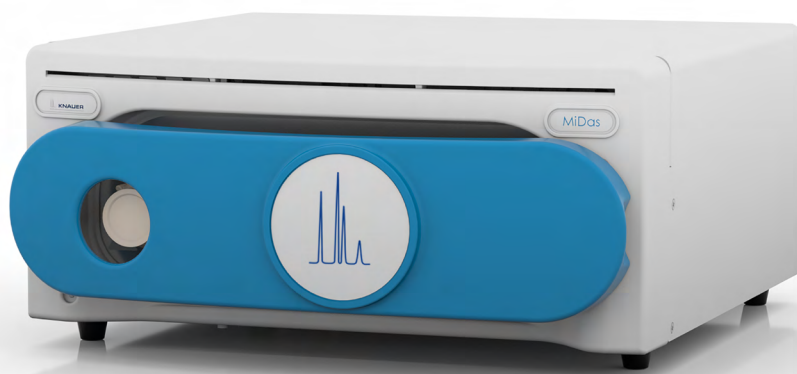


Science Together



MiDas™

Automated sampling unit Instructions



Document no. V6690

HPLC



Note: For your own safety, read the instructions and observe the warnings and safety information on the device and in the instructions. Keep the instructions for future reference.

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For latest version of the instructions, check our website:
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1. Symbols and signs





1.1 Terms and abbreviations





This table defines terms and abbreviations used in these instructions.

Term	Definition
ESI	Electrospray Ionisation
SFI	Split Flow Interface
MiD®	Molecular iD
m/z ratio	Mass-to-charge ratio
MSDS	Material Safety Data Sheet
LED	Light emitting diode
PRV	Pressure Relief Valve

1.2 Warning symbols (ENG)

The warning symbols described in the table below are used on MiDas™ and within these Instructions. All warnings and cautions must be observed at all times during operation and maintenance of the MiDas™. Failure to comply with the warning instructions violates safety standards associated with the proper use of the system and its design. KNAUER assumes no liability for the failure to comply with these requirements.

Symbol	Description
	Alternating Current
	Conformité Européenne
	Read the Instructions
	<p>CAUTION</p> <p>A Safety Alert symbol with the CAUTION notice denotes a potential hazard. Pay particular attention to the procedure or operation described. If performed incorrectly or without caution, the procedure may result in damage to hardware or the software.</p> <p>DO NOT proceed beyond a CAUTION notice without fully understanding the notice, its implications and how to meet the conditions stated.</p>

Symbol	Description
 Warning	<p>WARNING SERIOUS HAZARD</p> <p>A Safety Alert symbol with the WARNING notice denotes a serious hazard. The operation or suggested action may result in personal injury or death.</p> <p>DO NOT proceed beyond a WARNING notice without fully understanding the notice, its implications and how to meet the conditions stated.</p> <p>Warning notices are also displayed with symbols representing specific hazards.</p>
	<p>CAUTION, POSSIBILITY OF ELECTRIC SHOCK</p> <p>This symbol denotes a risk of electric shock. It indicates areas on the MiDas™ system where hazardous voltages are present.</p>
 Warning	<p>WARNING HAZARDOUS VOLTAGE</p> <p>This symbol highlights actions or procedures which, if not performed correctly, could lead to electric shock from hazardous voltages.</p>
	<p>WARNING CORROSIVE CHEMICAL</p> <p>This symbol with the WARNING notice denotes corrosive chemicals. A corrosive chemical may be present. Exposure may result in serious injury. Use appropriate skin protection.</p>



Note: A Note indicates important information necessary for the correct or optimal operation of the software or hardware. Read the information carefully and follow any instructions.



Units

Imperial and metric units.

Both imperial and metric units are used in this document. The unit of measurement chosen reflects historical use. Please note that the unit symbol for inches is given as " ; for example: 6" means 6 inches.

1.3 Pictogrammes de sécurité (FRA)

Les pictogrammes de sécurité présents dans la table ci-après sont utilisés sur le MiDas™ et dans ce guide. **AVERTISSEMENT** et **ATTENTION** doivent être suivis en tout temps lors de l'entretien, l'installation, la réparation et l'opération du MiDas™. Tout défaut d'application de ces règles de sécurité serait considéré comme une violation des normes de sécurité. KNAUER ne saurait voir sa responsabilité engagée en cas de manquement de l'utilisateur à respecter les consignes de sécurité.

Symbole	Description
	Courant Alternatif
	Conformité Européenne

Symbole	Description
	<p>Lisez le guide de l'utilisateur.</p>
	<p>ATTENTION</p> <p>Un symbole de sécurité avec la mention ATTENTION dénote un risque potentiel. Soyez particulièrement attentif à la procédure décrite. Si celle-ci est exécutée de manière incorrecte, elle peut engendrer un dommage de l'équipement et/ou une erreur de programme avec la conséquence probable de perdre des données.</p> <p>Ne continuer pas après un signal d'ATTENTION sans comprendre totalement sa signification et les conditions décrites.</p>
	<p>AVERTISSEMENT DE DANGER SÉRIEUX</p> <p>Un symbole de sécurité avec la mention AVERTISSEMENT dénote un danger sérieux. La procédure décrite peut entraîner un risque de blessure ou de mort.</p> <p>Ne continuer pas après un signal d'AVERTISSEMENT sans comprendre totalement sa signification et les conditions décrites.</p> <p>Des notices d'avertissement sont aussi associées avec des pictogrammes représentant des dangers spécifiques.</p>
	<p>ATTENTION, POSSIBILITÉ DE CHOC ELECTRIQUÉ</p> <p>Ce pictogramme dénote la possibilité de choc électrique. Ce pictogramme peut être trouvé sur le MiDas™. Il indique une région du MiDas™ où des tensions électriques sont présentes.</p>
	<p>AVERTISSEMENT DE TENSIONS DANGEREUSES</p> <p>Ce pictogramme avec la mention AVERTISSEMENT dénote des tensions dangereuses. Ce pictogramme peut être trouvé sur le MiDas™. Il indique une région du MiDas™ où des tensions dangereuses sont présentes.</p>
	<p>AVERTISSEMENT DE SUBSTANCES CORROSIVES</p> <p>Ce symbole met en évidence des actions ou des procédures qui, si elles ne sont pas effectuées correctement, peut entraîner l'exposition à des substances corrosives. Utilisez des protections corporelles adéquates.</p>



Note: Une Note indique des informations importantes pour l'utilisation du logiciel et/ou de l'équipement. Veuillez lire les informations avec attention et suivez les instructions.

