Zetasizer

nano series

Essentials

Malvern

Zetasizer Nano Essentials

MAN0382 Issue 5.0 August 2009

English

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Addendum to manual

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This Addendum presents new information for operating the Zetasizer Nano instrument. The content should be read in-place of, or in conjunction with, the sections indicated in the respective manual. The information detailed will be incorporated into the next manual release for the instrument.

Introduction - Read in place of relevant section on page 1-1 of the Zetasizer Nano Essentials Manual.

Introduction

This manual covers the operation and maintenance of the Zetasizer Nano particle analyser series.

Zetasizer Nano instrument	Model number	Measurement types
Nano S (Red badge)	**ZEN1600**	Particle Size and Molecular weight
Nano S (Green badge)	**ZEN1500**	Particle Size and Molecular weight
Nano Z (Red badge)	**ZEN2600**	Zeta potential
Nano ZS (Red badge)	**ZEN3600**	Particle Size, Molecular weight and Zeta potential
Nano ZS (Green badge)	**ZEN3500**	Particle Size, Molecular weight and Zeta potential
Nano S90 (Red badge)	**ZEN1690**	Particle Size - 90° optics
Nano ZS90 (Red badge)	**ZEN3690**	Particle Size and Zeta potential - 90° optics

Cleaning the cells - Read in addition to relevant section on page 4-5 of the Zetasizer Nano Essentials Manual.

Cleaning the cells

Cleaning the Surface zeta potential cell

Caution!
During cleaning it is vital not to let any fluid enter the top and cap area of the cell assembly.

Any cross contamination of material from one measurement to the next could affect the result, so it is extremely important to ensure the cell is completely clean before use.

Cuvettes used with the Surface zeta potential cell

- If a quartz cuvette was used for the measurement, it is recommended to clean the cuvette with Hellmanex, and then rinse with copious amounts of de-ionised water, **prior** to reusing it.
- If a plastic disposable cell was used for the measurement, it is recommended that this is disposed of and a new one used for all subsequent measurements.

General cleaning

As a complete assembly the cell can be cleaned using de-ionised water or with a Hellmanex solution. If Hellmanex is used, the cell **must** be rinsed with copious amounts of de-ionised water, **prior** to reusing it,

More efficient cleaning can be obtained by immersing the electrode and sample holder in a gentle ultrasound bath (30 Watts) for 5 to 15 minutes.

Over time, it is likely that the electrodes will become discoloured or tarnished. This is expected, and although it cannot be cleaned, this will not effect the quality of the data obtained.

Intensive cleaning

Cleaning can be performed as described in the following table. The material and chemical compatibility of each component is detailed in the User manual.

Component	Cleaning method
Cell cap	Wipe clean with a mild soap solution Rinse with water once cleaned.
Outer casing **Sample barrel** **Sample holder**	Wipe clean with a mild soap solution Rinse with water once cleaned.
Electrodes	Scrub gently with pipecleaner and Hellmanex, then scrub with copious amounts of de-ionised water.

Once cleaned, leave all parts to be fully dry before re-using; especially the electrode and sample holder area.

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Introduction to this manual

Introduction

This manual covers the operation and maintenance of the Zetasizer Nano particle analyser series.

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Nano S (Green badge)	ZEN1500	Particle Size and Molecular weight
Nano Z (Red badge)	ZEN2600	Zeta potential
Nano Z (Green badge)	ZEN2500	Zeta potential
Nano ZS (Red badge)	ZEN3600	Particle Size, Molecular weight and Zeta potential
Nano ZS (Green badge)	ZEN3500	Particle Size, Molecular weight and Zeta potential
Nano S90 (Red badge)	ZEN1690	Particle Size - 90° optics
Nano S90 (Green badge)	ZEN1590	Particle Size - 90° optics
Nano ZS90 (Red badge)	ZEN3690	Particle Size and Zeta potential - 90° optics
Nano ZS90 (Green badge)	ZEN3590	Particle Size and Zeta potential - 90° optics

Instruments with a red oval badge fitted to the instrument cover have a 633nm 'red' laser. Instruments with a green badge have a 532nm 'green' laser.

