows:

Unit	Model number
Mastersizer 2000	APA2000
Mastersizer 2000E	EPA2000
Hydro 2000G	AWA2000
Hydro 2000S	AWA2001
Hydro 2000MU	AWM2000
Hydro 2000SM	AWM2002
Hydro 2000 μ P	AWA2003/4
Scirocco 2000	ADA2000
Scirocco 2000M	EDA2000/EDA2001
Autosampler 2000	ASA2000

Using this manual

This manual contains essential information on the system.

**Warning!**

Read the Health and Safety information in **Chapter 3** before operating the instrument.

Read this manual in conjunction with the main **Mastersizer 2000 User Manual** and the appropriate dispersion unit manuals.

For more detail on the software, use its online **Help**. Each dialogue has a **Help** button giving information on it. **Advice** buttons give more sample related content.

Access to the instrument

Malvern personnel

Malvern personnel (service engineers, representatives, etc.) have full access to the instrument and are the only people authorised to perform all service procedures that may require the removal of the covers.

**Warning!**

Removal of the main covers by unauthorised personnel, even a supervisor, will invalidate the warranty of the instrument.

Supervisor

The supervisor is responsible for the management and safety of the instrument and its operation. The supervisor also trains the operators. The supervisor can perform all user maintenance routines identified in **Chapter 4**.

The supervisor has access to a more detailed manual in English.

Operator

An operator is a person trained in the use of the system. The operator can perform all user maintenance routines identified in **Chapter 4, except changing the fuse**.

**Warning!**

Failure to follow these guidelines could result in exposure to hazardous voltages and laser radiation.

Assumed information

General

The Mastersizer 2000/2000E can be used with a variety of sample dispersion units that allow it to measure wet and dry samples. The basic function of these is identical: to prepare and deliver the sample to the optical bench for measurement. For clarity, this manual assumes that the primary dispersion unit for each system is as follows:

- For the Mastersizer 2000 the Hydro 2000G.
- For the Mastersizer 2000E the Hydro 2000MU.

For more details of any sample dispersion unit, refer to its manual.

Naming convention

Within this manual:

- The Mastersizer 2000/2000E optical bench is referred to as “the optical bench” or “the instrument”. For simplicity, in general text the term “Mastersizer 2000” refers to both the Mastersizer 2000 and 2000E. Where the Mastersizer 2000E is different, this is always explained.
- The sample dispersion units are referred to in full (“the Hydro 2000G” or “the Hydro 2000MU”), or as “the dispersion unit”.
“Wet dispersion units” refers to the Hydro 2000G/S, Hydro 2000MU, Hydro 2000SM and Hydro 2000 μ P.
“Dry dispersion units” refers to the Scirocco 2000 and Scirocco 2000M.
- The combination of the optical bench, one or more dispersion units and the computer is referred to as “the system”.

Menu commands

Menu commands from the Malvern software are referred to in the form **main menu-menu item**. As an example, the command **Configure-New SOP** refers to selecting the **New SOP** item in the **Configure** menu. The same rules apply for sub-menus of sub-menus, so that **Tools-Options-Instrument Port** refers to the **Instrument Port** item in the **Options** sub-menu, which itself is a sub-menu of the **Tools** menu. Menu commands are always shown in bold text.

Where to get help

Help desk

All queries regarding the system should initially be directed to the local Malvern representative. Please quote the following information:

- Model and serial number of the instrument and dispersion unit.
- The software version (to see this select **Help-About** in the software).

Contact the United Kingdom help desk if the local Malvern representative is not available. The direct line to the United Kingdom Helpdesk is +44 (0) 1684 891800. This help line is primarily English speaking.

Remote support

Malvern Instruments offers a remote support service over the Internet. Benefits include fast and efficient fault diagnosis, reducing downtime and costs.

Online user training is also available, plus software updates. A direct Internet connection must be available to make use of this facility.

Malvern Website - www.Malvern.com

The Malvern website offers a comprehensive range of particle characterisation resources for use by customers 24 hours a day, seven days a week.

Resources include software downloads, Frequently Asked Questions, a knowledge base and application notes, plus information on other Malvern particle characterisation solutions.

Site requirements

This is a copy of Chapter 2 of the manual MAN0393 issue 1.0.

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Head office:

Malvern Instruments Ltd.
Enigma Business Park,
Groveswood Road,
Malvern,
Worcestershire WR14 1XZ
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Introduction

This document outlines site requirements for a Mastersizer 2000/2000E. Ensure all these are met **before** the Malvern Instruments engineer arrives to install and commission the system.

Environmental conditions

The site must be:

- Away from strong light sources (e.g. windows).
- Away from strong heat sources (e.g. radiators).
- Well ventilated (for noxious samples).
- On a horizontal vibration-free bench built to support the weight of the system (shown below):

Unit	Weight	Model number
Mastersizer 2000	35kg	APA2000
Mastersizer 2000E	35kg	EPA2000
Hydro 2000G	18.7kg	AWA2000
Hydro 2000S	16.8kg	AWA2001
Hydro 2000MU	17.1kg	AWM2000
Hydro 2000SM	10.5kg	AWM2002
Hydro 2000μP	11.9kg	AWA2003/4
Scirocco 2000	21.3kg	ADA2000
Scirocco 2000M	18.7kg	EDA2000/EDA2001
Autosampler 2000	30kg	ASA2000

In addition:

- Do not obstruct power sockets as they may need to be disconnected during an emergency.
- Avoid passing electrical cables through areas where liquids can be spilt.

If a sink is used to remove waste we recommend locating this to the left of the optical bench.

We recommend that the computer is positioned to the right of the optical bench.

Store/operate the system in the following conditions (accurate measurements are sample-dependent, for example dry powders may stick together in high humidity):

Operating temperature	10 to 35°C (50 to 95°F)
Storage temperature	-20 to 50°C (-104 to 122°F)
Humidity	10 to 90% (non-condensing)
Pollution degree	2 (BS EN 60664-1:2003)
Installation Category	II (BS EN 60664-1:2003)
IP Rating	20 (Indoor use only; BS EN 60529-1:1992)

Space required

Give enough space to allow easy access to all components of the system. Allow at least 800mm above the bench surface for access to the cell.

Any drain pipes from the Hydro 2000G/S must not exceed two metres in length.

Component dimensions are:

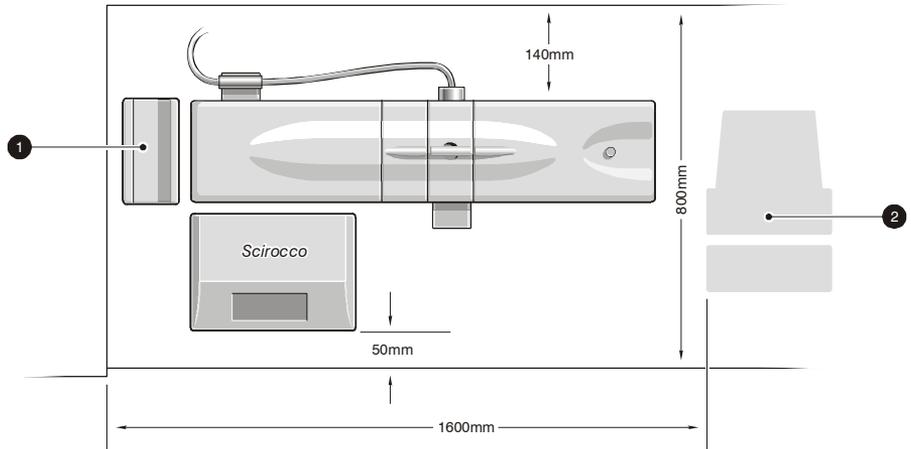
	Width	Depth	Height
Optical bench	1293mm	255mm	375mm
Hydro 2000G	348mm	365mm	333mm
Hydro 2000S	348mm	365mm	333mm
Hydro 2000SM controller	225mm	180mm	80mm
Hydro 2000SM dispersion unit	140mm	175mm	390mm
Hydro 2000µP	287mm	253mm	338mm
Scirocco 2000	352mm	355mm	332mm
Scirocco 2000M	220mm	310mm	290mm
Autosampler 2000	561mm	372mm	600mm
Cell holder	145mm	250mm	338mm

Dry dispersion units

Generally, a Scirocco 2000/2000M requires more space than a wet dispersion unit.

Scirocco 2000

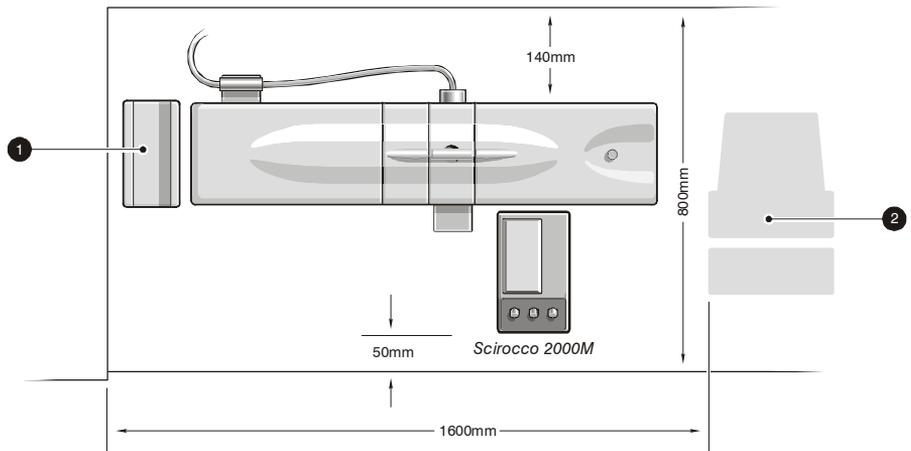
This diagram shows the **minimum** recommended space required for a typical system using a Scirocco 2000, with its cell holder ① and computer ②:



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Scirocco 2000M

This diagram shows the **minimum** recommended space required for a typical system using a Scirocco 2000M, with its cell holder ① and computer ②:



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Services

This section describes the services required.

General

The following services are required for each component:

Requirement	Optical bench	Hydro 2000G/S	Hydro 2000MU	Hydro 2000SM	Hydro 2000µP	Scirocco 2000	Scirocco 2000M	Autosampler 2000
Power sockets	2 ^b	1	1	1	1	2	2	1
Direct plumbed dispersant (option)^c	No	Yes	No	No	No	No	No	Yes ^c
Drain	No	Yes	No	Yes	No	No	No	Yes
Vacuum unit	No	No	No	No	No	Yes	Yes	No
Air line	No	No	No	No	No	Yes	Yes	No
Telephone socket	Yes ^b	No	No	No	No	No	No	No
Purge air supply	No	Yes ^a	No	No	No	No	No	No
Efficient extraction system	No	No	No	No	No	Yes	Yes	No

Notes:

- a** Only needed if aggressive dispersants are to be used in the Hydro 2000G.
- b** The second power socket and telephone socket are only needed if the remote modem support package is installed.
- c** Direct plumbed dispersant input is a **requirement** for the Autosampler, not optional.

In addition, the computer system requires one or more power sockets.

Power specification

The mains power supply must be clean and filtered. If necessary, fit an Un-interruptible Power Supply (UPS) to remove any spikes or noise. The power requirements are given below:

Unit	Power	Notes
Optical bench	60W	
Hydro 2000G	240W	
Hydro 2000S	240W	
Hydro 2000MU	120W	
Hydro 2000SM	60W	
Hydro 2000 μ P	48W	Only use the PSU/cables provided. Using another PSU voids any warranty and may be unsafe.
Autosampler 2000	240W	
Scirocco 2000	Main unit 240W Vacuum switcher box 800W	
Scirocco 2000M	Main unit 240W Vacuum switcher box 800W	

Services specification

Direct plumbed dispersant specification (Hydro 2000G/S only)

For most applications, the liquid dispersant is water from a header tank or the mains. If the input pressure to the dispersion unit exceeds 4 bar, an external pressure regulator **must be fitted** to reduce this to 4 bar.

The dispersant input must be filtered to remove particulates. The filtering depends on the size of the sample; if the sample contains a significant proportion of sub-micron particles the dispersant input should be filtered to remove them.

Direct plumbed dispersant specification (Autosampler 2000 only)

The Autosampler has two dispersant inputs, one for the cleaning station and one supplying dispersant to the sample pots. This allows use of different dispersants for cleaning and sample preparation, for example IPA as the sample dispersant but water for washing the head between samples. With this configuration, both dispersant inputs should conform to the specification below.

If using the same dispersant for the sample pot and washing, a single dispersant input can be used. In this configuration a tee-piece is used to split the supply between the two inlets.

For most applications the liquid dispersant is water from a header tank or the mains. If the input pressure to the dispersion unit exceeds 1.5 bar an external pressure regulator **must be fitted** to reduce this to 1.5 bar. For effective cleaning, we recommend that the input pressure is not below 0.5 bar.

The input should be filtered to remove particulates, depending on the size of the sample; if the sample contains a significant proportion of sub-micron particles the dispersant input should be filtered to remove them.

Drain requirements (Hydro 2000G/S and Autosampler 2000)

The drain must be within 2m of the dispersion unit and lower than the bench surface. It can be a normal sink, provided the sample and dispersant are non-hazardous.

Always dispose of waste dispersant and sample mixtures responsibly. Many local laws forbid disposal of chemicals in ways that allow their entry into the water system. Seek local advice on disposal of chemical waste.

Air line specification (Scirocco 2000 and 2000M only)



Caution!

The air line supply must be dry, free from oil and filtered to less than 0.01mm. Failure to meet this specification will permanently damage the dispersion unit and invalidate the warranty.

Air line pressure	5.5 to 8 bar g, but should nominally be set to 6 bar g.
Air flow	At least 90 l/min at 6 bar (87 psi g).
Air line oil filtering	To Class 1 of ISO 8573.1. i.e. <0.003mg/m ³ .
Air line particulate filtering	To class 1 i.e. <0.01mm.

The outlet from the compressor must be fitted with a push-fit adapter capable of taking a 6mm o/d polyurethane pneumatic tube.

Sound emissions from the system (including the compressor) must be less than 85 dBA, (measured at the operator's position).

Malvern Instruments can supply a compressor meeting this specification.

Vacuum unit specification (Scirocco 2000 and 2000M only)

If Malvern Instruments does not provide the vacuum unit used with the Scirocco 2000, any vacuum unit used must conform to the following specification (minimum specification before exhaust filter fitted):

Parameter	Condition	Value
Power	Continuous	800W
	Max. peak	950W
Air flow	-	39 litres/sec
Vacuum	-	20.4kPa
Suction power	With hose fitted to air cell output port.	182W

Malvern Instruments can supply a vacuum unit meeting this specification.

Purge air specification (Hydro 2000G only)

Particularly aggressive dispersants may cause the grease in pump motor bearings to leach out. If this may be a problem the air purge inlet port can be used to connect an air supply. This will keep fumes away from the bearings.

If this is done the air supply must conform to the following specification:

- 1800ml air/min @212mbar g.
- 0.064 cu ft/min @3.0psi g.
- In unclean environments, filtered to remove all particles larger than 0.5 microns.

Efficient extraction system (Scirocco 2000 and 2000M only)

The exhaust from the Scirocco 2000 air cell must be collected/extracted by an efficient extraction system. Never let the exhaust discharge into an enclosed room.

The Scirocco 2000M requires an air extraction system capable of extracting 39 litres/second (minimum rate) at a vacuum of 20.4kPa.

Computer specification

Contact the Malvern Helpdesk or website for the recommended computer specification; otherwise consult the **Software Update Notification** document supplied on the software CD.

Power cords and Power safety

The notes in this section indicate best practice. Follow these when connecting the instrument to the power supply.

**Warning!**

Do not operate this product with a damaged power cord set. If the power cord set is damaged in any manner, replace it immediately.

**Warning!**

Do not use the power cord received with this product on any other products.