2. Important safety information

The safety information given in this section is important; always observe all safety precautions when operating, maintaining, or servicing the MiDas™.

To avoid personal injury or damage to the instrument, **DO NOT** perform servicing or maintenance unless you are qualified and authorised to do so. **DO NOT** perform any servicing or maintenance procedures that are not described in these instructions.



Warning

WARNING If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

AVERTISSEMENT Si l'équipement est utilisé d'une manière non spécifiée par le fabricant, la protection fournie par l'équipement peut être altérée.



Caution

CAUTION MiDas™ should only be used with accessories that meet the manufacturer's specifications including the supplied power supply. Failure to do so may result in damage to the instrument and lead to the loss of liability and warranty entitlements.

ATTENTION MiDas™ ne doit être utilisé qu'avec les accessoires qui répondent aux spécifications du fabricant. Le cas contraire peut causer des dommages à l'appareil et entraîner la perte de responsabilité et de droits de garantie.

2.1 Electrical hazards



Warning

WARNING Unless specifically instructed, **DO NOT** remove any protective covers. The product is sealed at the factory. Damage or removal of the warranty seals leads to the loss of liability and warranty entitlements.

AVERTISSEMENT Sauf mention contraire, **NE PAS** retirer les couvercles de protection. Le produit est scellé à l'usine. Les dommages ou levée des scellés de garantie entraîne la perte de la responsabilité et droits de garantie.



Caution






CAUTION Plug the external power supply into MiDas™ first and then plug the Universal power supply into an AC power source. When disconnecting, unplug the power supply at the AC power source first.





ATTENTION Branchez l'alimentation externe de MiDas™ avant de brancher l'alimentation universelle à une source d'alimentation CA. Pour débrancher, débranchez l'alimentation à la source d'alimentation CA en premier.

2.2 Chemical hazards

Any chemicals used for analysis should be handled according to good laboratory practice. They should also be stored, used, and disposed of in accordance with the manufacturer's specifications, as well as local and national regulations.



The responsible individual must ensure that personnel are not exposed to hazardous levels of toxic substances as outlined in the Material Safety Data Sheets (MSDS), or any documentation provided by local governing bodies such as The Health Protection Agency (UK) or The Occupational Safety and Health Administration (US).

	<p>WARNING Potentially hazardous chemicals can be used with the MiDas™. Use care when handling chemicals and wear appropriate PPE.</p> <p>AVERTISSEMENT Des produits chimiques potentiellement dangereux peuvent être utilisés avec le MiD*. Faire preuve de prudence lors de la manipulation des produits chimiques et porter des EPI appropriés.</p>
	<p>WARNING Risk of explosion. Never use the device in potentially explosive atmospheres without appropriate protective equipment and approval by a notified body. Inform the technical support department of the manufacturer.</p> <p>AVERTISSEMENT Risque d'explosion. Ne jamais utiliser l'appareil dans des atmosphères potentiellement explosives sans équipement de protection approprié et l'approbation par un organisme notifié. Informer le service de support technique du fabricant.</p>
	<p>WARNING Organic solvents are highly flammable. Since capillaries can detach from their screw fittings and allow solvent to escape. It is prohibited to have any open flames near the analytical system.</p> <p>AVERTISSEMENT Les solvants organiques sont hautement inflammables. Les capillaires peuvent se détacher de leurs raccords vissés et permettre au solvant de s'échapper. Il est interdit d'avoir des flammes nues à proximité du système analytique.</p>
	<p>WARNING Organic solvents are toxic above certain concentration. Ensure that work areas are always well ventilated. Wear protective gloves and safety glasses when working on the device.</p> <p>AVERTISSEMENT Les solvants organiques sont toxiques au-dessus d'une certaine concentration. Veiller à ce que les aires de travail soient toujours bien ventilées. Porter des gants et des lunettes de sécurité lorsque vous travaillez sur l'appareil.</p>
	<p>WARNING Certain parts of the MiDas™ unit might react with substances used. Verify the chemical compatibility using the instructions provided in the Appendix A.</p> <p>AVERTISSEMENT Certaines parties de l'appareil Midas peuvent réagir avec certaines substances chimiques utilisées. Vérifier la compatibilité chimique en utilisant le guide fourni dans le Appendice A.</p>

 Caution	<p>CAUTION Rinse the valves after using buffer solutions to prevent the formation of crystals that can scratch the sealing surface.</p> <p>ATTENTION Rincer les soupapes après l'utilisation de solutions tampons pour empêcher la formation de cristaux qui peuvent rayer la surface d'étanchéité.</p>
 Caution	<p>CAUTION Do not submerge MiDas™ in liquids.</p> <p>ATTENTION Ne pas plonger MiDas™ dans des liquides.</p>
 Caution	<p>CAUTION Regularly check for leaks and clogged capillaries.</p> <p>ATTENTION Vérifiez régulièrement l'étanchéité des connexions et l'obstruction des capillaires.</p>
 Caution	<p>CAUTION To avoid damage from leaks, always place solvent bottles in the supplied solvent tray.</p> <p>ATTENTION Pour éviter les dommages causés par les fuites, toujours placer les bouteilles de solvant dans le bac à solvant fourni.</p>

2.3 Maintenance

Only perform maintenance tasks described in these instructions. All other maintenance tasks are to be performed by the manufacturer or a company authorized by the manufacturer.

 Warning	<p>WARNING Without exception, disconnect the power supply prior to performing any maintenance.</p> <p>AVERTISSEMENT Sans exception, couper l'alimentation électrique avant d'effectuer tous entretien.</p>
 Warning	<p>WARNING Without exception, never tamper with the PRV, cross section and bottle after installation. Installation of these components is only to be performed by KNAUER authorised engineers. Failure to do so may result in improper operation of the instrument and lead to the loss of liability and warranty entitlements.</p> <p>AVERTISSEMENT Sans exception, jamais altérer le PRV, section transversale et la bouteille après l'installation. L'installation de ces composants ne est à effectuer par des ingénieurs KNAUER autorisé. Ne pas le faire peut entraîner un mauvais fonctionnement de l'instrument et de conduire à la perte de responsabilité et de garantie des droits.</p>

2.4 Safety and regulatory standards

In accordance with the following directives:

- **2006/95/EC**
The Low Voltage Directive
- **2004/108/EC**
The Electromagnetic Compatibility Directive

The MiDas™ complies with the following safety standards:

- **IEC 61010-1: 2010 (3rd Edition)**
Safety requirements for electrical equipment for measurement, control, and laboratory use.
- **UL 61010-1: May 2012**
Electrical Equipment for Measurement, Control, and Laboratory Use; Part 1: General Requirements.
- **CSA C22.2 61010-1 (3rd Edition - 2011)**
Safety Requirements for Electrical Equipment.