High Temperature instruments have '**HT**' on the main instrument label. High Temperature and other build options exist for all the above instruments.

Note
For the Zetasizer model, serial number, software and firmware version, left-click the Nano icon in the right corner of the status bar.

Using this manual

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

For more detail on the Zetasizer software, use its online **Help**. Each window has a **Help** button giving information about it. **Advice** buttons present more sample-related content.

If using the MPT-2 Autotitrator, refer to the **Autotitrator manual** where necessary.

Menu commands

Software menu commands 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**. Menu commands are shown in bold text.

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. They 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.

Where to get help

Help desk

Direct all queries regarding the system to the local Malvern representative initially. Please quote the following information:

- Model and serial number of the instrument (located on the rear panel and the front of the cuvette holder).
- Options fitted; a small label alongside the model and serial number labels identifies any options fitted.
- The Zetasizer software version (select **Help-About** within the software).

Contact the United Kingdom help desk if the local Malvern representative is not available.
Direct line: +44 (0) 1684 891800 or email: helpdesk@malvern.com. This help line is primarily English speaking.

Remote support

Malvern Instruments offers a remote support service over the Internet. (A direct Internet connection must be available.)

Benefits include fast and efficient fault diagnosis, reducing downtime and costs. Online user training is also available, plus software updates.

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 particle characterisation solutions that Malvern can provide.

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Site requirements

This is a copy of Chapter 2 of the manual MAN0382 issue 5.0.

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Introduction

This document outlines site requirements for a Zetasizer Nano. Ensure all these are met **before** the instrument is delivered.

Environmental conditions

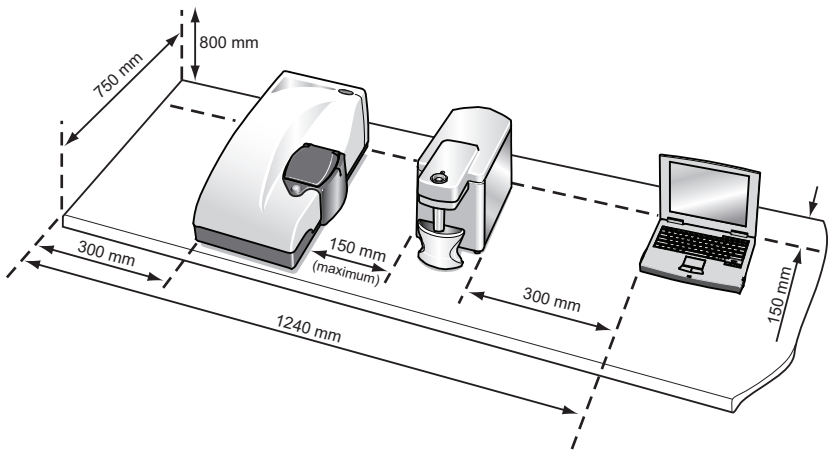
The site must be:

- Indoors and away from strong light (windows).
- Away from heat sources like radiators.
- Well ventilated (for noxious materials).
- On a horizontal vibration-free bench.

We recommend that the computer is positioned to the right of the instrument.

Space required

Provide enough space to allow easy access to all components and connections. This diagram shows the recommended space for a system. Always place the Autotitrator to the right of the instrument.



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Allow at least **800mm** above the bench surface for access to the cell area. The system dimensions are given below (the width is with the cuvette holder closed):

Component	Width	Depth	Height
Zetasizer Nano	320mm	600mm	260mm
MPT-2 Autotitrator	170mm	390mm	260mm
Computer and printer	See manufacturer's documentation		

Power requirements

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

Component	Power requirement	Power sockets required
Zetasizer Nano	~ 100-240V, 50-60Hz	1
MPT-2 Autotitrator	~ 100-240V, 50-60Hz	1
Vacuum Degasser	~ 100-240V, 50-60Hz	1
Computer	See manufacturer's documentation	
Computer monitor	See manufacturer's documentation	
Printer	See manufacturer's documentation	

Power cords and Power safety

The notes in this section indicate best practice. Adhere to 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 way, replace it immediately.