Power cord set requirements

Power cord sets must meet the requirements of the country where the product is used. For further information on power cord set requirements, contact a Malvern representative.

General requirements

These requirements apply **to all countries**:

- The power cord must be approved by an acceptable accredited agency responsible for evaluation in the country where the power cord set will be installed.
- The power cord set must have a minimum current capacity of 10A (7A in Japan only) and a nominal voltage rating of 125 or 250 volts AC, as required by each country's power system.
- The area of the wire must be a minimum of 0.75mm² or 18AWG, and the length of the cord must be less than 3m.
- Route the power cord so it is not likely to be walked on or pinched by items placed upon it or against it, or become wet. Pay particular attention to the plug, the electrical outlet, and the point where the cord exits the product.

Health and safety

Introduction

This chapter covers all the Health and Safety information and **all users must read it**. It covers:

- General safety issues.
- Power cords and Power safety.
- Wet dispersion units.
- Dry dispersion units.
- Autosampler 2000 safety.
- Moving the system.
- Sample handling warnings.
- Disposal of the instrument.

General safety issues

**Warning!**

Use of the system in a manner not specified by Malvern Instruments may impair the protection provided by the system.

Site requirements

The system has specific site requirements (see **Chapter 2**) that must be enforced to ensure safe operation of the instrument.

**Warning!**

Safety may be compromised if the system is used in an environment not conforming to the site requirements.

Laser safety warnings

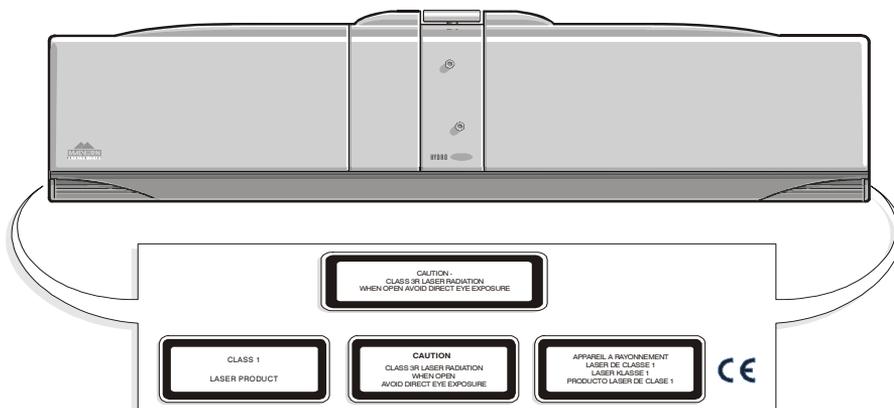
The **Mastersizer 2000 optical bench** is a **Class 1** laser product and, as such, there is no exposure to laser radiation in its normal operation. The laser passes through the cell area but this area is enclosed when the cell is fitted. When the cell is not fitted, a mechanical laser shutter prevents exposure to laser radiation.

**Warning!**

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

The internal laser has a maximum output of 4mW (CW) and a beam divergence of 1.3mrad.

This diagram shows the location of the laser warning labels:



iii 7928

The **Autosampler 2000** is a **Class 2** laser product; refer to its section below.

Electrical safety warnings

The Mastersizer 2000 and its dispersion units are mains powered; treat input power cables accordingly. The metal parts of the system are earthed via a protective earth connection.



Warning!

This product **must** be connected to a protective earth.

Take care when measuring samples not to spill liquid or powder over the system covers. Conducting materials or liquids can damage insulation and cause dangerous conditions. If a spillage occurs, disconnect the power and scrupulously clean up before re-applying power to the system. Users who suspect powder or liquid has entered the covers should call a Malvern representative to arrange a service call.



Warning!

Never attempt to remove the covers; always contact a Malvern representative.

PAT testing

If PAT testing is required, connect the earth lead to the appropriate earth stud. We recommend that the product is PAT tested annually, or if it is suspected that its electrical safety has been compromised.

Power cords and Power safety

The notes in this section indicate best practice. Follow these when connecting the instrument to the power supply.

**Warning!**

Do not operate this product with a damaged power cord set. If the power cord set is damaged in any manner, replace it immediately.

**Warning!**

Do not use the power cord received with this product on any other products.

Power cord set requirements

Power cord sets must meet the requirements of the country where the product is used. For further information on power cord set requirements, contact a Malvern representative.

General requirements

These requirements apply **to all countries**:

- The power cord must be approved by an acceptable accredited agency responsible for evaluation in the country where the power cord set will be installed.
- The power cord set must have a minimum current capacity of 10A (7A in Japan only) and a nominal voltage rating of 125 or 250 volts AC, as required by each country's power system.
- The area of the wire must be a minimum of 0.75mm² or 18AWG, and the length of the cord must be less than 3m.
- Route the power cord so it is not likely to be walked on or pinched by items placed upon it or against it, or become wet. Pay particular attention to the plug, the electrical outlet, and the point where the cord exits the product.

Power safety information

The following notes indicate guidelines to follow when connecting the Malvern Instruments power supply using single and multiple extension leads, connection via AC Adapters and use of Uninterruptible Power Supplies (UPS).

**Warning!**

To prevent electric shock, plug the instrument or dispersion unit into a correctly earthed electrical outlet.

The power cord supplied is equipped with a grounding connection to ensure grounding integrity is maintained.

Advice on use of Extension leads

Follow this advice when using **single or multiple socket extension leads**. These are also called ‘trailing sockets’.

- Ensure the lead is connected to a wall power outlet and **not to another** extension lead. The extension lead **must** be designed for grounding plugs and plugged into a grounded wall outlet.
- Ensure that the total ampere rating of the products being plugged into the extension lead **does not exceed** the ampere rating of the extension lead.
- Use **caution** when plugging a power cord into a multiple socket extension lead. Some extension leads may allow a plug to be inserted incorrectly. Incorrect insertion of the power plug could result in permanent damage to the instrument or dispersion unit, as well as risk of electric shock and/or fire. Ensure that the ground connection (prong/pin) of the power cord plug is inserted into the mating ground contact of the extension lead

Advice on use of AC adapters**Warning!**

Do not use adapter plugs that bypass the grounding feature, or remove the grounding feature from the plug or adapter.

- Place the AC adapter in a ventilated area, such as a desk top or on the floor.
- The AC adapter may become hot during normal operation of the instrument or dispersion unit. Use care when handling the adapter during or immediately after operation.
- Use only the Malvern-provided AC adapter approved for use with the instrument/dispersion unit. Using a different adapter may cause fire or explosion.

Advice on use of Uninterruptible Power Supplies (UPS)

- To help protect the instrument and/or dispersion unit from sudden, transient increases and decreases in electrical power, use a surge suppressor, line conditioner or UPS.

Wet dispersion units

This section lists specific safety issues for each dispersion unit.

Hydro 2000G/S safety



Warning!

Due to the possible risk of sonication of the blood, never put fingers in the tank when the ultrasonic probe is operating.



Warning!

Never put fingers in the tank when the pump/stirrer shaft is rotating.



Warning!

This product contains brushed DC motors so should not be used to measure highly volatile samples or dispersants.

Warning labels

Warning triangles warn of the potential risk from hazardous chemicals:

Location	Label/text	Meaning
DRAIN OUTPUT connector		The tank contents are drained here. Any risk depends on the dispersants and samples measured.
	MAX DISTANCE TO WASTE 2M	Keep within 2m of drain so tube does not exceed 2m.
DISPERSANT INPUT connector		The dispersant may be hazardous, though for most applications it is just water.

Hydro 2000MU safety

**Warning!**

Due to the possible risk of sonication of the blood, never put fingers in the tank when the ultrasonic probe is operating.

**Warning!**

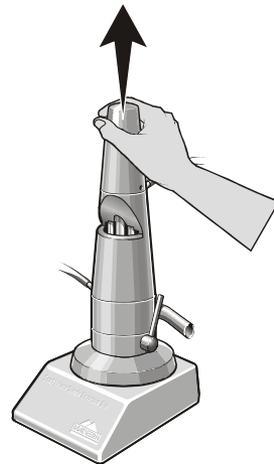
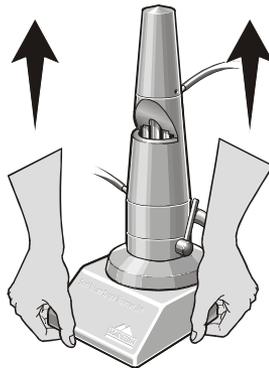
Never put fingers in the tank when the pump/stirrer shaft is rotating.

Hydro 2000SM safety

**Warning!**

Never put fingers in the tank when the pump/stirrer shaft is rotating.

Never lift the dispersion unit by its motor cap (as shown on the right below):



ill 3058

Hydro 2000 μ P safety



Warning!

Due to the possible risk of sonication to the blood, never put fingers in the tank when the ultrasonic probe is operating.

Warning labels

Warning triangles warn of potential risks:

Location	Label/text	Meaning
Ultrasound connector (if Ultrasound fitted)	 ULTRASOUND	For added protection against electric shock, ensure that the ultrasound cable is connected at both the control unit and cell unit while the dispersion unit is powered.
DRAIN OUTPUT connector	 MAX DISTANCE TO WASTE 2M	The tank contents are drained here. Any risk depends on the dispersants and samples measured. Keep within 2m of drain so tube does not exceed 2m.
DISPERSANT INPUT connector		The dispersant may be hazardous, though for most applications it is just water.

The following are potential hazards:

- Dispersant input spillage** – to reduce the risk of spillage, we recommend using only syringes supplied by Malvern Instruments. Other syringes must meet the **Chemical Compatibility** guidelines in the **Hydro 2000 μ P User Manual**. Also, they should not exceed 20ml capacity to reduce the risk of over-filling the cell.

If a spillage occurs, power off the dispersion unit and disconnect it from the power supply before cleaning it up. Consult the **Material Safety Data Sheet** for the spilt substance for recommendations on cleaning.

- Pump shaft** – do not touch the pump shaft while it is running.
- Fumes** – use the system in a fume cupboard if using dispersants that emit hazardous fumes. Consult Malvern Instruments before using dispersants with ignitable vapour.

Other safety issues

- **Power Supply Unit** – the PSU used on the Hydro 2000 μ P is not designed for wet environments. Do not place the power supply in areas prone to spillages, etc.
- **Spillages from the tank** – we recommend fully draining the system before moving the cell unit. This is not always practical (i.e. if the unit is left filled with clean dispersant to prevent the cell windows from drying out.). In these cases, always fit the tank plug to minimise the risk of spillage.
- **Waste beaker** – if knocked over when full of sample/dispersant, the waste beaker is a potential hazard. Always use the beaker holder provided to retain the beaker.

Dry dispersion units



Warning!

The typical Scirocco configuration is not suitable for measuring hazardous materials. However, if extra precautions are taken (e.g. using a fume cupboard or efficient exhaust filtering) this may be possible.



Warning!

Static discharge can occur around the exit and feed pipe regions under certain combinations of material, flow rate and humidity. If this is a concern contact the Malvern representative.



Warning!

If the unit is used with a vacuum unit not supplied by Malvern, this must meet the specification: air flow 39l/s (minimum rate), vacuum 20.4kPa.

Warning labels

Warning triangles warn of the potential risk of damaging the dispersion unit:

Location	Label/text	Meaning
VACUUM MONITOR connector	 CONNECT ONLY TO AIR CELL	Unit may be permanently damaged if high pressure air lines are connected here. Only connect the air cell.
AIR IN connector	 6-8 BAR, FILTERED, DRY & FREE OF OIL	Unit may be permanently damaged if the air supply is over 8 bar, dirty or contains oil. Chapter 2 has the air specification.
Sample area lid	 LID MUST BE LOCKED SHUT WHEN PERFORMING A MEASUREMENT	Excessive noise (over 85dB) is generated if this lid is not shut during use. In this case, use suitable ear defenders.
Vacuum switcher box "mains outlet to vacuum cleaner"		The power socket is switched on and off by computer control so may be powered on unexpectedly.

Pneumatic safety

Observe all local regulations and recommendations on the use of compressed air.

Do not direct a compressed air line at the human body.

During installation and maintenance, ensure that the supply pressure regulator is adjusted to zero and the on/off supply valve is in the OFF position.



Warning!

Do not attempt to remove any compressed air tube without first reducing and switching off the air supply (as described in the above paragraph) as well as venting the dispersion unit.

Always use tubes of a suitable pressure rating. The air inlet tube should have a normal operating rating of 10 bar g.

Some fittings used on the dispersion unit are of the push-in quick-release collet type.

► To vent the dispersion unit:

1. Turn off the air at the main supply.
2. With the system switched on (including the vacuum unit) select full pressure from the accessory control dialogue.
3. Allow the system to vent.
4. Remove the air line.

Dust hazards

To provide operator protection, we recommend wearing protective filter dust masks and suitable safety spectacles for handling dry powders.

Certain types of dry powders can be hazardous to health if inhaled. Such materials are not suitable for dry dispersion by the dispersion unit.

Dust extraction systems

We recommend ducting all sample-contaminated exhaust air from the dispersion unit via an efficient extraction filtration system for safe discharge to the outside atmosphere.

Ensure that all air filters are efficient and that replacements, when fitted, meet the correct specification. Ensure that elements are replaced at specific intervals of time to meet the requirements of the installation. Do not allow filters to clog or become inefficient. Dispose of used filters safely.

Noise emissions

Due to the noise emitted from the dispersion unit and the air cell, before use the dispersion unit cover **must** be closed. Excessive noise (over 85dBA) is generated if this lid is not shut during use. In this case, use suitable ear defenders.

In normal operation (with all safety features enabled) sound emissions for the dispersion unit, including the compressor, will be under 85dBA.

Autosampler 2000



Warning!

Never put fingers in the washpot or sample pot when the pump/stirrer shaft is rotating.



Warning!

This product contains brushed DC motors so should not be used to measure highly volatile samples or dispersants.

Warning labels

Warning triangles warn of the potential risk from hazardous chemicals:

Location	Label/text	Meaning
DRAIN OUTPUT connector		The wash pot contents are drained here. Any risk depends on the dispersants and samples measured.
	MAX DISTANCE TO WASTE 2M	Keep within 2m of drain so tube does not exceed 2m.
DISPERSANT INPUT connector		The dispersant may be hazardous, though for most applications it is just water.

Laser safety warnings

The Autosampler 2000 is a Class 2 laser product, using a low powered laser diode in the form of a barcode reader. The internal laser has a maximum output of 1mW (CW) and a wavelength of 630-680nm.

Although staring directly at the laser beam momentarily causes no known biological damage, do not stare at it. Do not allow the laser beam to hit the eye of an observer, even through reflective surfaces such as watch straps, etc.

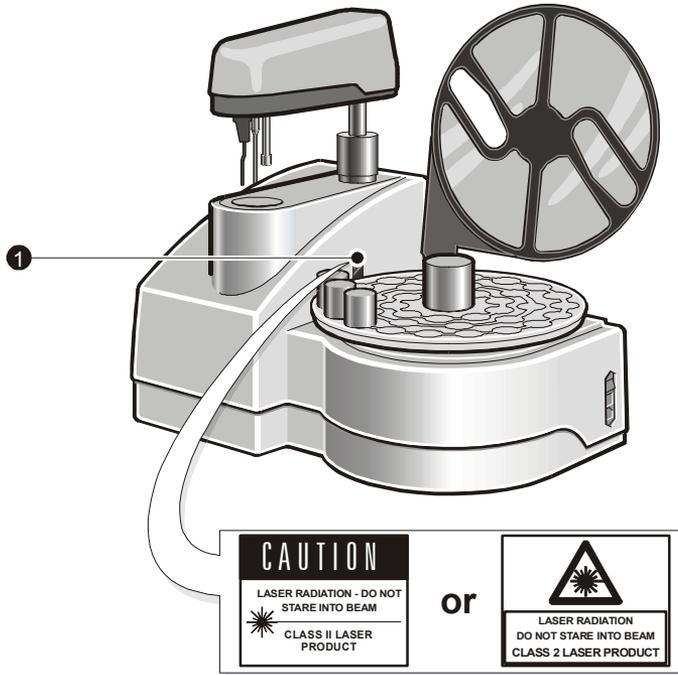
The laser passes from the barcode reader aperture ①, through to the pots located on the sample tray.