MiDas™ A and B conform to the following standards for EMC conformity:

- **IEC/EN 61326:2006**
Electrical equipment for measurement, control and laboratory use
EMC requirements.
- **EN 61000-3-2:2006 + A1:2009 + A2:2009**
Electromagnetic compatibility (EMC).
Limits for harmonic current emissions
(equipment input current < 16 A per phase).
- **EN 61000-3-3:2008**
Electromagnetic compatibility (EMC).
Limitation of voltage changes, voltage fluctuations and flicker in public
low-voltage supply systems, for equipment with rated current ≤ 16 A per
phase and not subject to conditional connection.
- **ICES-003:2004**
Spectrum Management and Telecommunications Policy.
Interference-Causing Equipment Standard.
Digital Apparatus.



In accordance with all of the essential requirements of all applicable European product directives; the declaration of conformity document is available upon request.



FCC CFR47:Part 15:B:2008



Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their expense.



Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment under FCC rules.

Subject to the Waste Electrical and Electronic Equipment (WEEE) Directive; see WEEE compliance statement.

WEEE Compliance Statement

This statement is only valid only for customers in EU member countries. The European Union (EU) directive for product recycling (The Waste Electrical and Electronic Equipment - WEEE Directive) will be shortly be incorporated into the national laws of each EU member state. Products falling under the scope of the WEEE Directive are identified with a crossed over "wheelie" bin symbol on the product label. An authorized waste disposal service must be used to dispose of the product for recycling or disposal, or alternatively return the product to KNAUER.



Warning

WARNING The manufacturer's declaration becomes invalid if the user modifies the original product or installs additional components.

AVERTISSEMENT La déclaration du fabricant est annulée si l'utilisateur modifie l'origine du produit ou installe des composants supplémentaires.

Electromagnetic compatibility

The MiDas™ has been tested and evaluated to ensure it fully complies with EMC and safety standards as outlined in IEC 61010-1: 2010.

Precautions

The following safety precautions concerning the operation of the MiDas™ and the site in which it is used must be observed at all times in order to prevent injury and damage to the system and associated instruments.



WARNING DO NOT use the instrument if there are signs of visible damage.
DO NOT operate if site conditions are not within specifications.
DO NOT override any safety interlock.

AVERTISSEMENT NE PAS faire fonctionner l'appareil s'il présente des signes de dommages visibles.

NE PAS faire fonctionner si les conditions du site ne sont pas conformes aux spécifications.

NE PAS altérer un verrouillage de sécurité.



WARNING DO NOT attempt to operate the instrument with the covers removed.

DO NOT attempt to adjust or replace components other than those that have been described in these instructions.

AVERTISSEMENT NE PAS essayer de faire fonctionner l'appareil avec les couvercles enlevés.

NE PAS tenter de régler ou remplacer des composants autres que ceux qui ont été décrits dans ce Guide de l'utilisateur.



WARNING The instrument is not designed to be operated in a potentially explosive atmosphere. It is the responsibility of the customer to verify the operating environment meets the requirements of a "non-hazardous area" with regards to potentially explosive atmosphere.

AVERTISSEMENT L'instrument n'est pas conçu pour être utilisé dans une atmosphère explosible. Il est de la responsabilité du client de vérifier que l'environnement de fonctionnement répond aux exigences d'un secteur non-dangereux quant à l'atmosphère explosible.

3. Product information



Note: Only use the device for applications that fall within the range of the intended use. Otherwise, the protective and safety equipment of the device could fail.

MiDas™

MiDas™ is a general platform designed to connect the 4000 MiD® with a range of high concentration and high flow rate applications. Without such a stage signal saturation, memory effects, solvent incompatibility and system clogging would hamper robust analysis. The primary functions of MiDas™ are:

- Sample a high concentration analyte
- Reduce to a manageable flow rate
- Dilute in an ESI compatible solvent
- To serve as a front end for the 4000 MiD®

MiDas™ supports three sampling modes depending on configuration; Continuous, Batch and Direct Sampling. MiDas™ is capable of Continuous Sampling and also supports Direct Sampling.

Continuous Sampling

This case describes the monitoring of the composition of a continuous flow of liquid. The sample is passively accepted into the MiDas™ from an external supply. The output of a flow chemistry reactor would be an example of this application.

Direct Sampling

This case describes the assessment of the composition of a fixed volume of liquid injected into MiDas™ via the syringe port. The sample is driven into the MiDas™ by an external pump, where it is diluted and analysed automatically. This might be achieved using the 4000 MiD®'s Calibration Kit syringe pump, or any other customer supplied pump.

The Attenuator

The attenuator is an active splitter. Its function is to divert a small portion of a flow so that it can be diluted in the make-up solvent. This allows the MiDas™ to accept samples at saturated concentrations and in non-polar solvents which would be otherwise incompatible with electrospray ionisation (ESI).

The make-up pump

MiDas™ incorporates a make-up pump which dispenses from an external reservoir. This reservoir is filled with an ESI compatible solvent (Such as Water, Methanol, Acetonitrile...) with the conventional modifiers (Such as Formic acid, Ammonium Acetate...).



Note: Care should be taken to ensure that the analyte has moderate solubility in this make-up so that precipitation does not occur within MiDas™.

Direct sampling valve

MiDas™ features a 2-position-6-port valve which can be automatically switched at the start of an acquisition run. The recommended operation has a storage loop and syringe port configured as a loop injector. The valve body is polyether ether ketone (PEEK) chosen for its chemical compatibility.



Note: Care should be taken to ensure that the sample does not contain solid particulates which could damage the moving parts. KNAUER recommends that you extract your sample through a filter prior to injecting into the valve.