Warning!
Do not use the power cord supplied 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 more information, contact a Malvern representative.

General requirements

The following 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 0.75mm^2 or 18AWG, and the length of the cord must be less than 3m.
- The power cord must be routed so it will not be walked on, pinched by items placed on or against it, or become wet. Pay particular attention to the plug, the electrical outlet and the point where the cord exits the product.

Additional services

Purge specification

If measuring samples at low temperatures there is a risk of condensation occurring on the cell; this occurs when the measurement temperature is less than the 'dew point' of the ambient air surrounding the cell being measured. This is particularly likely in humid climates.

The purge inlet port can be used to connect a dry air supply to the instrument, i.e. a supply with a dew point below the target temperature. This removes any moisture in the air immediately surrounding the cell and prevents condensation. The air supply must conform to the following specification:

- Compressed air to DIN 8573-1
- Oil = Class 1
- Water = Class 3
- Particulate = Class 3
- Pressure = 100 kPa g

For connection purposes, the purge connection uses an M5 internal thread.

Caution!
The purge air line supply must conform to the above specification. Failure to meet this specification may result in permanent damage to the instrument and invalidate the warranty.

Telephone socket specification

The telephone socket for remote support needs a direct Internet connection.

Computer specification

The Zetasizer software can run on a network but this is not recommended as, with any software, running other software at the same time may affect the speed of the Zetasizer software.

Contact the Malvern Helpdesk or website for the recommended computer specification, otherwise consult the Software update notification document supplied on the software CD.

Laser safety

Zetasizer Nano instruments are Class 1 laser products and as such, require no special laser safety considerations during normal operation. However, during servicing (which must be performed by a qualified Malvern representative), the servicing engineer may be exposed to class 3b, or above, laser radiation. We therefore recommend that the administrative controls recommendations of the Laser Safety Regulations (IEC 60825-1(1993) +A1(1997)+A2(2001) are implemented.

MPT-2 Autotitrator services

Nitrogen purge specification

Warning!
A Nitrogen supply must be used in a well ventilated environment.

The MPT-2 Autotitrator has a purge connector for connection of a Nitrogen purge supply. This can be used to blanket the area directly above the sample and prevent any absorption of Oxygen that may change the pH characteristics of the sample, i.e. cause a pH drift.

If a Nitrogen supply is required it must conform to these specifications:

- The Nitrogen supply must be dry, free from oil and filtered to remove any contaminants that could affect the sample.
- The flow rate should be adjustable between 2 and 20 ml/min.

Health and safety

General warnings and Safety regulations

Warning!
The instrument or samples to be measured may be hazardous if misused. Read and fully understand this section before operating the system.

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

The instrument must only be stored or operated in environmental conditions conforming to **Chapter 2** and as indicated below.

Positioning the Instrument

Warning!
Do not position the instrument such that the power cord, where it exits the product, is unreachable for disconnection.

Warning!
Do not obstruct the ventilation slots underneath the instrument, nor the fans on the rear panel. Restricting airflow can damage the instrument or cause overheating.

Electrical warnings and Safety regulations

Warning!
The Zetasizer Nano contains high voltage components. Only Malvern trained personnel are permitted to remove its main cover.

The instrument is mains powered and all power cables and electrical sockets should be treated accordingly. Do not place cables where they may become wet.

Should the instrument become wet (e.g. sample or dispersant is spilt), switch it off and disconnect it from the mains power supply immediately. Scrupulously clean and dry the instrument before re-applying power.

Warning!
This product **must** be connected to a protective earth.
The metal parts of the optical unit and the accessories are earthed via a protective earth connection.