Warning!

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

This diagram shows the location of the laser warning labels ①:



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Moving the system

If it is necessary to move the system, follow these guidelines.

Moving the optical bench

- Disconnect the computer and power supply before trying to move the system.
- Adopt proper lifting techniques to avoid back injury. One person alone must not try to lift the optical bench.
- Always lift the instrument by holding it under its base using the handholds. Never lift an instrument by its covers. Refer to the **Unpacking instructions** provided.
- If moving it large distances, we recommend repacking the instrument in its original packaging.

Moving sample dispersion units

If it is necessary to move the dispersion unit, follow these guidelines:

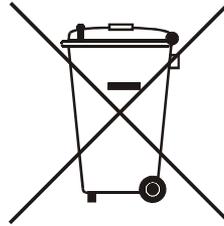
- Disconnect the power supply before attempting to move the dispersion unit.
- Disconnect and drain or vent any tubing carrying fluids or compressed air, including sample tubing, before moving the dispersion unit.
- Lift the dispersion unit by holding it under the base.
- If moving it large distances, we recommend repacking the unit in its original packaging.

Sample handling warnings

- Always handle all substances in accordance with the **COSHH (Control Of Substances Hazardous to Health) regulations** (UK) or any local regulations concerning sample handling safety.
- Before using any substance, check the **Material Safety Data Sheets** for safe handling information.
- Use the instrument in a well ventilated room, or preferably within a fume cupboard, if fumes from the sample or dispersant are toxic or noxious.
- Wear personal protective equipment as recommended by the **Material Safety Data Sheets** if toxic or hazardous samples are being handled, particularly during sample preparation and measurement.
- Wear protective gloves when handling hazardous materials, or those that cause skin infections or irritations.
- Do not smoke during measurement procedures, particularly where inflammable samples are used or stored.
- Do not eat or drink during measurement procedures, particularly where hazardous samples are used or stored.
- Take care when handling glass (e.g. beakers). Hazardous materials may enter a wound caused by broken glass.
- Always test a new sample or dispersant for chemical compatibility before use.
- After measuring hazardous samples, scrupulously clean the system to remove any contaminants before making another measurement.
- Always label samples for analysis using industry standard labelling, particularly if they are handled by a number of staff or stored for long periods. Clearly mark any operator hazard and associated safety precautions that are required for the handling of dangerous materials.
- It is important to keep a record of all hazardous substances used in the system for protection of service and maintenance personnel.
- Always adopt responsible procedures for the disposal of waste samples. Most local laws forbid the disposal of many chemicals in such a manner as to allow their entry into the water system. The user is advised to seek local advice as to the means available for disposal of chemical wastes in the area of use. Recommendations can be found in the **Material Safety Data Sheets**.
- The surfaces of the system may be permanently damaged if samples are spilt onto them. If spillages should occur, then the system should be disconnected from the power supply before scrupulously cleaning up the spillage.

Disposal of the instrument

This regulation is applicable in the European Union and other European countries with separate collection systems.



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This symbol on the product or on its packaging indicates that when the last user wishes to discard this product it must not be treated as general waste. Instead it shall be handed over to the appropriate facility for the recovery and recycling of electrical and electronic equipment.

By not discarding this product along with other household-type waste, the volume of waste sent to incinerators or landfills will be reduced and natural resources will be conserved.

For more detailed information about recycling of this product, please contact the local city office, the waste disposal service, or the Malvern representative.

Maintenance

Introduction

This chapter covers all the user maintenance procedures for the system. Do not attempt any maintenance procedure not specified here. An operator can perform all procedures **except replacing fuses**.

This chapter starts with relevant warnings then covers:

- Optical bench – cleaning the covers, cell area and optics.
- Wet dispersion units – this section suggests a maintenance schedule then gives cleaning procedures for cell windows. It also describes how to clean the tank and level sensor (Hydro 2000G/S), flow path (Hydro 2000MU and SM) and well cone (Hydro 2000 μ P).

This section then describes how to replace sample tubing and also describes procedures for the Hydro 2000 μ P dispersant input assembly.

- Dry dispersion units – this section suggests a maintenance schedule then gives cleaning procedures for the sample tray, cell windows and filters. It also describes how to replace tubing, vacuum cleaner bags and filters.
- Window cleaning procedures – these guidelines apply to both wet and dry dispersion units; refer to this section as required.
- Autosampler 2000 – describes cleaning the tray, de-scaling the wash pot shower outlets, replacing sample delivery tubing and replacing the Y-piece.
- Replacing the fuses for all units (**not an operator procedure**).

Warnings

**Warning!**

Before carrying out any maintenance operation, read and observe the safety warnings listed in **Chapter 3**.

**Warning!**

The system contains no internal serviceable parts. Never attempt to remove the covers of the optical bench or an accessory or dispersion unit. Removal of the covers invalidates the warranty and may expose the user to dangerous laser radiation.

**Warning!**

Failure to follow these guidelines could result in the emission of laser radiation or exposure to hazardous voltages. Laser radiation can be harmful to the body and can cause permanent eye damage.

Hydro and Scirocco dispersion units do not contain a laser but are connected to the optical bench that does. The Autosampler 2000 also contains a laser.

Optical bench

**Warning!**

Before cleaning, always disconnect the unit from the power supply and computer and disconnect all electrical cables.

Ensure the unit is completely dry before re-applying power.

Cleaning the covers

**Caution!**

The surfaces of the system may be permanently damaged if samples or dispersants are spilt on them. If a spillage occurs, disconnect the system from the power supply before carefully cleaning it up.

Periodically clean the covers thoroughly using a mild soap solution.

Never use excessive liquid for cleaning and always avoid electrical components (connectors, etc.) and the cell windows.

Never use a solvent based solution for cleaning; it may damage the surface.

Cleaning the cell area

**Caution!**

The cell area contains delicate optical devices that have their own cleaning procedures, outlined later in this section. Never use the procedure for cleaning the cell area to clean the optical devices.

Periodically clean the cell area thoroughly using a mild soap solution.

Never use excess liquid to clean the instrument. Always avoid optical components (detectors, protection window and lenses).

Never use a solvent-based solution to clean the cell area; it may damage the surface.

Check the cell area's cleanliness at least once a week.

Cleaning the optics

The cell area contains delicate optics that require special cleaning procedures. Inspect the following for cleanliness every day:

- Protection window.
- Backscatter detectors.
- Lens.

Dust on device surfaces can be removed using a compressed gas duster can or a specialist camera lens brush. Keep the can upright in use to prevent liquid emerging. Avoid handling the brush bristles as grease from fingers will be transferred to the optics. If unsure that the brush is clean, rinse it in ethanol and let it dry before use.



Caution!

Do not wipe the optics with an ordinary dry cloth; this causes scratches. Always use the procedure below to clean the surfaces.

Inspect the devices by reflected light for any smears or prints. If they're found:

1. Breathe on the device surface to wet it.
2. Gently wipe a good quality lens tissue over the wetted surface once. Do not touch the device while wiping it. Re-inspect; if it's still marked, repeat with another clean tissue.
3. If the mark remains consider using a liquid cleaner like Ethanol Absolute or Propan-2-ol. Soak a cotton wool bud and wipe it across the device gently. After one pass discard the bud to avoid scratching. Re-inspect and repeat until clean.

Wet dispersion units

This section covers all the Hydro 2000 dispersion units.

Maintenance schedule

Follow the maintenance schedule below to keep the dispersion unit working well. This list is only a guide; the exact frequency at which to perform tasks depends on many factors, including:

- The samples being measured.
- The dispersant being used.
- The environmental conditions.
- The number of measurements made (frequency of use).

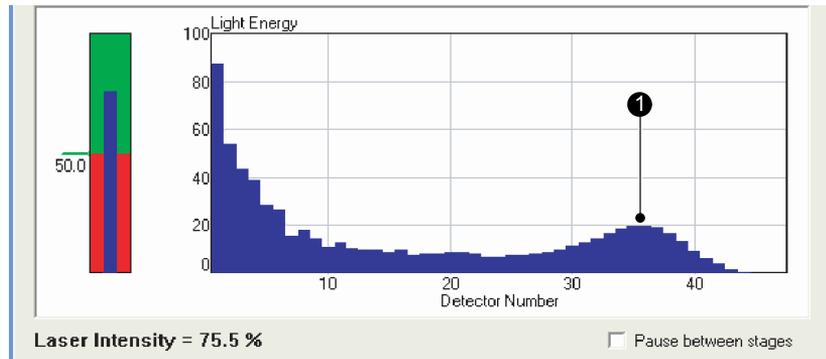
Procedure	Period/situation
Inspect the cell windows for dirt and scratches	At least once a week, or if during a background measurement either of these is seen: - one of the first few detectors displays a value above 100 Light Energy units. - background signal over 20 Light Energy units recorded by one of the detectors above detector 20 (see below).
Check the window seals for damage	At least once a month. Always watch for signs of leaks and rectify immediately.
Clean the covers	Once a month.
Clean the sample tank	If changing dispersant types, or if sample is seen to adhere to the sample tank and the normal flush routine fails to remove it.
Replace the dispersant tubing	If the tubing leaks or becomes discoloured. This may allow bubbles to enter, causing rapid fluctuations in the background (see below).
Perform a Quality Audit Standard measurement	At least once a week or as internal quality procedures specify.
In addition, on a Hydro 2000 μ P do the following:	
Replace the dispersant inlet valve	If the valve shows signs of leaking.
Replace the dispersant syringe	If the syringe leaks or becomes discoloured.

Poor background

Problems which indicate the need for cleaning or maintenance are the following. These expand on the situations in the first row of the above table.

Material stuck to windows

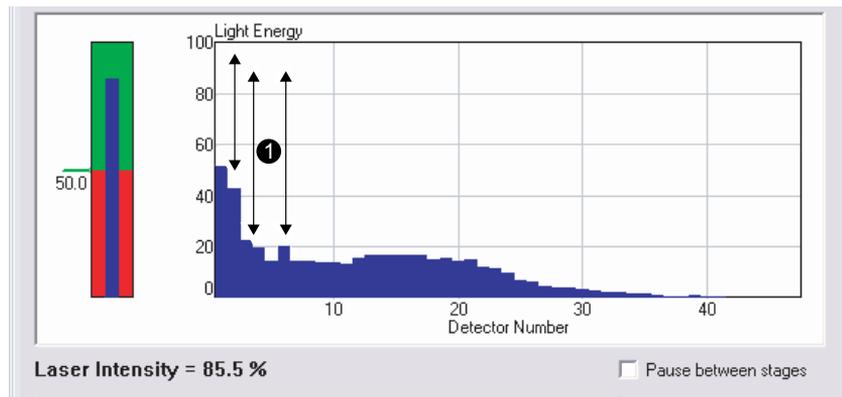
Significant scattering on high number detector channels, as shown below ①, often indicates that fine material is stuck to the cell windows:



iii 8011

Contaminated dispersant or air bubbles in system

Contamination by coarse particles or bubbles in the dispersant may cause fluctuations in the background over time. This shows as rapidly changing readings ① on the first few detectors. For example, the Light Energy reading for a detector may show 20 units one moment and then 200 units the next.



iii 8012

Bubbles may enter the system:

- as a result of using high pump or stirrer speeds with viscous dispersants or those containing surfactants.
- due to leaking tubing or seals.

Cleaning

Clean the covers as described earlier for the optical bench.

Cleaning cell windows

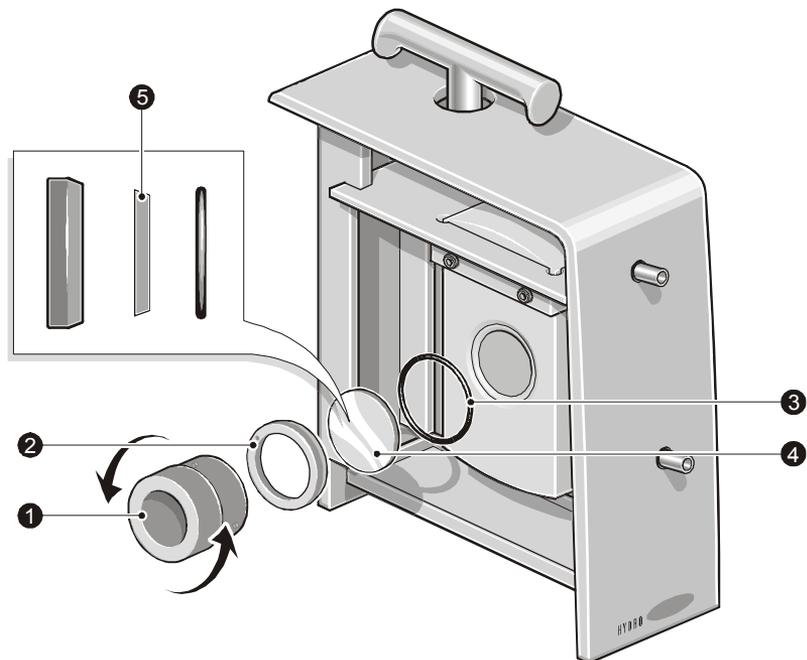
Cleaning the system by rinsing through with fresh dispersant a couple of times is usually sufficient to prepare for a new measurement. Over time, users will notice that they cannot achieve such a good background measurement (see **Chapter 4** of the main **User Manual**). This is the time to clean the cell windows.

Before starting, ensure that the cell has been drained of dispersant and remove the cell assembly from the optical bench.

Replace windows if necessary. Always replace both windows at the same time, as the second window will probably fail an inspection soon after the first.

► To remove the cell window (Hydro 2000G/S/SM/MU):

1. Insert the two pegs on the window tool ① (found in the base of the cell holder) into the holes on the metal retaining ring ②.



2. Rotate the window tool anti-clockwise and remove the ring ②.
3. If the O ring ③ does not come out with the ring, carefully remove it with tweezers.

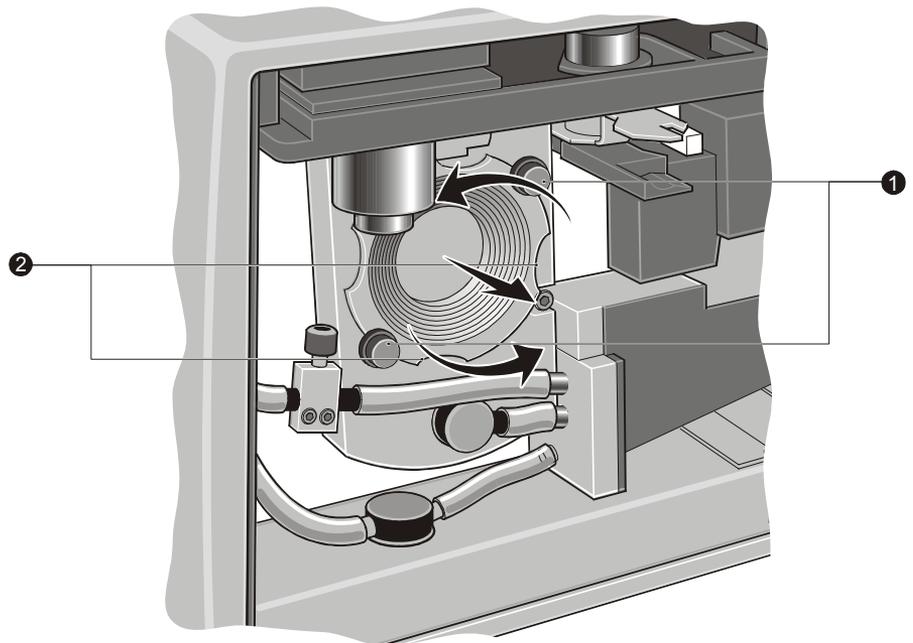
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4. Tip the window ④ out of the retaining ring onto a clean paper towel.