3.1 Views

3.1.1 Front view

Legend

- ① Direct access aperture
- ② Communications LED

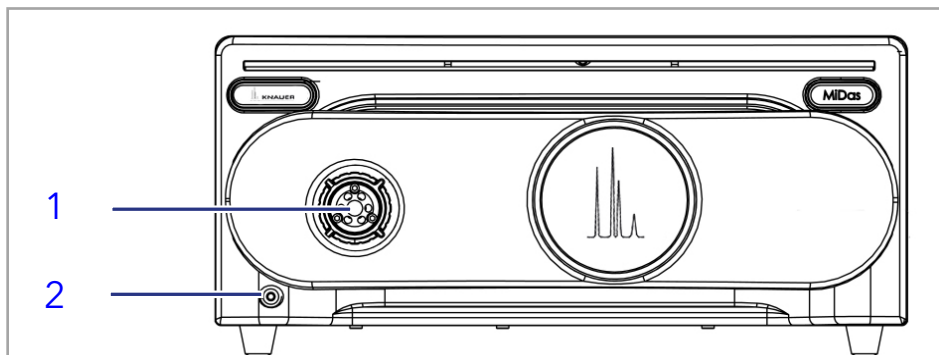


Fig.1 MiDas™ front panel with fluidic ports covered

Legend

- ③ Direct sampling valve
- ④ Attenuator
- ⑤ Make-up pump outlet
- ⑥ Make-up pump inlet

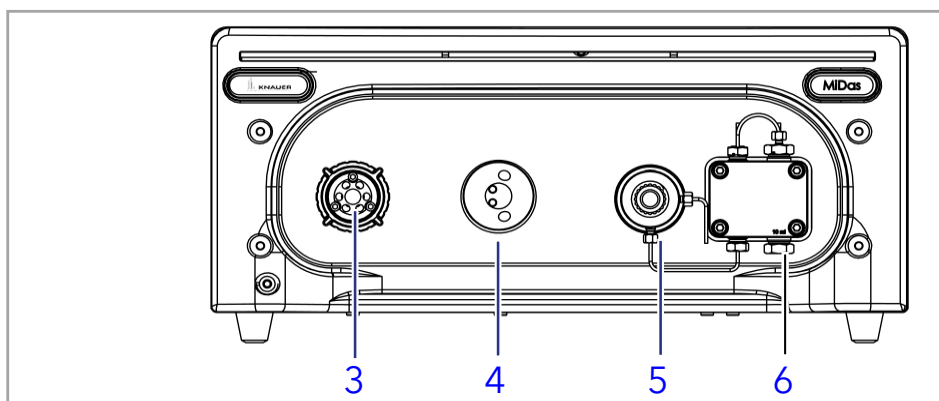


Fig.2 MiDas™ front panel without cover, showing fluidic ports

3.1.2 Rear view

Legend

- ⑦ USB communication port
- ⑧ Power socket

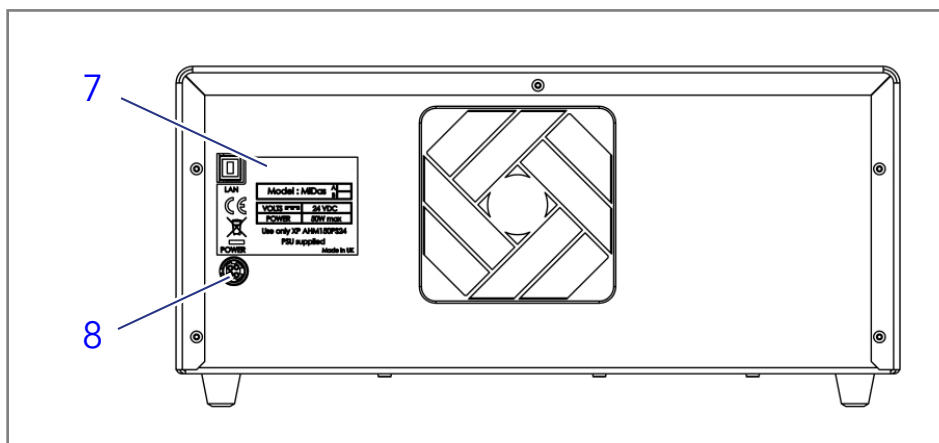


Fig.3 Layout of rear panel

4. Scope of delivery



Note: Only use original parts and accessories made by KNAUER or a company authorized by KNAUER.

Regarding the scope of delivery, please refer to the corresponding chapter in the 4000 MiD® instructions (document no. V6695).

5. Unpacking and setup

5.1 Site requirements and storage conditions

The technical data (see chapter 9 on page 30) describes the site requirements and storage conditions necessary for the MiDas™. Make sure all the requirements are met before installation and use of the system.

5.2 Power supply

The power supply in the MiDas™ accepts any line voltage in the range 100-240 V. There is no voltage selector at the rear of the MiDas™ and there are no externally accessible fuses.



CAUTION When operating MiDas™ it must be possible to disconnect the instrument from mains supply at any time. In the event of an emergency the power connector of the instrument must be easily accessible and removable.

ATTENTION Lors de l'utilisation MiDas™ il doit être possible de déconnecter l'appareil de l'alimentation secteur à tout moment. En cas d'urgence, le connecteur d'alimentation de l'instrument doit être facilement accessible et débranchable.



CAUTION When installing or operating the instrument you must ensure that there is sufficient space behind the instrument to unplug the power cord.

ATTENTION Lors de l'installation ou l'utilisation de l'instrument vous devez vous assurer qu'il ya suffisamment d'espace derrière l'appareil pour débrancher le cordon d'alimentation.

5.3 Power cords

Power cords are available for the MiDas™ depending on the country/region of operation. The female end of all supplied power cords are identical and plug into the rear of the instrument (see Fig.3). The male end of the cord will fit the wall outlet of the appropriate country/region.



WARNING Never use any cabling not supplied or recommended by KNAUER. Use of unspecified cabling may lead to improper operation or failure to comply with safety or EMC regulations.

AVERTISSEMENT Ne jamais utiliser des câbles non fournis ou recommandés par KNAUER. L'utilisation de câbles non spécifiés peut entraîner un mauvais fonctionnement ou du non-respect de la sécurité ou de la compatibilité électromagnétique.



WARNING MiDas™ must never be operated from a power outlet that has no ground connection. The absence of a ground connection can lead to electric shock or short circuit.