PAT testing

If PAT testing is required, connect the earth lead to the earth stud underneath the rear right-hand corner of the instrument. 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. Replace a damaged power cord set immediately.

Warning!
Do not use the supplied power cord 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 the 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 0.75mm^2 or 18AWG, and the length of the cord must be less than 3m.
- The power cord must be routed so it will not be walked on, pinched by items placed on 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 are guidelines for 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 accessory into correctly earthed electrical outlets.
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 accessory, 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 (when used)

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. Take care when handling the adapter during or immediately after operation.
- Use only the Malvern-provided AC adapter approved for use with the instrument and/or accessory. Using another AC adapter may cause a fire or explosion.

Advice on use of Uninterruptible Power Supplies (UPS)

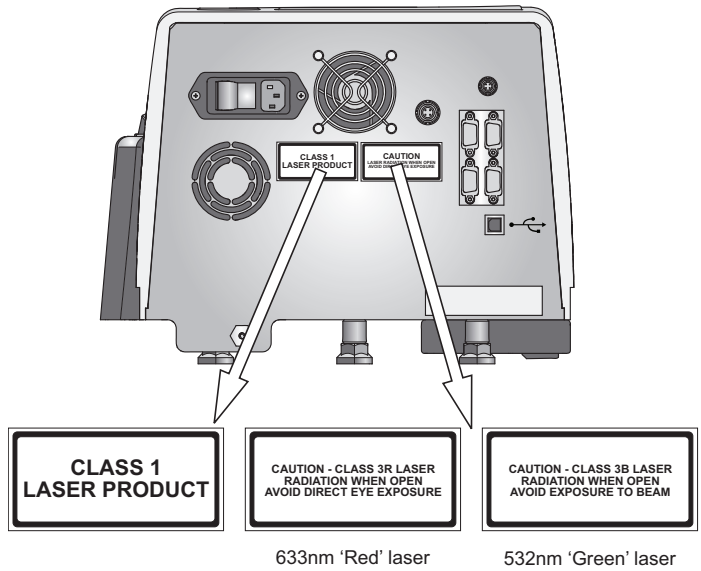
- To help protect the instrument and/or accessory from sudden, transient increases/decreases in electrical power, use a surge suppressor, line conditioner or UPS.

Laser safety regulations

The Zetasizer Nano is a Class 1 laser product. As such, there is no exposure to laser radiation in normal operation of the instrument.

Caution!
The 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:



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The standard laser has a maximum cw-power of 4mW at 632.8nm, while the option laser has a maximum cw-power of 50.0mW at 532nm.

Temperature warnings

Warning!
The warning triangles on the cuvette lid and thermal cap warn of potentially hazardous temperatures within the cell area. The temperature range of the cell area is 2°C to 90°C for the standard instrument, 2°C to 120°C for the High Temperature option.

Purge warnings (MPT-2 Autotitrator)

Warning!
If a Nitrogen supply is used the system must be located in a well ventilated environment. Turn **off** the supply when not in use.

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 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. For recommendations see the **Materials Safety Data Sheets**.
- The surfaces of the system may be permanently damaged if samples are spilt onto them. If a spillage occurs, disconnect the system from the power supply before scrupulously cleaning it up.

Moving the system

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

- Always disconnect the computer and power supply before attempting to move the system.
- Always adopt proper lifting techniques to avoid back injury.
- Always lift the instrument by holding the handholds under its base. Never lift an instrument by its covers. Refer to the **Unpacking instructions** provided.
- If the system is moved large distances, we recommend that it is repacked in its original packaging.

Disposal of the instrument

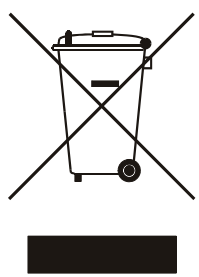
Dispose of the system responsibly. Follow these guidelines:

- Disable the laser in such a way as to make it impossible for it to be powered up. Ask the local Malvern representative for advice.
- Decontaminate the instrument if hazardous materials have been used in the system.
- Refer to any local regulations on disposal of equipment.