**Caution!**

The outer faces of the cell window are optically coated; treat them with the same care as a camera lens.

5. Inspect both sides of the cell window. If there are any signs of scratches, replace the windows. Spare windows can be obtained from a Malvern representative.
 6. Clean the windows as described in **Window cleaning procedures** below.
- **To remove the cell window (Hydro 2000 μ P):**
1. Ensure that the cell has been fully drained.
 2. Disconnect the control cable (and ultrasonics cable if fitted).
 3. Loosen but do not remove the two window ring lock screws ①.



4. Rotate the window ring so the removal notches ② align with the lock screws.
5. Grip the window ring and lift it clear. This is easier after moving the cell latch out of the way. The window and its seal will come away with the window ring.
6. Detach the window and seal from the window ring. Replace damaged O rings.
7. Clean the windows as described in **Window cleaning procedures** below.

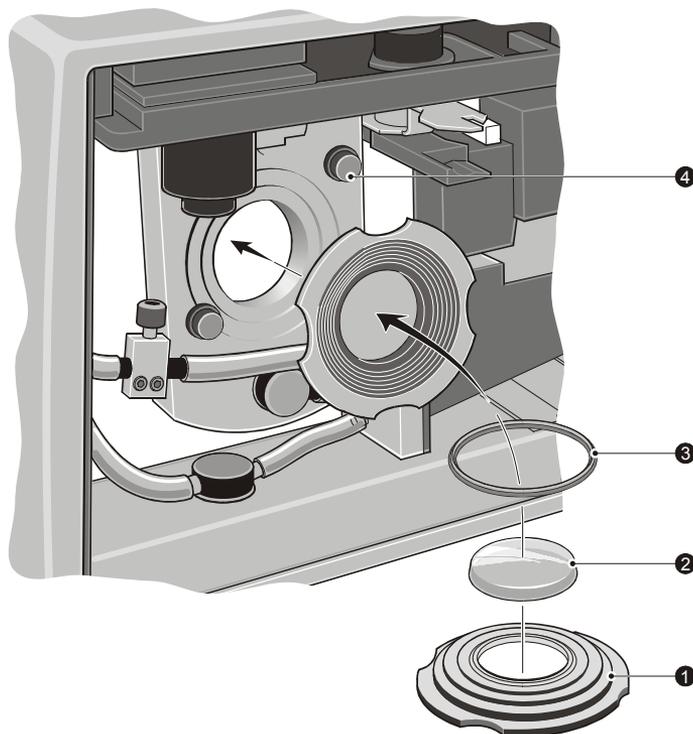
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► **To re-assemble the windows (Hydro 2000G/S/SM/MU):**

1. Place a piece of tissue over the window to prevent finger marks getting onto the surface, then push the window into the retaining ring. The window has a chamfered edge and the side with the widest diameter must face outward. The diagram above shows this orientation ⑤.
2. Add the O ring to the window ring so it fits around the window chamfer.
3. Screw the window ring back in place. Ensure the window is fully home in the mount and is not held back by the O ring, otherwise the window will move when the dispersant flow is changed, causing the system to optically misalign.
4. Replace the cell in the optical bench. Take care to connect the tubes the correct way round.
5. To check for leaks, pump dispersant through the cell. Check that no dispersant leaks from the cell windows or sample tube connectors.

► **To re-assemble the window ring (Hydro 2000 μ P):**

1. Place the window ring on a clean, flat surface, with the “domed” surface of the window ring facing upwards ①.



iii 5803

2. Place the window on the centre of the window ring, making sure that the bevel on the window tapers in towards the top ②.
3. Loosely place the seal around the window, making sure that the raised edge of the seal faces upwards ③.
4. Push the seal in around the window. This can be difficult as the seal is designed over-size to ensure a good seal and minimise particle traps. Do not touch the surface of the window during the procedure. We recommend placing the fore-fingers on opposite sides of the seal (with both of the fingers pointing towards the centre of the window) and push the seal into place. Do not use fingernails to push the seal in as this may cause permanent damage to the seal. Rotate the window ring and repeat. Continue until the seal is in place.
5. Hold the window ring assembly at a shallow angle and inspect for any high areas around the seal. Gently push these down so the seal is at an even height.
6. Fit the window ring to the cell, ensuring the seal side of the window ring faces into the cell.
7. Give the window ring a 1/8th turn.
8. Initially, slightly over tighten the two lock screws ④. This will bed the seal in properly.

**Caution!**

Never leave the window ring over tightened. This may cause measurement errors.

9. Slacken the two lock screws and then re-tighten them until the seal compresses slightly.

Cleaning the flow path (Hydro 2000MU and SM)

Usually, draining and rinsing the beaker then circulating clean dispersant through the cell a few times is sufficient. However, over time deposits may accumulate on the pump/stirrer head.

Inspect the head weekly. If it requires cleaning, disconnect the dispersion unit from the mains power and use a bottle brush to clean it. Use a detergent (e.g. Decon 90) if required. Rinse the head thoroughly to remove all detergent traces.

Cleaning the tank (Hydro 2000G/S)

**Warning!**

Never put fingers in the tank when the pump/stirrer shaft is rotating.

Usually the cleaning routine from the **Configure-Accessory** dialogue is sufficient to keep the tank clean. However, over time deposits may accumulate in the tank.

Inspect the tank once a week. If it requires cleaning, disconnect the dispersion unit from the mains power and use a bottle brush to clean it. Use a detergent (e.g. Decon 90) for cleaning if required.

Make several clean flushes to clear all traces of detergent and deposits in the tank.

Cleaning the level sensor (Hydro 2000G/S)

**Caution!**

Do not use detergents to clean the level sensor.

The level sensor can be falsely triggered if it becomes dirty. Clean it weekly by wiping the end with a clean cloth moistened with water or the solvent routinely used in the dispersion unit.

**Note**

For particularly sticky and persistent samples, gentle scrubbing with a soft toothbrush should remove all deposits.

Cleaning the well cone (Hydro 2000 μ P)

**Warning!**

Due to the possible risk of sonication of the blood and its unknown effects, never put fingers in the well cone when the ultrasonic probe is operating.

The cleaning routine from the **Configure-Accessory** dialogue usually keeps the well clean, but over time deposits may accumulate on the well cone. Inspect the well weekly; if it requires cleaning, disconnect the dispersion unit from the power supply then use a very small, non-shedding bottle brush or pipe cleaner to clean it. If required, use a detergent (e.g. Decon 90) to aid cleaning.

Make several clean flushes to clear all traces of detergent and deposits in the well.

Replacing the sample tubing

**Warning!**

When changing the tubing do not allow any dispersant or sample to come into contact with the system covers. Some samples can cause permanent damage to the surfaces.

**Warning!**

Do not allow dispersant or sample to come into contact with the skin. Some dispersants and samples may cause injury.

If organic solvents are regularly used as dispersants, the flexible tubing that connects the dispersion unit to the air cell may become hard and discoloured. When tubing loses its elasticity, air will leak into the system at the connections to the sample unit and cell. The resulting bubbles in the system cause instability in the backgrounds and sample measurements.

When tubing hardens, moving a dispersion unit relative to the optical bench may cause the tubing to become detached.

To change the tubing, ensure that the cell and tubing are fully drained, then simply pull it off the metal connecting ports and replace with new tubing. Push the new tubing onto the pipe boss to a minimum of 7mm.

The tubing originally supplied by Malvern is Tygon™ available from Cole-Parmer Instrument Company. Tygon™ is chemically compatible with a wide range of materials. Contact the manufacturer for full information on compatibility.

To retain chemical compatibility, always replace tubing with tubing of the same or better grade. Always check the compatibility of new tubing with the samples in use before connecting and using the system. Refer to **Appendix B** of the **dispersion unit manual** for information on chemical compatibility.

The specification of the tubing is:

- Internal diameter - 5/16".
- External diameter - 1/2".

Dispersant input assembly (Hydro 2000 μ P)

The dispersant input assembly comprises the dispersant syringe, non-return valve and inlet tube. Inspect these periodically for leaking, discolouration and blockage.

Dispersant syringe

Replace the dispersant syringe if it becomes permanently contaminated by a dispersant or starts to leak.

We do not recommend removing the plunger too often during cleaning as it will wear on the inside of the syringe barrel, causing leaks. To avoid excessive cleaning, we recommend using one syringe for each type of dispersant used. This also reduces the risk of cross-contamination.

When removing and re-assembling the syringe plunger, wet both the plunger and barrel surfaces to reduce wear.



Warning!

To reduce the risk of spillage, we recommend using only syringes supplied by Malvern Instruments.

Other syringes must meet the **Chemical Compatibility** guidelines in the **Hydro 2000 μ P User Manual**. Also, they should not exceed 20ml capacity to reduce the risk of overfilling the cell.

Dispersant inlet tube

Replace the dispersant inlet pipe if it becomes contaminated, discoloured or starts to leak.

To replace the tube, first ensure that it is empty by using a syringe to inject air through it, then simply unscrew the connector from the cell unit and pull from the non-return valve.

Dispersant inlet valve

Only replace the dispersant valve if it becomes contaminated or starts to leak.

Dry dispersion units

Follow these procedures for the Scirocco 2000 and Scirocco 2000M.

Maintenance schedule summary

Follow the maintenance schedule below to ensure that the dispersion unit continues to function correctly. This list is only a guide; the exact frequency at which to perform tasks depends on many factors, including:

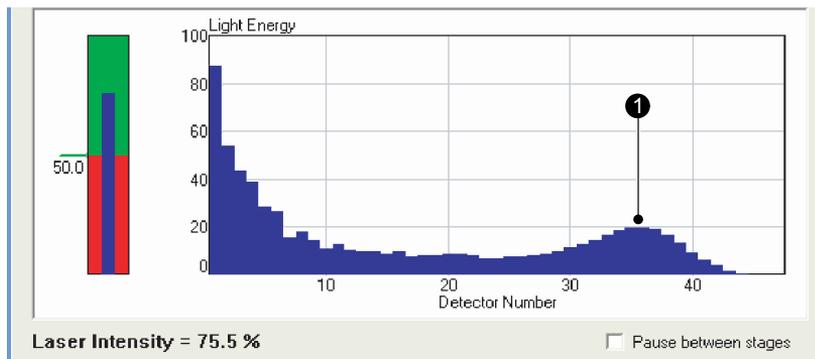
- The sample being measured.
- The dispersant being used.
- The environmental conditions.
- The number of measurements made (frequency of use).

Procedure	Period/situation
Inspect cell windows for dirt and scratches	At least once a week, or if during a background measurement either of these is seen: <ul style="list-style-type: none"> - one of the first few detectors displays a value above 100 Light Energy units. - background signal over 20 Light Energy units recorded by one of the detectors above detector 20 (see below).
Clean the unit	Check/clean sample tray and venturi at least daily. Check/clean vacuum cleaner bag weekly. Check/clean air filters monthly.
Clean the covers	Once a month.
Replace sample tubing	Weekly.
Perform a Quality Audit Standard measurement	At least once a week or as internal quality procedures recommend.

Poor background

This section expands on the situation in the first row of the above table.

Significant scattering on high number detector channels, as shown below ①, often indicates that fine material is stuck to the cell windows:



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Cleaning the sample tray

Clean the covers as described earlier for the optical bench.



Warning!

If the Scirocco has been used to measure hazardous materials (see the notes in the **Health and Safety** information), the vacuum used must have an efficient filter that stops particles being ejected into the atmosphere.

We recommend cleaning the dispersion unit periodically using the vacuum nozzle and soft brush provided. Always remove the stainless steel balls before cleaning.

► To clean the sample tray:

1. Disconnect the dispersion unit from the power supply.
2. Remove the sample tray by releasing the locking screw. Clean any spillage seen through the aperture in the top of the main cover. Clean the covers with a damp cloth but **do not** use solvents here: it may cause permanent damage.

On a system in regular use, some powder build up will occur in the cone, nozzle, transport tube and exhaust throat. The speed at which this develops depends on the materials measured and their adhesion properties.

This build up is not a problem unless it restricts the airflow significantly. However, if it becomes excessive, the dispersion unit may begin to “pulse” in flow rate, or shed material back into the airflow causing measurement problems.

We recommend periodically running a fine abrasive grit through the dispersion unit to clean off attached powder. Clean the cone more frequently if required using a bottle brush. This is easiest with the sieve and sample tray removed.

**Caution!**

When handling the sieve take extreme care to avoid letting ball bearings fall into the dispersion unit. If this happens call Malvern Instruments to arrange a service call. **Do not** attempt to remove the ball bearings or allow the dispersion unit to be used.

If the sieve clogs with powder, a simple way to clear it is to detach the tray, remove the sieve (using the sieve tool provided) and empty its contents into the tray, then gently tilt the tray. The ball bearings will roll and separate from the powder. To clean more thoroughly, dip the sieve tool into a beaker of water with the sieve still attached and the ball bearings captive. Brisk agitation will rinse the basket and balls that can then be dried.

Cleaning after measurements

Cleaning must match the intensity of usage and the adhesion properties of materials. Generally, the advice is as follows:

Every 20 measurements:

- Inspect and, if necessary, clean the cone area under and around the sieve.
- Inspect the contents of the sieve to see if large sample agglomerates are gathering. If so, separate the balls from the agglomerates and refill the sieve with balls.
- Brush the tray/hopper and surrounding area clear of sample, taking care not to introduce dust onto any optical components.

Every 100 measurements:

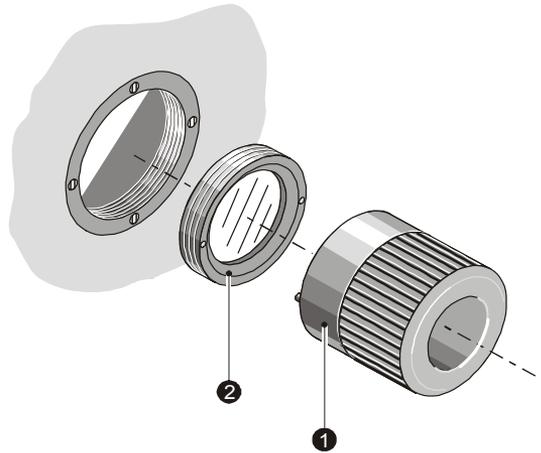
- Repeat the above, but also run abrasive grit through the instrument for approximately five minutes. If necessary, repeat until clean. Use about one heaped desert/table spoon of grit with maximum feed rate and a pressure of 3 bar g.
- Change the filters in the vacuum unit.

Cleaning the cell windows

Check the cell windows for cleanliness every day.

► **To clean a cell window:**

1. Insert the pegs on the window tool ① (kept in the cell holder base) in the two holes on the retaining ring ②.



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Caution!

Take care when removing and replacing the windows not to touch the surfaces of the glass with the fingers.

2. Rotate the window tool anti-clockwise and remove the ring ②. Unlike Hydro 2000 windows, the window rings remain in place during cleaning.
3. Inspect both sides of the cell window. If there are traces of scratches replace the windows. Spare windows can be obtained from a Malvern Representative.
4. Remove any dust on the window surfaces using a compressed gas duster can. Keep the can upright in use to prevent liquid propellant emerging. Do not shake the can immediately before use or it will emit liquid propellant.



Caution!

Do not wipe the windows with an ordinary dry cloth as this will cause scratches. Always use the procedure below to clean the surfaces.