AVERTISSEMENT MiDas™ ne doit jamais être utilisé à partir d'une prise de courant qui n'a pas de connexion à la terre. L'absence de mise à la terre peut provoquer un choc électrique ou un court-circuit.



WARNING Never use a power cord other than that supplied by KNAUER. The use of an inadequately rated power cord can lead to electric shock or short circuit.

AVERTISSEMENT N'utilisez jamais un cordon d'alimentation autre que celui fourni par KNAUER. L'utilisation d'un cordon d'alimentation non-adéquat peut provoquer un choc électrique ou un court-circuit.

5.4 USB cable and attached computer equipment

The cable attached to the USB port and connected computer equipment must conform to IEC 60950.



WARNING Never use any cabling or computer equipment not supplied or recommended by KNAUER. Use of unspecified cabling may lead to improper operation or failure to comply with safety or EMC regulations.

AVERTISSEMENT Ne jamais utiliser des câbles ou matériel informatique non fournis ou recommandés par KNAUER. L'utilisation de câbles non spécifiés peut entraîner un mauvais fonctionnement ou du non-respect de la sécurité ou de la compatibilité électromagnétique.

5.5 Setting up MiDas™

5.5.1 Operational configuration

Fig. 4 shows two typical configurations of MiDas™ either on top or beside the 4000 MiD®.



CAUTION Allow sufficient spacing around the MiDas™ for proper cooling and for the connection of mains plug, syringe pump, etc.

ATTENTION Laisser un espace suffisant autour de MiDas™ pour le refroidissement et pour la connexion de prise secteur, pompe seringue, etc.



CAUTION The centre of gravity for the MiDas™ is situated towards the front of the unit. Ensure this is observed when positioning or moving the unit. Lifting the unit from the front is recommended.

ATTENTION Le centre de gravité du Midas est situé vers l'avant de l'appareil. Prenez en compte lors du positionnement ou du déplacer l'appareil. Il est recommandée de soulever l'unité depuis l'avant.



Fig.4 The operational configuration of the MiDas™. Either adjacent (left and centre) or stacked (right) with the 4000 MiD®

5.5.2 Front panel

For the front panel layout see see chapter 5.5.2 on page 14.

Connection	Description
A	Pressure bypass assembly (see chapter 5.5.7 on page 17)
B	Pressure relief valve assembly (see chapter 5.5.8 on page 18)

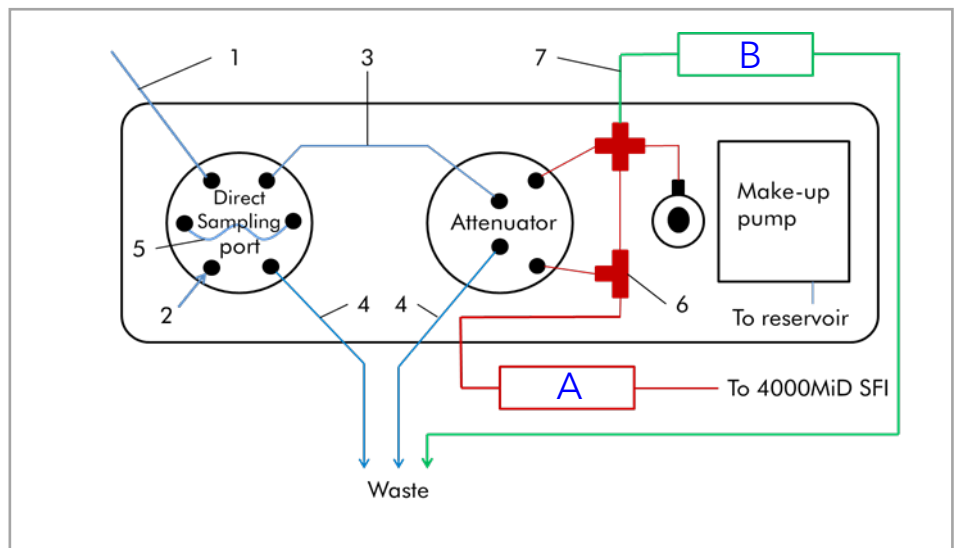


Fig.5 A schematic of the recommended fluidics arrangement

Fig.6

Reference	Part number	Description
1	A2524	PEEK tubing, OD 1/16", ID 0.25mm, 0.5m
2	A03281	Injection port
3	A2524	PEEK tubing, OD 1/16", ID 0.25mm, 0.5m
4	A04782	PTFE tubing, OD 1/16", ID 0.9mm, 1m
5	A2524	PEEK tubing, OD 1/16", ID 0.25mm, 0.5m
6		Pressure bypass assembly
7		Pressure relief valve assembly



Warning

WARNING Never disconnect the tubing while the unit is in operation. Liquid splashing might cause physical damage

AVERTISSEMENT Ne pas débrancher les tuyaux de l'outil durant l'opération. Les éclaboussures peuvent causer d'importants dégâts.



Warning

WARNING The waste tubing from the pressure relief valve (P005319) should be directed to a suitably sized waste container and securely fastened.

AVERTISSEMENT Le tuyau d'évacuation de la soupape de décharge de pression (P005319) doit être dirigé vers un conteneur de déchets de taille appropriée et bien fixé .

5.5.3 Rear panel

For the rear panel layout see chapter 5.5.3 on page 15.



Warning

WARNING Never disconnect the tubing while the unit is in operation. Liquid splashing might cause physical damage

AVERTISSEMENT Ne pas débrancher les tuyaux de l'outil durant l'opération. Les éclaboussures peuvent causer d'importants dégâts.



Warning

WARNING The waste tubing from the pressure relief valve (P005319) should be directed to a suitably sized waste container and securely fastened

AVERTISSEMENT Le tuyau d'évacuation de la soupape de décharge de pression (P005319) doit être dirigé vers un conteneur de déchets de taille appropriée et bien fixé .

5.5.4 The direct sampling valve

The direct sampling valve has six fluidic ports enumerated anti-clockwise from 1 shown in Fig. 6 . Refer to the port description given the table below.