European Union and other European countries

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

Here the system must be disposed of in accordance with the European **Disposal of Electrical & Electronic Equipment** regulations.



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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 land-fills will be reduced and natural resources will be conserved.

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

Maintenance

Warning!
No one except a qualified Malvern representative must remove the main cover.

Cleaning the instrument

Warning!
Before cleaning, always disconnect the instrument from the power supply and disconnect all electrical cables.

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

- Clean the covers periodically using a mild soap solution.
- **Never** use excessive liquid to clean the instrument and always avoid electrical components (connectors, etc.).
- **Always** ensure that the instrument is completely dry before applying power.
- The paint has a solvent resistant finish, but it is good practice never to use a solvent-based solution. It may damage the painted surfaces.
- **Never** use an abrasive cleaner on the instrument as this may damage the painted surfaces.
- **Never** use compressed air.

Cleaning the cells

Clean cells thoroughly between measurements, especially between different types of sample. Cross-contamination between samples can seriously affect the results.

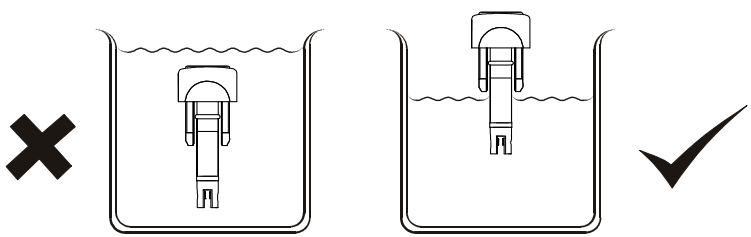
Cleaning the universal 'Dip' cell

Caution!
Do **not** immerse the complete cell. Only the sample electrodes must dip in to the dispersant, as shown below.

Clean the dip cell electrodes regularly. They are made of solid palladium and can be cleaned physically and chemically.

To clean the cell:

1. Immerse the electrodes in a gentle ultrasound bath (30 Watts) for five to 15 minutes before use. Use the dispersant used for the previous sample as the cleaning fluid. If this dispersant contains additives such as surfactants, follow this by ultrasonicating for two minutes in the pure solvent.



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Warning!
Take care: ultrasonication can produce a fine aerosol of the bath liquid.

2. Remove the electrodes from the bath and rinse them with pure solvent. A pipe cleaner can be used for **gentle** cleaning of electrodes.
3. To protect the dip cell after cleaning, we recommend placing it in an empty cuvette for storage.

Before making a measurement, rinse the electrodes and cuvette with the sample to be measured.

When changing the sample, thoroughly rinse the electrodes with pure dispersant.

Note
The electrode holder is made from Natural PEEK (polyetheretherketone) which is resistant to a wide range of chemical products. However, seek advice from Malvern and the sample manufacturer before using strong acid or base.

Cleaning cuvettes

Two main types of cuvette are available:

- Disposable polystyrene – do not clean and re-use disposable cuvettes. It gives inaccurate results.
- Reusable glass or quartz – the cleaning procedure depends on the sample measured so specific instructions cannot be given. Follow these guidelines:
  - Rinse the cuvette with the dispersant that was used for the measurement.
  - Try submerging the cuvette in an ultrasonic bath of clean solvent.
  - Once clean, wipe the cuvette with a lint free tissue (photographers' lens cleaning tissues are recommended).
  - The smaller and more dilute the sample, the more important cleanliness is.

Cleaning the Folded capillary cell

This cell is intended to be used once then discarded, but can easily be used again if required. We recommend that, before a cell is used for the first time, it is flushed through with ethanol or methanol to facilitate wetting. A syringe or a wash bottle can be used. Use only sufficient fluid to wet the surface of the cell and electrodes.

The cell should then be flushed through with water as described below.