5. Inspect the window by reflected light for smears or prints.

6. Clean the windows as described in the **Window cleaning procedures** section below.
7. Replace the window in the cell using the window tool, taking care not to touch the glass surface.

**Note**

The cell windows are part of the optical system and removing them for cleaning will change their position. Remember to add an **Align** stage to the next measurement sequence or click the **Align** button.

► **To re-assemble the windows:**

1. Screw the window ring back in place.
2. Ensure that the window is fully home in the mount, otherwise it will move when the air flow is changed, causing the system to optically misalign.

Replacing tubing

The vacuum sensor tube or sample tube may need replacing.

Vacuum sensor tube

Inspect the vacuum sensor tube regularly since the seal it makes can weaken as the tube loses its elasticity. If a vacuum error occurs, cutting 1cm from each end of the tube often cures the problem. After doing this two or three times, replace the tube.

Sample tube

The bore of the sample tube will eventually become coated with a layer of powder. This can be removed by running a cleaning abrasive such as brown alumina through the feeder on a regular basis. Once this fails to clean the tubing, replace it.

Replacing vacuum cleaner bags

Vacuum cleaner bags lose their efficiency when choked by fine particles. This gradually destabilises optimum airflows within the unit, causing inconsistent results.

The fullness of the vacuum cleaner bag is not a reliable indicator of a need to replace the bag, particularly if the materials measured are very fine:

- Fine particles (1 to 10 microns) will quickly clog the pores in the bag without filling it.
- Coarse particles can half fill the bag before any destabilising effect is observed.

We recommend noting the interval between bag changes and always measuring a sample just before a bag is changed. Measuring the same sample after changing the

bag will show how smooth the transition between bags was. If a noticeable difference is observed, change bags more frequently.

Checking the air filter

If an air filter is fitted to the dispersion unit's air supply, clean or replace this as necessary. Drain any condensation from the filter bowl regularly.

Checking the exhaust vacuum filter

If the air exhaust is a vacuum filter system, ensure the filters are changed regularly as recommended by the manufacturer.

If the exhaust is a vacuum cleaner, regularly clean and empty this. Change the exhaust air filters regularly as recommended by the manufacturer.

Ensure that any hazardous waste collected is disposed of according to the **Material Safety Data Sheets** supplied with the material.

Window cleaning procedures (all units)

Follow these guidelines for windows from all dispersion units. References to O rings only apply to the wet dispersion units.

General guidelines

Laser light scattering systems rely on the cleanliness of the optical components (e.g. cell windows). Dust on the optics causes light scattering; the system will respond to particles on the optics in a similar way to particles presented in the flow cell. The signal from dirty optics will contribute to the background signal, so it is good practice to keep the optical components as clean as possible.

When optical components have been used for a long period, even in the cleanest laboratories, assume that they have traces of fine grit on them as well as the obvious dust. Fingerprints usually contain grease and grit so need careful cleaning.

As optical components are very expensive, take a cautious approach to cleaning, assuming that the contamination is worse than it appears. As grit is usually as hard, if not harder, than the glass used to make optical components, it is important to lift it away from the surface before wipes are used. Use minimal pressure to clean the surface. Repeat this if it doesn't work first time, but remember that scratching the optical surface ruins the component.

When cleaning a window, hold it with the fingertips and try to prevent them protruding above the surface. This prevents any grease from fingers being picked up by the tissue and deposited on the surface. To further limit problems of grease pick-up from the fingers, hold the window with the fingers at the top and bottom and wipe from side to side so that if any grease is picked up, it is not deposited on the surface.

Do not use rubber gloves to hold the window. Gloves invariably have oils and short chain polymers in the surface; some of these oils, especially silicone components, are more difficult to remove than finger smears. **Never bring silicone products into close contact with glass optical components.** Clean hands are best.

Cleaning procedure:

1. Inspect the window in reflected light from a fluorescent tube or other light source. If there are any smears or prints, breathe on the window to moisten it and gently wipe its surface once with a good quality lens tissue. Do not touch the window with fingers during this wipe. Re-inspect the window; if it's still marked, repeat with a new clean tissue.
2. If marks remain, use a liquid cleaner such as Ethanol Absolute or Propan-2-ol. This can be soaked on a cotton wool bud and wiped across the window gently. After one pass over the window discard the bud to avoid scratching. Re-inspect the window and repeat until clean.

**Caution!**

The outer faces of the windows have an anti-reflective coating and are more prone to scratching than the inner surfaces. Be careful not to touch the faces of the windows or put them down on dirty surfaces.

3. If the surface is just dusty use a clean air aerosol duster (see **“Clean air” aerosol dusters** below) or soft brush (see **Brushing optical surfaces** below).
 4. If the surface is smeared but you are sure there is no grit on it, wipe the surface as described below in **Wiping cell windows**.
 5. If the surface has fingerprints on it or has not been cleaned for a long time, assume there is grit on it. Wash the surface (see **Washing cell windows** below) then wipe it as described below in **Wiping cell windows**.
-

**Caution!**

Never use acetone for cleaning optical components as the adhesives used to bond them may leach out and be deposited across the component, rendering it useless. Ethanol is much safer.

“Clean air” aerosol dusters

If used appropriately, these can quickly clean the worst dust off a component. These cans use liquefied butane which boils off when the valve is pressed down, producing a blast of gas to blow dust off the optical surface. Do not use these in a dusty environment as it stirs up settled dust, which settles on the surface being cleaned.

The aerosols only remove the largest and most loosely attached dust particles, but can often deposit droplets of liquid butane on the optical surface. These droplets boil away leaving a drying mark on the surface. This effect can be limited by keeping the aerosol perfectly upright, and testing the aerosol first by squirting it in a safe direction to ensure that the nozzle is clean.

Brushing optical surfaces

Camera suppliers sell large soft brushes for brushing dust off camera lenses. These often have a bulb attachment to blow gently on the lens to assist in removing dust. Use the brush with a light flicking action to knock dust off without applying pressure to the surface.

Avoid a typical “brushing” action; as the brush is moved sideways grit trapped in the brush is dragged across the surface, scratching it. These scratches accumulate with subsequent cleaning, causing early failure of the component.

Avoid fingering the brush itself as grease from fingers will stick to the brush and be transferred to the window when the brush is used.

**Caution!**

All other optical assemblies require precision mounting and alignment. Never attempt to remove these from the system.

Washing cell windows

The procedure is:

1. Remove the window from the cell.
2. Pour a small amount of dilute detergent solution into a flat container such as a petri dish. For really dirty windows, or when contamination with grit is suspected, use a very dilute detergent solution. A neutral detergent like Decon75 is best, although most detergents sold for cleaning glassware can be used if sufficiently dilute.
3. Hold the window above the dish with the surface to be cleaned facing downwards. Using a very soft brush, such as squirrel hair or sable, run the detergent solution across the surface. The window may need angling slightly to allow the liquid to run across it. Use the brush to lift the liquid, allowing it to run across the surface, but not to rub.
4. Once the surface has been flooded a few times, adopt a gently flicking action as described above. Wet the brush and try to flick away the dirt on the window. As before, avoid applying any pressure to the surface and work across the whole area, flicking the grit away.
5. Do not expect to remove all the greasy smears or O ring marks at this stage; they will be removed by wiping later. The aim is to weaken the bond between the grit/grease and the glass surface, allowing it to be lifted away by the water.
6. After carefully cleaning both sides of the surface, wash away the dilute detergent solution by flooding the surface with ethanol from a wash bottle.
7. Wipe as described below to produce the final clean surface.

Wiping cell windows

Fold a piece of lint free cloth (proprietary lens tissue is best) into quarters. The edge that wipes the surface should be large enough to span the whole width of the window. If the tissue is too small a corner of the wipe will be drawn across the surface, leaving a smear.

**Caution!**

If any silicone oils are deposited on the glass surface they adhere so strongly that it is impossible to clean them off, ruining the component.

The procedure is:

1. Gripping the tissue about half way down, dampen the edge of the tissue with a small quantity of ethanol (too much will flood the tissue). Allow the ethanol to soak in.
2. Breathe gently on the window, allowing warm moist air to condense on the optical surface, producing an even fogging without wet spots. Immediately wipe the whole surface in a single positive action before the condensed water vapour disappears. Do not put fingers behind the tissue to press it down; use the stiffness of the tissue to hold itself against the surface, curving the tissue to increase the pressure if necessary. This not only limits the pressure that can be applied to the surface but prevents grease being dissolved off the fingers and passing through the tissue and onto the surface.
3. Use each tissue for one pass only. This is the only way to ensure a clean undamaged surface. If a wipe has done its job it will be loaded with grease from the surface. Wiping the surface again will just deposit the grease back on the surface. Worse, if the wipe has lifted off some remaining grit this could scratch the clean surface.
4. Marks from the O rings usually form an oily line around the outer part of the optical surface. With surfaces contaminated in this way, wiping from the centre outwards prevents the oily mark from being spread from an unimportant area across the window centre. If there are smears associated with starting the pass in the centre of the surface, once the O ring marks have been completely removed give the surface a single wipe from side to side.

Autosampler 2000

This section covers regular Autosampler 2000 maintenance.

Cleaning the Autosampler 2000 tray

The Autosampler tray is mounted on a platter. It can simply be lifted off the platter and the underside of the tray then wiped down with a mild soap solution. Ensure that the sample pot positions on the tray are clean, so that pots sit flat on it. To correctly replace the tray, position it on the platter and turn it until it clicks into place.

Clean the inside and outside of the baffle on the stirring head using a cotton bud moistened with mild soap solution.

De-scaling the wash pot shower outlets

In hard water areas, inspect the wash pot shower outlets periodically for signs of limescale buildup. In severe cases, limescale will block the outlets.

To remove any deposits, insert a pin into the holes until the obstruction clears.

A better solution is to install a mechanical/electrical limescale removal device on the dispersant inlet to the shower.

Changing the sample delivery tubing

The tube that delivers sample from the Autosampler to the Hydro 2000 tank may occasionally need replacing. To do this:

1. Initiate a cleaning cycle (use the **Clean** button in the **Autosampler Accessory** window). This flushes dispersant through the tube, making sure there is no residual sample to leak from the tube and cause injury. Switch the Autosampler off and disconnect it from the mains power supply.
2. Pull the sample delivery tube (loose at the Hydro 2000 end) out of the tank cover. There is no need to remove the tank cover. Users who do remove the cover must note the following warnings:



Warning!

Never put fingers into the tank when the pump/stirrer shaft is rotating.

**Warning!**

Due to the possible risk of sonication of the blood and its unknown effects, never put fingers into the tank when the ultrasonic probe is in operation.

3. Loosen the sample delivery tube at the Autosampler by squeezing the hose clamp tabs together with a pair of pliers.
4. Remove the old tube, replace it with new clean tubing and replace the clamp.

Replacing the Y-piece

Replace the Y-piece regularly, depending on the amount of use and type of sample being measured. Request part ASU4026 from a Malvern representative. The pack includes a Y-piece and tie wraps for securing it to the pipework.

**Warning!**

Disconnect the Autosampler from mains power before beginning so the Autosampler is not operated while you are replacing the Y-piece.

**Warning!**

Wear gloves when changing the tubing as the Y-piece may contain a hazardous dispersant.

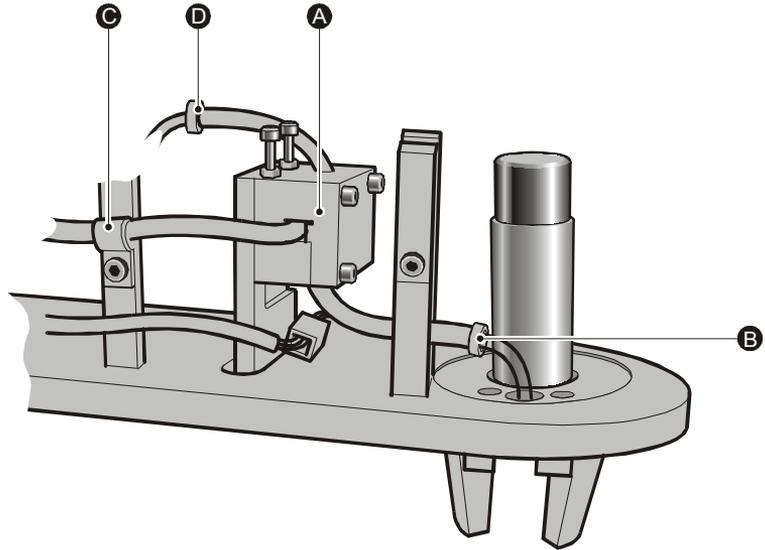
**Caution!**

When changing the tubing, do not allow any dispersant to come in contact with the system covers. Some dispersants and samples can permanently damage the surfaces.

Y-piece replacement procedure

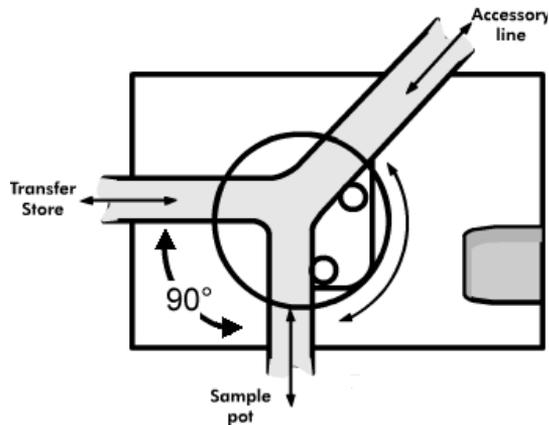
The Y-piece assembly is fitted by placing it in the Y-piece valve assembly. No setup of the clamping action is required.

- ▶ **To replace the Y-piece:**
 1. Switch the Autosampler off and disconnect it from the mains. This places the clamping pins in the resting position (above). No clamping should be present.
 2. Remove the arm cover. It is held by spring fixings and simply pulls off.



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3. Slide off the retainer clips that hold the Y-piece to the dip tube ②, the transfer store ③ and the accessory line ④.
4. Remove the Y-piece.
5. Place some silicone grease or similar on the clamping pins.
6. Push the new Y-piece into the valve assembly. Ensure the Y-piece is inserted with the **90° corner** to the **bottom left** on the valve assembly as shown below:



7. Push each end of the Y-piece onto the pipework.
8. Check there are **no kinks or tight bends** in the Y-piece when fitted. If there are, remove from pipework and cut as required. Only **smooth bends** should be present.

- Secure the Y-piece to the pipework with the tie-wraps.

Checking the Y-valve operation

Using the **Autosampler accessory** controls, check the operation of the Y-piece valve. This is done using the cleaning commands.

Checking the Head/sample pot line position

- Connect the Autosampler to the mains power and switch on.
- In the Malvern software select **Configure-Autosampler** to open the **Autosampler Accessory** dialogue:



- Under **Cleaning**, select **Clean accessory line only** and press **Clean**. The valve will move to clamp the head/sample pot line.
- Check that **no dispersant** appears in the head/sample pot line during the transfer. If it does an engineer will be required to reset the valve.

Checking the Accessory line position

- Under **Cleaning**, select **Clean head line only** and press **Clean**. The valve will now move to clamp the accessory line.



- Check that no dispersant appears in the accessory line during the transfer. If it does an engineer will be required to reset the valve.

Replacing fuses

If the optical bench or a dispersion unit does not power up, a fuse may have blown. Follow the relevant section below.

**Warning!**

Fuses must not be replaced by the operator. Only the supervisor or a Malvern representative should attempt to replace the fuses.

**Warning!**

Always disconnect the mains power supply before attempting to replace a fuse.

**Warning!**

Failure to replace the fuse with a fuse of the correct size and value may result in hazardous operation.

Power lead fuses

Replace power lead fuses with a fuse suitable for the cable. This only applies to 240V power leads; 220V and 110V power leads are not fitted with integral fuses. The power lead fuse for the optical bench is a standard domestic 5A fuse.