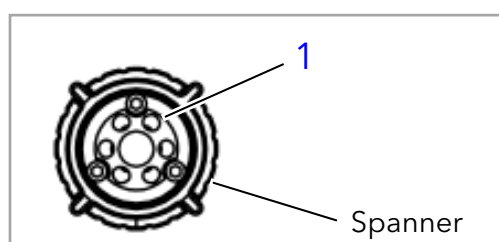


Fig.7 The direct sampling valve ports and notable features

Ports	Description
Fluidic Ports	Pressure: 0-60 bar (0-1000 psi)
	Tubing: OD Ø1/16" PEEK
	Fitting: Coned 10-32 PEEK

5.5.5 The attenuator

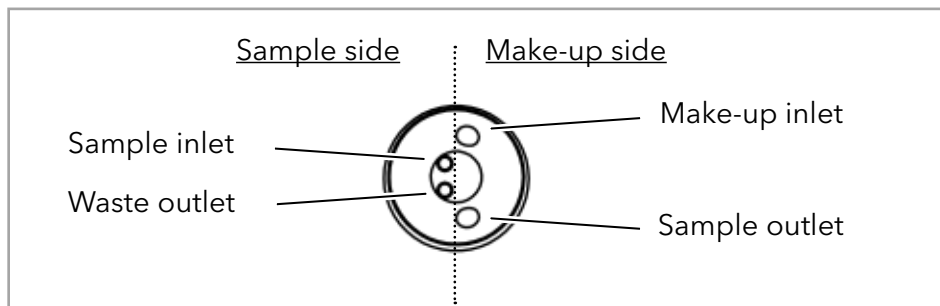


Fig.8 The attenuator ports and notable features

Ports	Description
Fluidic ports	Pressure: 0-60 bar (0-1000 psi)
	Tubing: OD Ø 1/16" PEEK
	Fitting: Coned 10-32 PEEK

5.5.6 The make-up pump

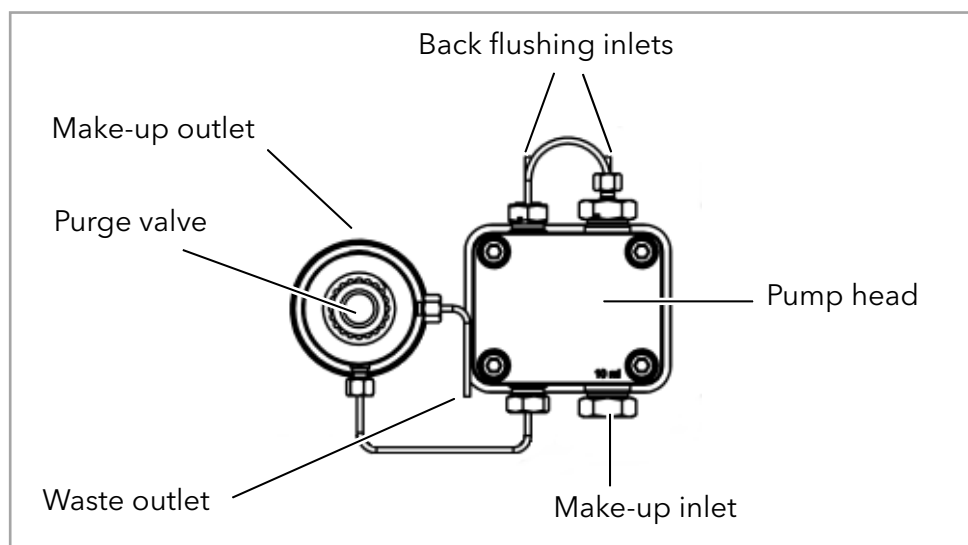


Fig.9 The make-up pump ports and notable features

Port	Description
Make-up pump outlet	Tubing: OD Ø1/16" PEEK
	Fitting: Coned 10-32 PEEK
Waste outlet	Tubing: OD Ø3-ID Ø1 Silicone
Back flushing inlets	Pressure : 0 bar (0 psi)
	Tubing: OD Ø3-ID Ø1 Silicone

Port	Description
Make-up Inlet	Pressure: 0 Bar (0 psi) Tubing: OD Ø1/8" PTFE Fitting: ¼-28 Flangeless Ø1/8" Tefzel

5.5.7 The pressure bypass assembly

In order to improve signal stability it is recommended that a pressure bypass is fitted across the make-up side of the attenuator as detailed in Fig.9 and the table below. This arrangement serves to smooth out pressure changes over the attenuator cycling.

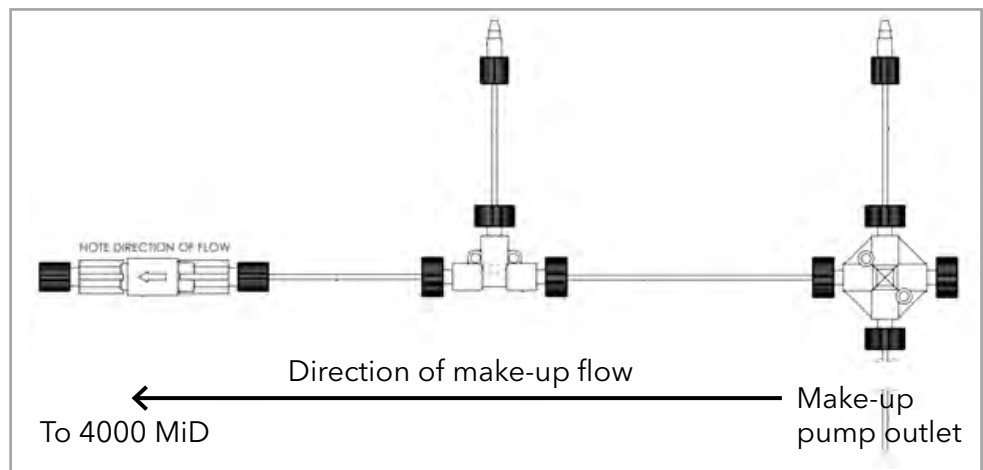


Fig. 10 Details of the fluidic path in the pressure bypass

Component	Description
Bypass inlet	Length: OD Ø1/16" ID Ø0.005" PEEK x 150mm Fitting: 1 x Coned 10-32 PEEK
Bypass	Tubing: OD Ø1/16" ID Ø0.0025" PEEK x 90 mm Fitting: 2 x Coned 10-32 PEEK
Attenuator inlet/outlet	Tubing: OD Ø1/16" ID Ø0.005" PEEK x 60 mm Fitting: 2 x Coned 10-32 PEEK
Bypass outlet	Tubing: OD Ø1/16" ID Ø0.005" PEEK x 60 mm Fitting: Coned 10-32 PEEK, ¼-28 Flangeless
Cross	Fitting: Coned 10-32 PEEK, ¼-28 Flangeless Bore: ID Ø 0.02"
Tee	Fitting: Coned 10-32 PEEK, ¼-28 Flangeless Bore: ID Ø 0.02"
Backpressure regulator	Fitting: OD Ø1/16" ¼-28 Flangeless Pressure: 7 Bar, 100 psi

5.5.8 Pressure relief valve assembly

To protect the attenuator from overpressure by the make-up pump, a pressure relief valve present between the pump and the attenuator. A pressure in excess of 750psi (52 bar) causes the relief valve to open and divert flow to waste. The configuration of the pressure relief assembly is shown in Fig.10 .