To clean the cell:

- Fill one syringe with de-ionised water or the dispersant.
- Place the full syringe in one of the sample ports on the cell and the empty syringe in the other.
- Flush the contents of the full syringe through the capillary cell into the empty syringe.
- Repeat the flushing process five more times, flushing the liquid backwards and forwards between the syringes.

Never attempt to clean the outside of the folded capillary cell. It causes small surface scratches that give inaccurate results.

Cleaning the High concentration cell

General cleaning

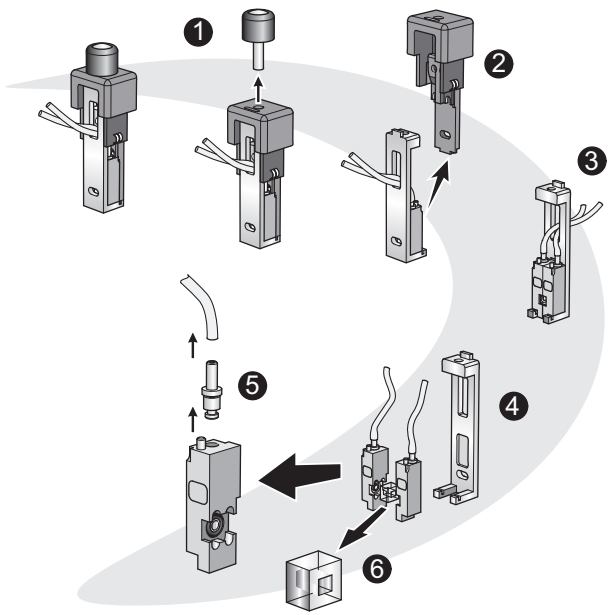
Rinsing of the cell **prior** to a measurement should be carried out by flushing through with copious amounts of de-ionised water.

External surfaces of the assembled cell can be wiped clean with a weak soap solution

For more intensive cleaning follow the instructions below.

Intensive cleaning

The cell first has to be disassembled before cleaning can be performed.



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- Remove the screw cap ①.
- Separate the two halves of the cell ② by pulling the rear casing vertically away from the metal front.
- Note how the Electrode chambers and quartz measurement cell block are assembled ③.
- Remove the chambers and cell block from the metal front casing ④.
- Detach the pipework and remove the top port ⑤ .
- Protect the cell block from damage ⑥.

Once the cell has been disassembled, cleaning can be performed as described in the following table. The material and chemical compatibility of each component is detailed in Appendix A of the User manual.

Component	Cleaning method
Screw cap	Wipe clean with a mild soap solution
Outer casing	Black part of casing (Delrin): Wipe clean with a mild soap solution Metal part of casing (Stainless steel): Immerse the casing in Hellmanex and place in a gentle ultrasound bath (30 Watts) for five to 15 minutes. Rinse with water once cleaned.
Electrode chambers and port	Electrode Chamber: Scrub gently with interdental brush and Hellmanex, then scrub with copious amounts of de-ionised water. Smaller internal bore: Scrub gently with interdental brush and Hellmanex, then scrub with copious amounts of de-ionised water.
Quartz measurement cell block	Scrub both internally and externally with interdental brush. Afterwards brush with copious amounts of water Note: Once inserted back into assembly, a cotton bud with ethanol can be used for light cleaning of the outside of the cell block. This is only to remove any errant marks that may have occurred when assembling the cell.

Once cleaned, leave all parts to dry before re-assembling. Re-assembly is the reverse of dis-assembly. Take care not to damage the sprung electrodes located in the rear casing.

Replacing the system fuse

Warning!
Fuses must not be replaced by the operator. Only the supervisor or a Malvern representative should attempt to change the fuse.

If the instrument does not power up, check the system fuses. These are in the mains power switch on the rear panel.

Before changing a fuse, disconnect the instrument from the mains power.

Pull the fuse holders out and replace faulty fuses with others of the following specification:

- Rating – T 2A L 250v (T = Time delay)
- Size – 5mm x 20mm

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