Optical bench

The fuse is in the plug on the 240V power lead (see above).

Hydro 2000G/S/MU

The fuse is located on the rear panel in the mains power switch.

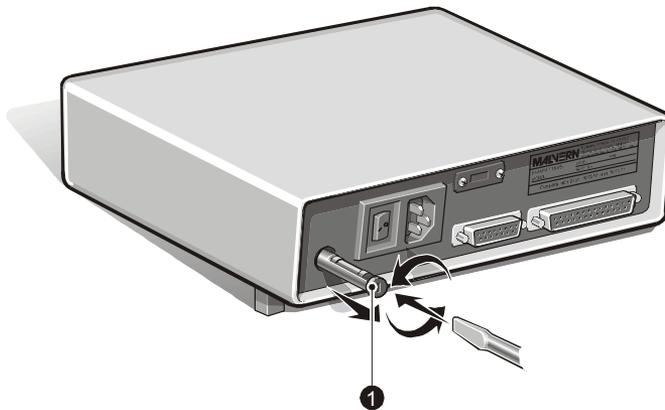
Before attempting to change the fuse, disconnect the dispersion unit from the power supply. The fuse holder can then be pulled out. If the fuse requires changing, it can be simply pulled out of the holder and replaced with two **20mm type T5A** fuses.

Hydro 2000 μ P

There is no user-changeable fuse except for that in the power lead.

Hydro 2000SM

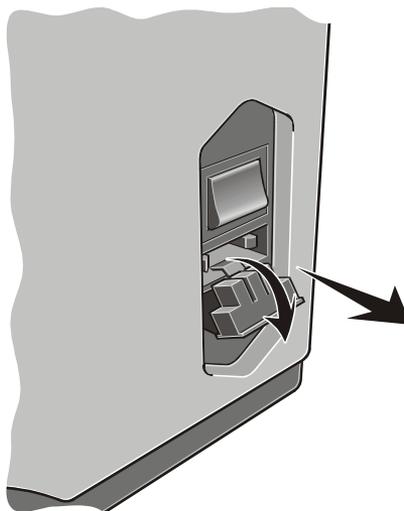
If the dispersion unit motor fails to run, check the fuse in the dispersion controller. It is located on the back panel as shown below ①. Disconnect the power supply then turn the fuse holder anti-clockwise until the fuse tray may be pulled out. Lift out the fuse. If it needs replacing, replace it with a new **20mm T0.25A** fuse.



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Autosampler 2000

The fuse is in the mains power switch on the side of the Autosampler. Disconnect the Autosampler from the mains power supply then pull out the fuse holder:



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If the fuse needs changing, simply pull it out of the holder and replace it with two 20mm type T5A fuses.

Scirocco 2000

The supervisor can change these fuses:

- The main dispersion unit fuse – located on the rear panel in the power switch.
- The vacuum switcher unit fuse – located next to the “From dry powder feeder” connector on the vacuum switcher unit.

Main dispersion unit fuse

The fuse is located on the rear panel in the power switch.

Disconnect the dispersion unit from the power supply then pull out the fuse holder. If the fuse requires changing, replace it with two 20mm type T2A fuses.

Vacuum switcher unit fuse

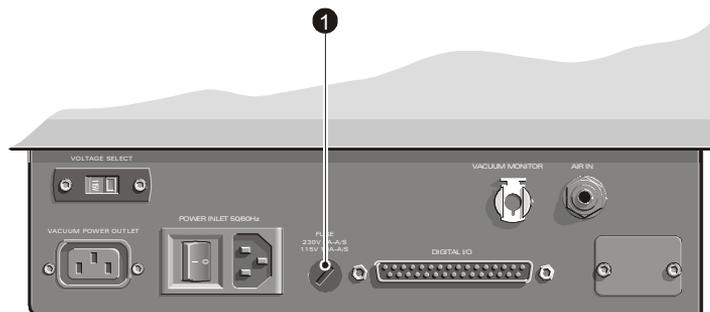
If the vacuum unit fails to switch on when requested, check the vacuum switcher unit fuse. This fuse is located next to the “From dry powder feeder” connector on the vacuum switcher unit.

First disconnect the dispersion unit from the power supply. Next unscrew the fuse holder (using a small flat-bladed screwdriver) and pull it out. If the fuse requires changing, simply pull it out of the holder and replace it with either of these:

- 1.25" type T10A fuse for 100 to 120V applications.
- 1.25" type T6.3A fuse for 200 to 240V applications.

Scirocco 2000M

The fuse is located on the side panel ①. Disconnect the power supply before removing the fuse holder cover.



If the fuse requires replacing, remove it and replace it with this new fuse:

- 100V - 120V use 20 mm T10A type fuse.
- 200V - 240V use 20 mm T5A type fuse.

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Installation

Introduction

This chapter explains how to reconnect the system if it is moved **after** it has been commissioned. Systems **must** be commissioned initially by a Malvern Instruments representative.



Caution!

If a system is covered by a QSpec contract, only move it under the supervision of a Malvern Instruments representative.

This chapter covers:

- Guidelines to follow before starting.
- Connecting the optical bench and computer.
- Connecting wet dispersion units – covers Hydro 2000 dispersion units.
- Connecting dry dispersion units – covers Scirocco dispersion units.
- Connecting multiple dispersion units – “chaining” units.
- Connecting the Autosampler 2000.
- Powering on the system.
- Testing the system.
- Installing the software – how to install the software on a new computer.

Refer to the computer and printer manuals for details on their connection.

Guidelines

Ensure that the new location of the system has the correct services and space **before** attempting to move the system; see **Chapter 2**.

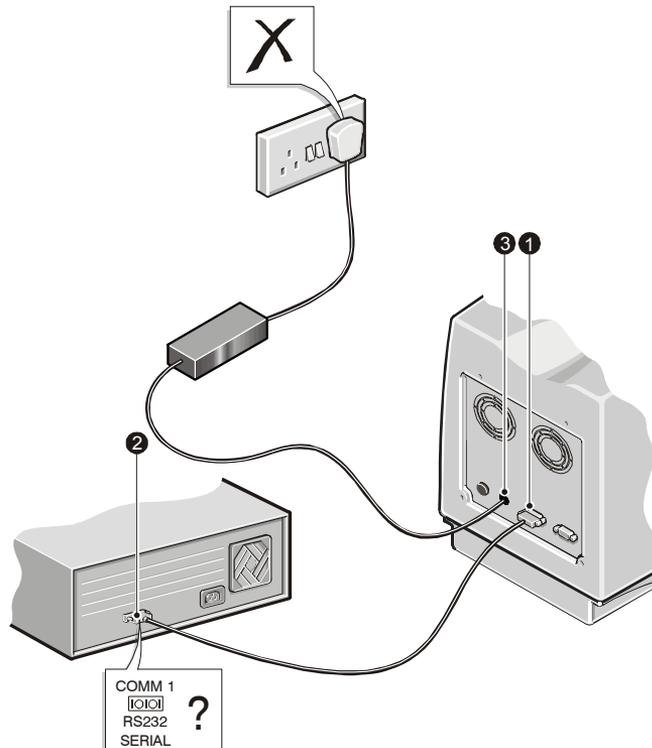
Before moving the system, ensure that any wet dispersion units are drained, any air lines for dry dispersion units vented, and the system allowed to cool. All pipes and cables must be disconnected before moving a dispersion unit.

To verify that the system has not been affected by the move, make a measurement of a standard sample **before and** after moving the system. If the results differ significantly, check through this installation procedure to see if any mistakes were made. Contact your Malvern representative if the difference persists.

Connecting optical bench and computer

► To connect the optical bench and computer:

1. With the computer switched off, connect one end of the RS232 cable to the **Computer** socket on the optical bench ①.



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2. Connect the other end of the RS232 cable to the computer socket marked **COMM 1, RS232 1, IOIOI 1** or **Serial 1** ②. If the **COMM 1** port is being used by another device, change the COM port as shown below.
3. Plug the power cable into the power socket on the optical bench ③ but **do not** connect to the power supply at this point.

**Warning!**

We recommend that the computer and waste sink are not adjacent.

▶ **To change the COMM port:**

1. Start the Malvern software by double clicking on the Mastersizer icon.
2. Select **Tools-Options-Instrument port**.
3. Select from the COMM ports available.
4. Select **OK**.

Connecting wet dispersion units

This section covers the Hydro 2000G/S, SM, MU and μ P.

Connecting the Hydro 2000G/S

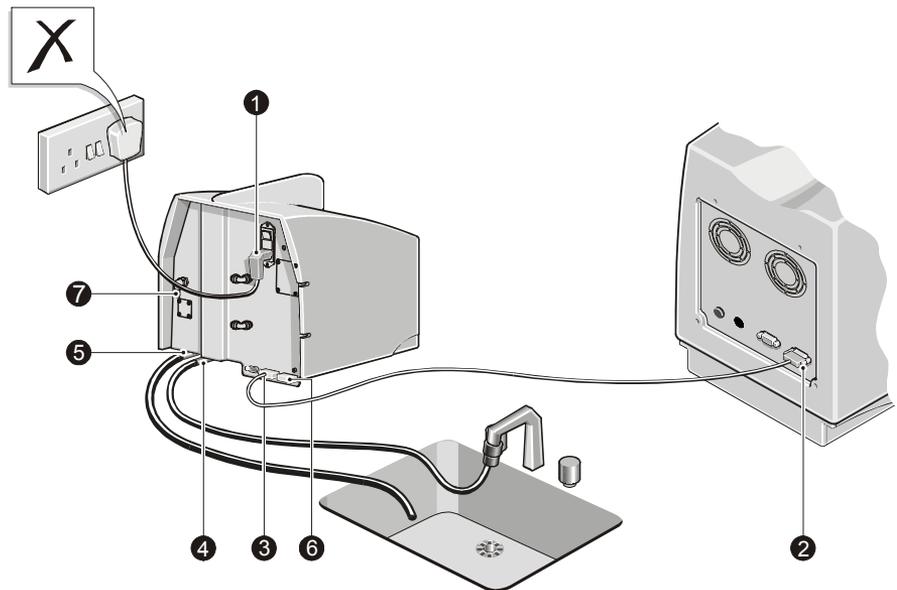


Note

All electrical cables and plumbing pipes (except the cell tubes) should pass under the optical bench to allow the dispersion unit to sit properly in front of it.

► To connect the Hydro 2000G/S:

1. Plug the right-angled power cable into the power socket on the rear panel of the dispersion unit ① but **do not** connect to the power supply at this point.



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2. Connect the communications cable from the **ACCESSORY** connector on the optical bench ② to the **Accessory comms in** connector on the dispersion unit ③.
3. Screw the dispersant pipe to the Dispersant input connector ④. The inlet pressure to the dispersant pipe must be between 1 and 4 bar.
4. Connect the drain pipe to the drain output connector ⑤ and secure it with a jubilee clip.

**Caution!**

If this is the only or last dispersion unit used on the system, the termination plug ⑥ **must** be fitted.

5. If using the purge pump, connect it to the air purge connector ⑦.
6. Connect the cell by following the instructions later in this chapter.

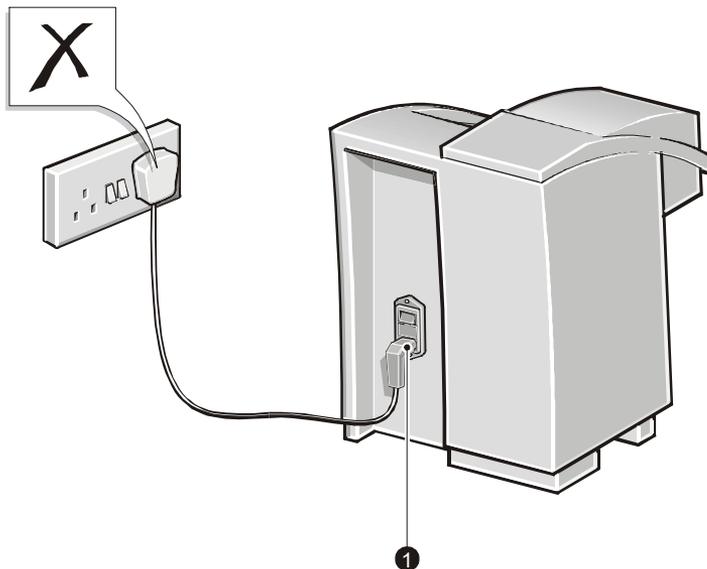
Connecting the Hydro 2000MU

**Note**

The power cable should pass under the optical bench to allow the dispersion unit to locate properly in front of the optical bench.

► **To connect the Hydro 2000MU:**

1. Plug the right-angled power cable into the power socket on the rear panel of the dispersion unit ① but **do not** connect to the power supply yet.



2. Connect the cell by following the instructions later in this chapter.

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Connecting the Hydro 2000SM

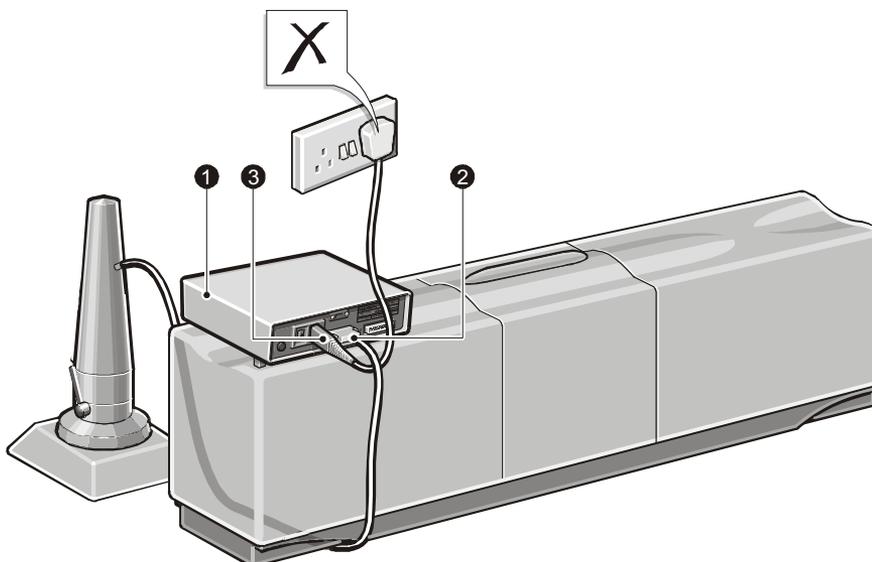


Note

The Dispersion Unit cable should pass under the optical bench. Locate the Controller Unit ① on top of the optical bench (right-hand side).

► To connect the Hydro 2000SM:

1. Connect the cable from the Dispersion Unit to the **Dispersion Unit** socket on the back ② of the Controller Unit.



2. Plug the power cable into the power socket on the back of the Controller Unit ③ but **do not** connect it to the power supply yet.
3. Connect the cell by following the instructions later in this chapter.

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Connecting the Hydro 2000 μ P

It is normal to locate the dispersion unit on the right hand side of the optical bench. If required to locate the dispersion unit on the left, reposition the cell holder on the other side of the control unit. Refer to **Chapter 5** of the dispersion unit manual.