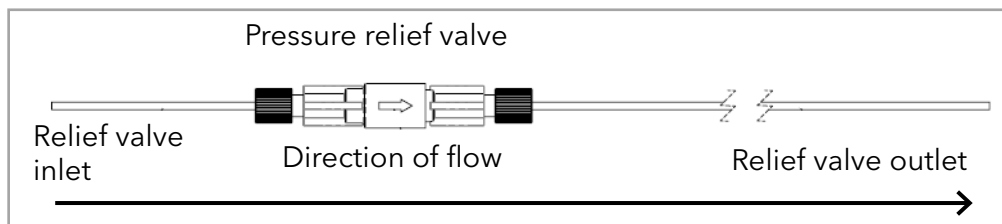


Fig.11 Details of the fluidic path in the pressure bypass

Component	Description
Relief valve inlet	Length OD Ø1/16" ID Ø0.02" ETFE x 50mm
Relief valve	Fitting OD Ø1/16" ¼-28 Flangeless
	Pressure 52 Bar, 750 psi
Relief valve outlet	Tubing OD Ø1/16" ID Ø0.02" ETFE x 1000 mm



Warning

WARNING The waste tubing from the pressure relief valve (P005319) should be directed to a suitably sized waste container and securely fastened

AVERTISSEMENT Le tuyau d'évacuation de la soupape de décharge de pression (P005319) doit être dirigé vers un conteneur de déchets de taille appropriée et bien fixé .

5.5.9 Assembling a MiDas™ system

Fig. 11 shows how to assemble the main components and accessories of a MiDas™ system ready for use. Refer to the labels listed in the table below during operation.



Warning

WARNING The drip tray pictured is designed to catch minor leaks and should not be relied upon as a permanent part of the fluidics handling. Make sure the fluidics path is constructed out of the correct components and is leak free prior to extended operation. Fix all leaks immediately upon discovery

AVERTISSEMENT Le bac de récupération montré est conçu pour attraper les petites fuites et ne doit pas être perçu comme une partie intégrante de la manipulation fluidique. Assurez-vous que le chemin fluidique construit à partir des composants est correct et sans fuite avant l'utilisation prolongée. Réparez les fuites immédiatement après la découverte.

Legend

- ① Make-up reservoir
- ② Make-up drip tray
- ③ MiDas™
- ④ Front cover
- ⑤ Gutter
- ⑥ Drain pipe

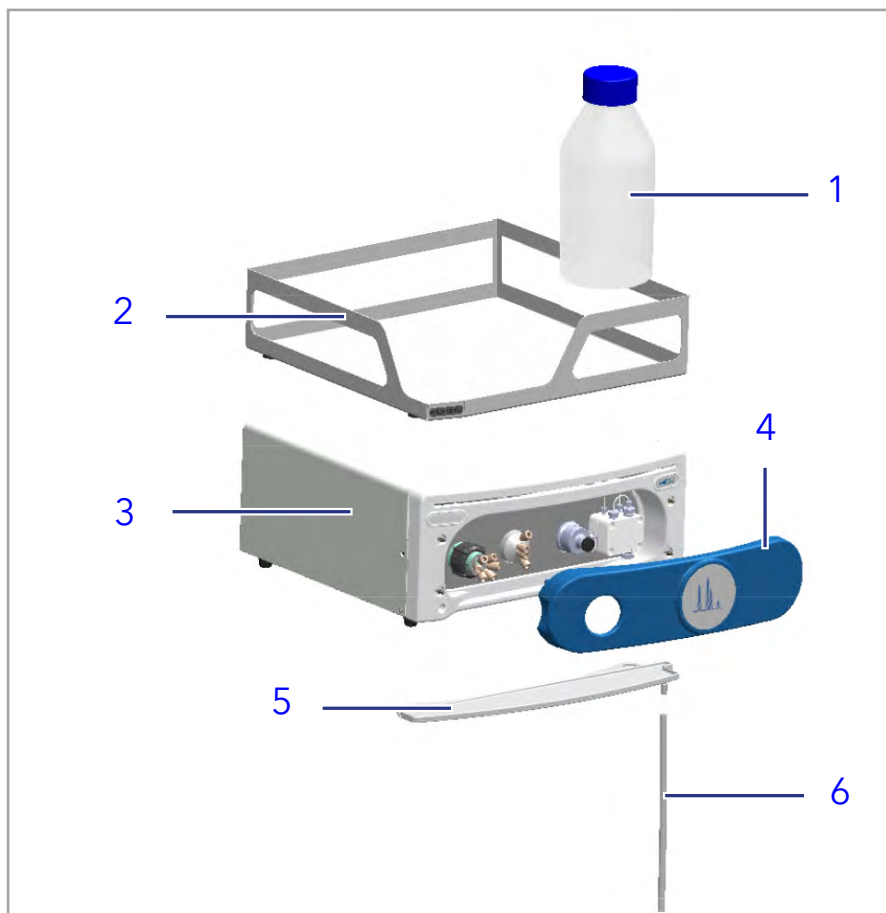


Fig.12 Exploded view of a MiDas™ System with accessories.

5.5.10 Connecting the make-up line to the pump head

Legend

- ① Pump head
- ② Cutting ring
- ③ Fastening screw
- ④ Teflon hose

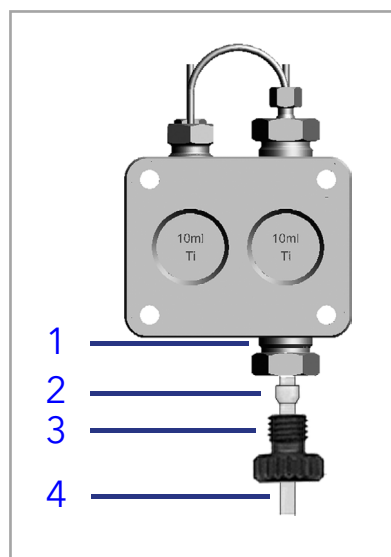


Fig.13 The connecting the make-up line to the pump head



Note: Make sure that the tapered side of the cutting ring is pointed towards the fitting.