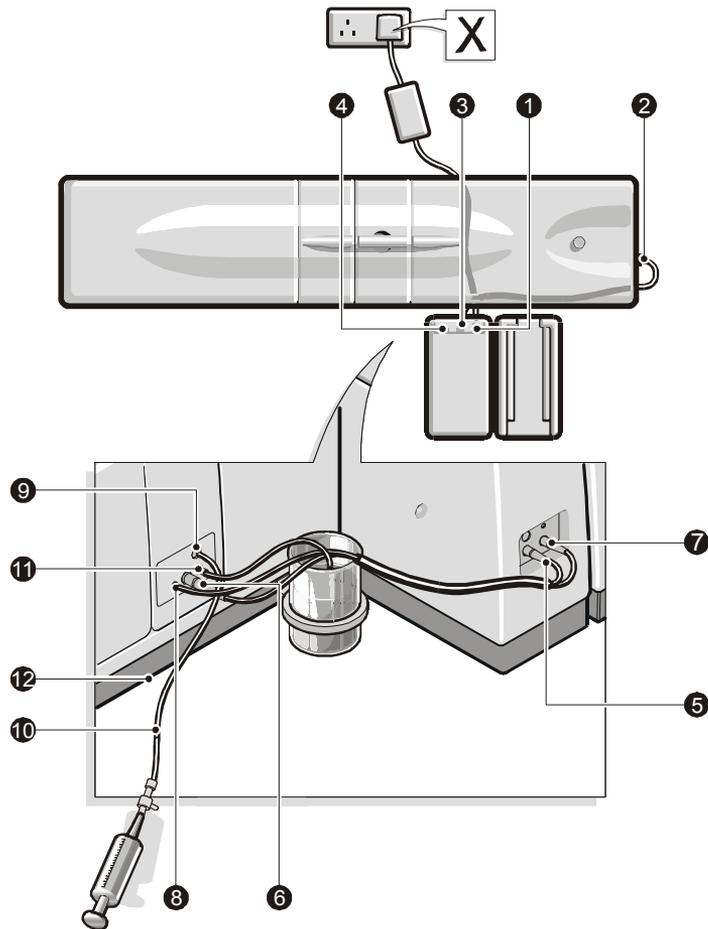


Warning!

The power supply used on the Hydro 2000 μ P is not designed for operation in wet conditions. Do not place it in areas prone to spillages.

► To connect the Hydro 2000 μ P:

1. Pass the power connector under the optical bench (via the rear of the unit) and connect it to the power input connector on the rear panel of the control unit
 ①. **Do not** connect to the power supply yet.



2. Connect the communications cable to the **ACCESSORY** connector on the optical bench ②. Pass the other end of the cable under the optical bench and connect it to the **Accessory comms in** connector on the control unit ③.



Caution!

If this is the only (or last) dispersion unit used on the system, the termination plug ④ **must** be fitted.

3. Connect the control cable from the controller unit ⑤ to the cell unit ⑥.

4. If the ultrasound option is fitted, connect the ultrasonic control cable from the front of the controller unit ⑦ to the front of the cell unit ⑧. This cable **must** be fitted on ultrasound instruments.
5. Connect the dispersant inlet pipe to the dispersant inlet port ⑨.
6. Connect the non return valve ⑩ to the other end of the inlet pipe
7. Connect the drain tube to the drain port ⑪.
8. Place the other end of the drain tube in the waste beaker. The beaker can be held in place by the beaker holder ⑫. Attach the beaker holder to the optical bench by sliding it into the optical bench skirt moulding from the side of the unit.

Connecting Hydro 2000 cells

Each Hydro cell is internally coded so it can be identified by the optical bench. Therefore, if using more than one cell, the correct cell for the dispersion unit **must be** connected.

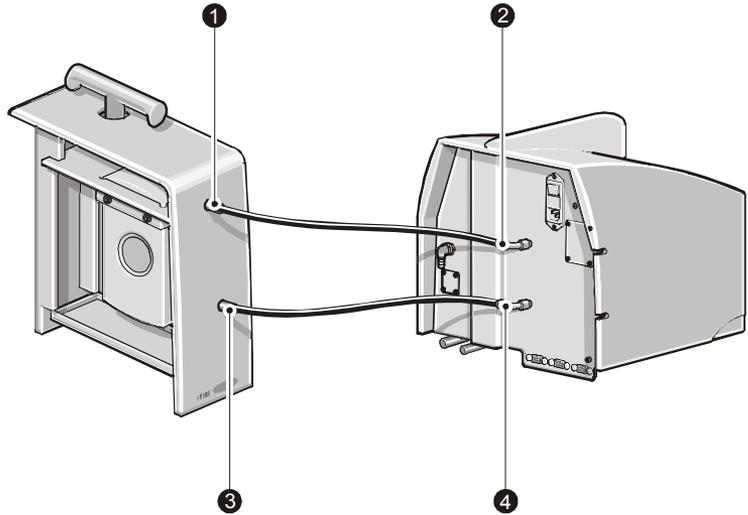
The only external identification for the cells are colour coded bands around the cell's inlet and outlet ports. These help the user correctly connect the sample pipes as the connector on the sample pipe has a corresponding coloured ring. The colour coding is as follows:

Port	Colour	Dispersion Unit
Top port	Blue	All
Bottom port	Black	Hydro 2000G
Bottom port	White	Hydro 2000S
Bottom port	Orange	Hydro 2000MU
Bottom port	Red	Hydro 2000SM

All pipe fittings for the cell are “push fit”. Push the sample tubes at least 7mm onto the connectors to prevent leaks.

► To connect the cell (Hydro 2000G/S/MU):

1. The cell is provided with four sample tubes. Two of them have colour coded connectors on them, the others are spares. Referring to the illustration below, take the blue connector and attach it to the top cell connector ①. Connect the other end to the **Cell out** connector on the dispersion unit ②.

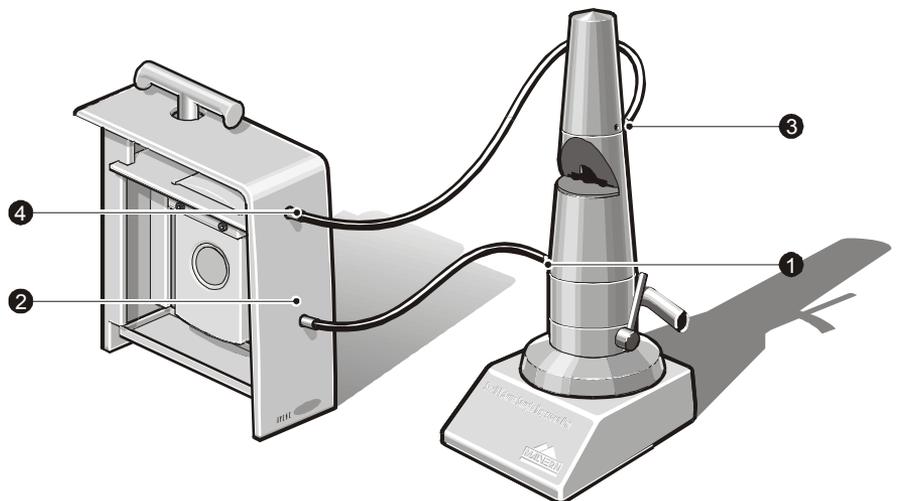


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2. Connect the other sample tube which has a connector to the bottom cell connector ③. Connect the other end to the **Cell in** connector on the dispersion unit ④.
3. Before finally pushing the dispersion unit against the optical bench, perform a fill and empty cycle to check for leaks on the back of the dispersion unit.

Hydro 2000SM cell

Fit the Hydro 2000SM cell in the same way. The inlet and outlet connectors are not marked on the dispersion unit; use this diagram to identify these connectors:



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Connecting dry dispersion units

This section describes connection of Scirocco dispersion units.

Scirocco 2000



Note

For clarity, none of the diagrams in this section show the Scirocco 2000 in its final position. The Scirocco must only be positioned in front of the left-hand side of the optical bench.



Caution!

The transit bolt located under the dispersion unit **must** be removed prior to powering it up. **Always** re-install the transit bolt if moving the dispersion unit large distances.

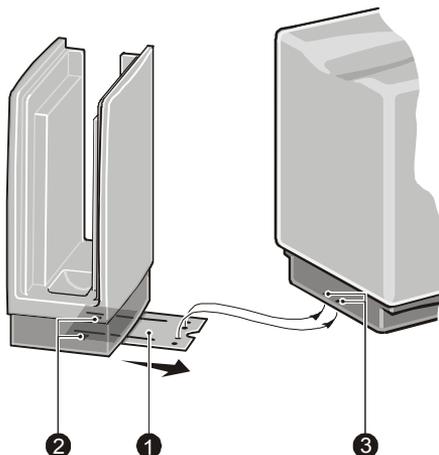


Note

All electrical cables and pneumatic pipes should pass under the optical bench to allow the dispersion unit to locate properly in front of it.

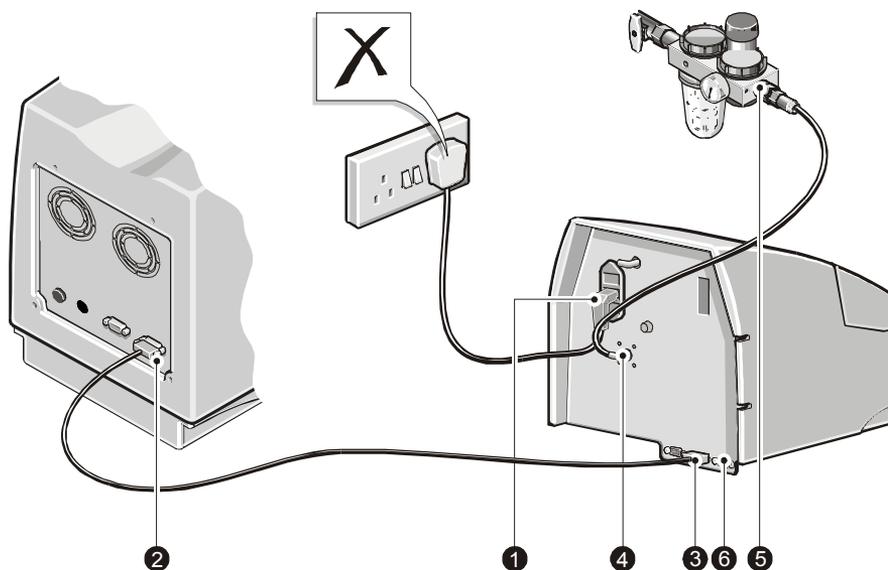
► To connect the Scirocco 2000:

1. Extend the cell holder location bracket ① by slackening the two hand nuts ②. Attach the bracket to the two locating bosses ③ under the left-hand side of the optical bench.



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2. Plug the right-angled power cable into the power socket on the rear panel of the dispersion unit ① but **do not** connect to the power supply yet.



3. Connect the communications cable to the **ACCESSORY** connector on the optical bench ② and connect the other end to the **Accessory comms in** connector on the dispersion unit ③.
4. Push fit the **Air in** pipe ④ from the pneumatic supply ⑤. Do not turn on the pneumatic supply until you power up the system.

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Note

The pneumatic supply should have an air pressure of 5.5-8 bar and **must** be clean and free from oil.

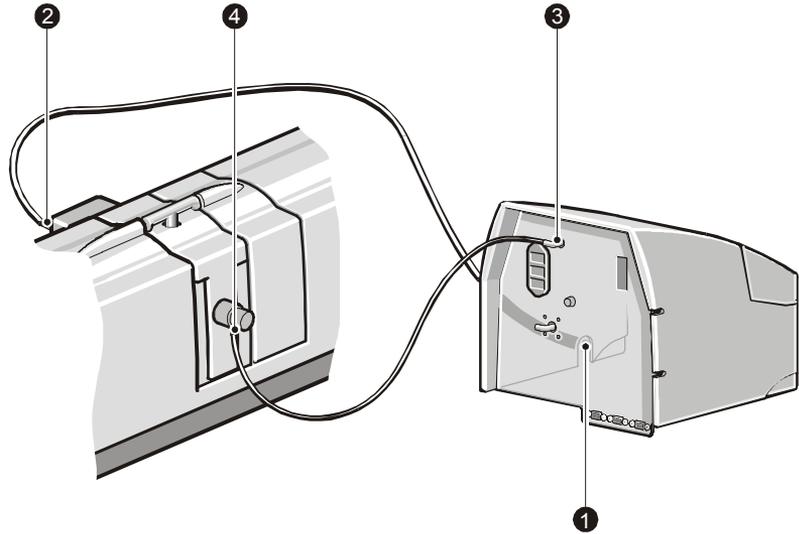


Caution!

If this is the only (or last) dispersion unit used on the system, the termination plug ⑥ **must** be fitted.

► To connect the air cell:

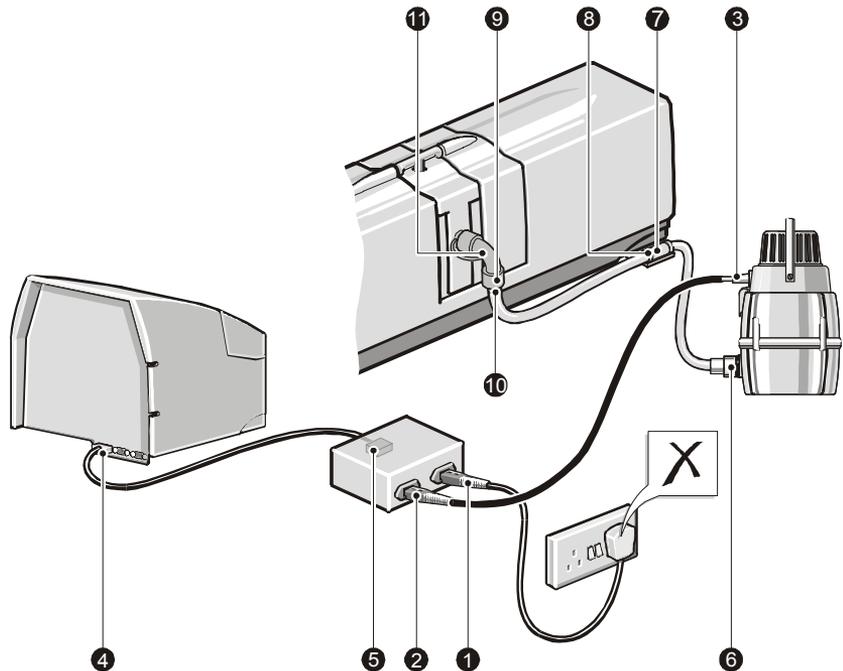
1. With the air cell fitted in the optical bench, push fit the sample tube from the sample outlet on the dispersion unit ① to the connector on the front of the air cell ② (see below).
2. Connect the vacuum monitor tube from the **Vacuum monitor** connector ③ on the rear panel to the connector on the rear of the air cell ④.



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► To connect the vacuum switcher box:

1. Plug the power cable into the **Mains inlet** socket on the vacuum switcher box ① but **do not** connect to the power supply yet.



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2. Connect the power cable from the mains outlet socket on the vacuum switcher box ② to the mains inlet socket on the vacuum unit ③.
 3. Connect the communication cable from the Auxiliary socket ④ on the dispersion unit rear panel to the vacuum switcher box's **Accessory** connector ⑤.
- ▶ **To connect the exhaust pipe:**
1. Connect the vacuum tube from the vacuum unit ⑥ to the exhaust bracket ⑦.
 2. Connect the vacuum extension tube from the exhaust bracket ⑦ and secure with a jubilee clip ⑧.
 3. Connect the other end of the tube to the rear of the air cell ⑨ and secure with a jubilee clip ⑩.
 4. Check that the earth connector on the end of the vacuum extension tube ⑪ is connected.

Connecting the Scirocco 2000M

For clarity none of the diagrams in this section shows the dispersion unit in its final position. It must be positioned in front of the right-hand side of the optical bench.

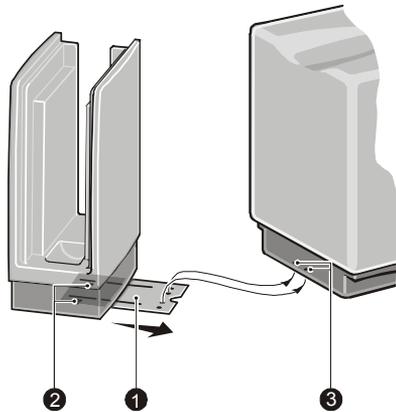


Note

All electrical cables and pneumatic pipes should pass under the optical bench to allow the dispersion unit to locate properly in front of it.

► To connect the Scirocco 2000M:

1. Extend the cell holder location bracket ① by slackening the two hand nuts ②. Attach the bracket to the two locating bosses ③ under the left-hand side of the optical bench.

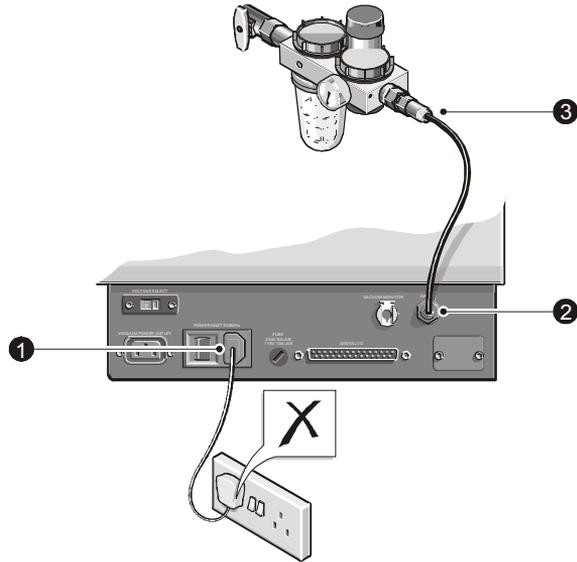


2. Plug the power cable into the power socket on the rear panel of the dispersion unit ① but do **not** connect to the power supply at this point.
3. Push fit the **Air in** pipe ② from the pneumatic supply ③ - do **not** turn on the pneumatic supply until you power up the system.



Note

The pneumatic supply should have an air pressure of 6 bar and **must** be clean and free from oil.

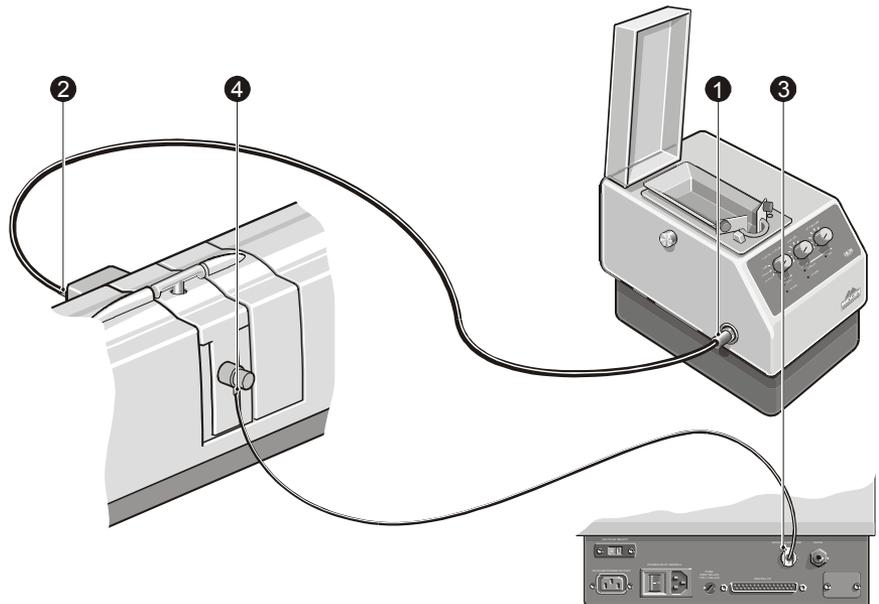


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Connecting the air cell

With the air cell fitted in the optical bench, push fit the sample tube from the sample outlet on the dispersion unit ① to the connector on the front of the air cell ②.

Connect the vacuum monitor tube from the **Vacuum monitor** connector ③ on the rear panel to the connector on the rear of the air cell ④.

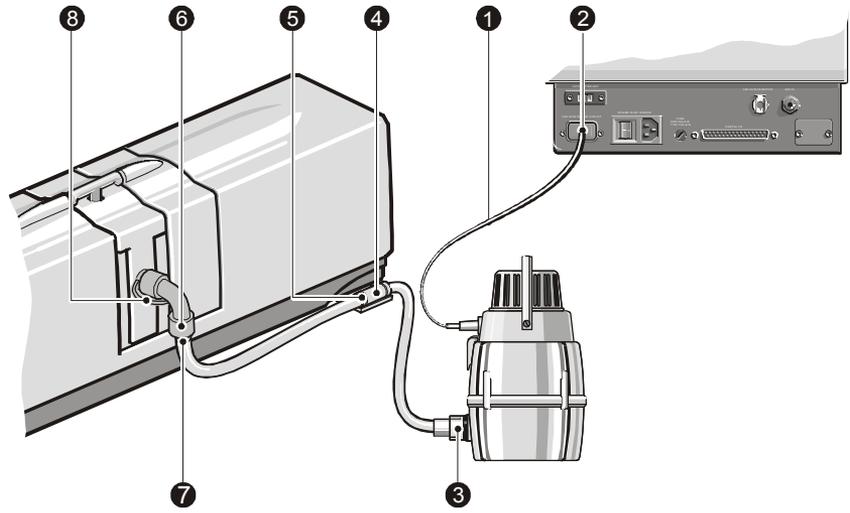


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Connecting the exhaust system

► **To make the electrical connections:**

Connect the vacuum unit power lead ① (supplied with the Malvern vacuum unit) to the side connector panel “Vacuum Power Outlet” socket ②, as illustrated below.



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► **To connect the exhaust pipe:**

1. Connect the vacuum tube from the vacuum unit ③ to the exhaust bracket ④.
2. Connect the vacuum extension tube from the exhaust bracket ④ and secure with a jubilee clip ⑤. Connect the other end to the rear of the air cell ⑥ and secure with a jubilee clip ⑦. Check that the earth connector on the end of the vacuum extension tube ⑧ is connected.

Sample hopper and sieve



Caution!

To ensure that the perspex lid always functions as a sound reducer, it is designed not to stay open. Do not force it as this may damage the unit.

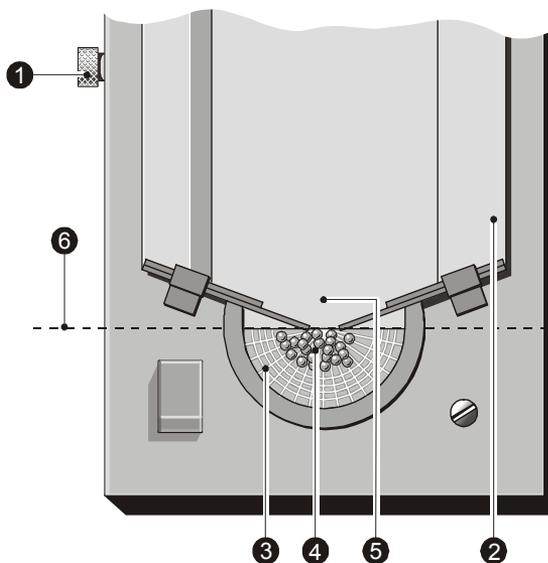
► To set up the sample hopper and sieve:

1. Open the perspex lid on top of the dry powder feeder, unscrew the locking screw ① and lift the hopper ② out of the dispersion unit.
2. Take the sieve and ball bearings from the dispersion unit case.



Note

Two sieves are provided with the dispersion unit. Use the sieve with the largest mesh with cohesive samples, and the small mesh sieve for free flowing samples. Use one sieve only.



3. Fill the sieve ③ half full of ball bearings ④.
4. Place the sieve in the sample cone (the dispersion unit is usually shipped with one of the sieves already fitted).
5. Place the hopper in the dispersion unit and ensure that the location groove of the hopper correctly locates with the two location screws.

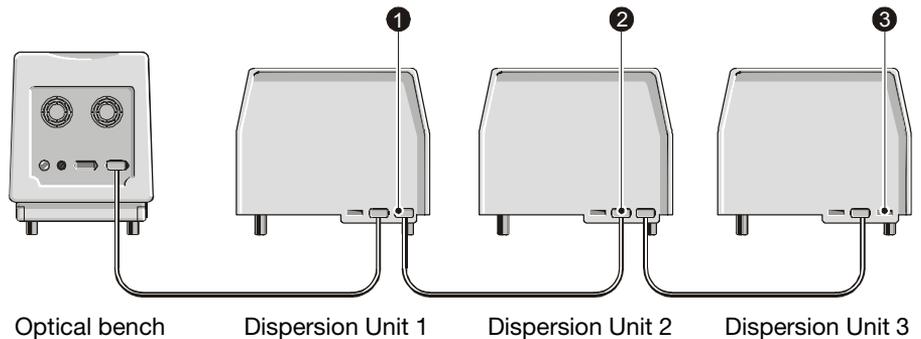
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6. The hopper should be positioned so that the tongue ⑤ is across the center line ⑥ of the sieve as illustrated above.
7. Tighten the locking screw ① so that the hopper cannot be moved manually.
8. The hopper has a pair of gates which slide to adjust the gap between them. The gap should be no more than 3 or 4mm.
9. Close the perspex lid.

Connecting multiple dispersion units

It is possible to have more than one dispersion unit connected at a time by linking the communication cables in a “chain”:

- If more than one dispersion unit is connected, connect a communications cable between the **Accessory COMMS - Out** connector on the first dispersion unit ① and the **Accessory COMMS - In** connector on the second dispersion unit ②.
- The last dispersion unit in the chain must have the CAN termination plug ③ in its **Accessory COMMS - Out** connector.



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Connecting the Autosampler 2000

All electrical cables and plumbing pipes (except the sample tube) should pass under the optical bench to allow the Autosampler to be located in front of the optical bench.

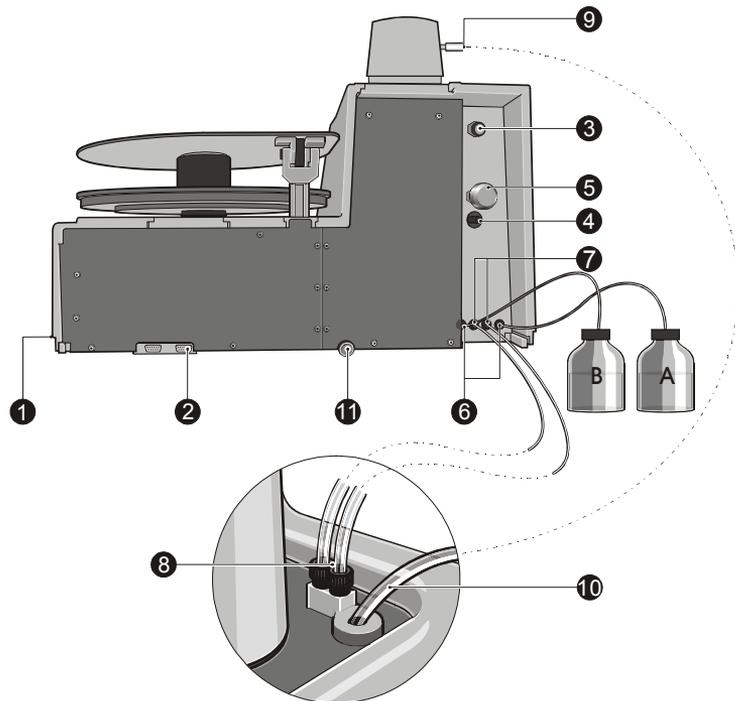


Caution!

If several dispersion units are linked in a chain, the Autosampler must be the last one in the chain.

► To connect the Autosampler 2000:

1. Plug the power cable into the power socket on the side of the Autosampler ①, but **do not** connect to the power supply at this point.
2. Connect the communications cable from the Hydro dispersion unit to the **Accessory comms** connector ② on the back of the Autosampler.
3. Connect the main dispersant (to be used for filling sample pots and dispersing particles) to the main dispersant inlet ③.



The lower part of this graphic shows the Hydro 2000G tank.

ill 5977

4. Connect the cleaning station dispersant (which will be used to clean the sampling head) to the dispersant inlet ④. Use the flow control valve ⑤ to regulate the dispersant flow so that it doesn't splash when washing the sampling head.
5. Connect the two additive containers (A and B) to the additive inlets ⑥, and connect the additive outlets ⑦ to the Hydro tank cover ⑧. On the rear panel of the Autosampler the ports, from left to right, are: additive B in, additive B out, additive A out, additive A in.
6. Connect the sample tube to the sample outlet in the side of the sampling head. ⑨ You may need to expand the tube in order to push it on to the outlet pipe.
7. Connect the other end of the tube to the Hydro tank cover ⑩.
8. Connect the cleaning station drain pipe to the drain output connector ⑪.

Powering on the system

**Warning!**

Users must read and fully understand the **Health and Safety** chapter before powering up the system.

To avoid the computer reporting communication problems, switch on the system in this order:

1. Dispersion units.
2. Optical bench.
3. Computer and software.

▶ **To power on the optical bench:**

1. Connect the optical bench's mains power plug to the power supply and switch it on.
2. Switch the on/off switch on the side panel to "ON".

▶ **To power on the computer and start the software:**

1. Power up the computer and printer by following the instructions in the manuals supplied.
2. Start the Malvern software (if it is not configured to do so automatically) by double clicking on the **Mastersizer 2000** icon.

**Note**

If the software is not installed yet, see the section below for instructions on this.

3. If the message below appears, check that the optical bench is switched on and connected to the computer. Press **Retry**.



4. Before using the instrument to measure a sample, wait for 30 minutes for the temperature to stabilise.

Follow these guidelines:

- ▶ **To power on the Hydro 2000G, S, SM or MU:**
 1. Before turning on the dispersion unit, ensure that the splash guard is in place.
 2. For the Hydro 2000G and Hydro 2000S, turn on the dispersant supply. The dispersant supply must be between 1 and 4 bar.
 3. Connect the mains power plug to the power supply and switch on.
 4. Switch the on/off switch on the rear panel to ON.
- ▶ **To power on the Hydro 2000 μ P:**
 1. Connect the Hydro 2000 μ P mains power plug to the power supply and switch on.
 2. Switch the on/off switch on the front of the controller unit to ON.
- ▶ **To power on the Scirocco 2000/Scirocco 2000M:**
 1. Connect the Scirocco mains power plug to the power supply and switch on.
 2. Switch the on/off switch on the rear panel to ON.
 3. Turn on the pneumatic supply.
 4. Connect the vacuum unit mains power plug to the power supply and switch on.
- ▶ **To power on the Autosampler:**
 1. Connect the Autosampler mains power plug to the power supply and switch on.
 2. Switch the on/off switch on the rear panel to ON.
 3. Turn on the main dispersant supply and the cleaning station dispersant supply. Ensure that both supplies are in the range of 0.5 - 1.5 bar.

Testing the system

Use these checks to verify that the system is still working correctly after the move:

- The indicator on the optical bench should be blue.
- The indicator on a dispersion unit with its cell attached to the optical bench should be green. (This does not apply to a manual dispersion unit.)
- The indicator on an accessory with its cell not attached to the optical bench should be amber. (This does not apply to a manual dispersion unit.)
- If the indicator shows red check the COMMS lead. (Excluding manual accessory.) If this does not rectify the problem, contact the Malvern representative.

To verify that the system is still working correctly, make another measurement using the standard sample and compare the results to those obtained before moving the system.

Installing the software

If the computer was supplied by Malvern, all software will be installed. If not, follow this procedure:

1. Install Windows™ according to its documentation. Details of the supported versions are given on the Malvern software CD.
2. Insert the Malvern software CD.
3. If **Autorun** is enabled on the computer, the software will start to install automatically. Follow the on-screen instructions to complete the installation.
4. If **Autorun** is not enabled, select **Start-Run-Setup.exe** and follow the instructions on the screen.
5. Once the software is installed, the **Mastersizer 2000** icon will appear.

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