- Procedure**
1. Push the Teflon hose through the fastening screw and cutting ring.
 2. Insert the hose end as far as possible into the inlet of the pump head.
 3. Tighten the fitting by hand.

6. Operation

6.1 Priming the make-up pump



Caution

CAUTION Running the pump when dry can cause damage to the pump. Ensure that the pump has been primed and pistons have been back-flushed (see chapter 7.6.1 on page 26) before starting pumping.

ATTENTION Utiliser la pompe à l'état sec peut causer des dommages à la pompe. Assurez-vous que la pompe a été amorcée et les pistons ont été contre-rincés (see chapter 7.6.1 on page 26) avant de commencer le pompage.



Caution

CAUTION Check regularly that the make-up reservoir contains enough fluid and does not run dry during operation.

ATTENTION Vérifiez régulièrement que le réservoir de maquillage contient suffisamment de liquide et ne tarit pas en cours de fonctionnement.

Refer to Fig. 8 on page 16 when following this procedure.

- Procedure**
1. Make sure that the filter is immersed in the make-up reservoir.
 2. Open the black purge valve by unscrewing anti-clock 1 turn by hand.
 3. Attach the supplied plastic syringe using the metal adaptor and silicone tubing to the waste outlet.
 4. Draw liquid from the reservoir by repeated filling the syringe, detaching it and then emptying to an appropriate waste container.
 5. When satisfied that the line to the pump is filled and liquid is being drawn through the pump in a continuous stream shut the purge valve fingertight clockwise.

The pump is now primed and ready to dispense make-up.



Note: This operation should be performed on any change to the make-up composition to avoid the possible appearance of solvent fronts mid-experiment.

6.2 Powering on the system



Caution

CAUTION Condensation caused by relocating MiDas™ to new ambient conditions could cause hardware failure within MiDas™. Allow device to acclimatise for 3 hours before powering on a recently moved system.

ATTENTION La condensation provoquée par le déplacement du MiDas™ dans de nouvelles conditions ambiantes pourrait provoquer une défaillance. Laissez MiDas™ s'acclimater pendant 3 heures avant de mettre l'appareil sous tension.

First ensure all fluidic connections have been completed as detailed in Fig. 5 on page 14.

Make sure the external power supply is disconnected from the mains before plugging it into the MiDas™.

Turn on the external power supply at the wall socket.

After powering up, the 4000 MiD® should recognise the presence of the MiDas™ automatically. The communications LED should now be a solid green. A flashing LED indicates no communication (see „9. Technical data“ on page 30).

6.3 Adding make-up solution to the Make-Up Reservoir



WARNING Potentially hazardous chemicals can be used with the MiDas™. Use care when handling chemicals and wear appropriate PPE.

AVERTISSEMENT Des produits chimiques potentiellement dangereux peuvent être utilisés avec le MiD®. Faire preuve de prudence lors de la manipulation des produits chimiques et porter des EPI appropriés.

- Procedure**
1. Carefully remove Make-Up Reservoir (K) and place in a suitably ventilated area.
 2. Add make up solution to the Make-Up Reservoir.
 3. Degas the solution by sonicating the Make-Up Reservoir for 10 minutes.
 4. Return the Make-Up Reservoir to the MiDas™ and carefully reattach the tubing to the pump and make sure that the filter is immersed in the make-up reservoir.
 5. It is recommended to prime the make-up pump, previously detailed in this section.

7. Functional tests



Note: Standard processes regarding IQ and OQ in single devices may be handled differently in individual cases.

7.1 Installation Qualification (IQ)

The customer may request the Installation Qualification, which is free of charge. In case of a request, the Technical Support of KNAUER or from a provider authorized by KNAUER performs this functionality test during the installation.

The Installation Qualification is a standardized document that includes the following:

- confirmation of flawless condition at delivery
- check if the delivery is complete
- certification on the functionality of the device

7.2 Operation Qualification (OQ)

The Operation Qualification includes an extensive functionality test according to KNAUER standard OQ documents. The Operation Qualification is a standardized document and free of charge. It is not part of the delivery, please contact the Technical Support in case of request.

The Operation Qualification includes the following:

- definition of customer requirements and acceptance terms
- documentation on device specifications
- device functionality check at installation site

Test intervals	To make sure that the device operates within the specified range, you should test the device regularly. The test intervals are dependent on the usage of the device.
Execution	The test can be carried out either by the Technical Support of KNAUER or from a provider authorized by KNAUER (for a fee).

8. Maintenance

8.1 General maintenance

The following maintenance may be carried out by users:

- Replacing the direct sampling valve (if present)
- Replacing the rotor/stator of the attenuator
- Replacing the pump head
- Exchanging check valves

Any other maintenance must be carried out by, or organizations authorized by, KNAUER.

8.2 Prior to maintenance

Before maintenance can commence, the MiDas™ must be decontaminated by removing any hazardous chemicals used by the instrument. Further, the instrument should be disconnected from any other instrument and the unit **MUST** be disconnected from the power supply. To protect the electronic components of the MiDas™ from ESD the rear chassis of the MiDas™ should be connected to an electronic ground either through the ground pin in the mains power supply or a grounding clip. After disconnecting the unit from the mains wait at least one minute before attempting any maintenance.



Caution

CAUTION When operating MiDas™ it must be possible to disconnect the instrument from mains supply at any time. In the event of an emergency the power connector of the instrument must be easily accessible and removable.

ATTENTION Lors de l'utilisation MiDas™ il doit être possible de déconnecter l'appareil de l'alimentation secteur à tout moment. En cas d'urgence, le connecteur d'alimentation de l'instrument doit être facilement accessible et débranchable.



WARNING Potentially hazardous chemicals can be used with the MiDas™. Use care when handling chemicals and wear appropriate PPE.

AVERTISSEMENT Des produits chimiques potentiellement dangereux peuvent être utilisés avec le MiD*. Faire preuve de prudence lors de la manipulation des produits chimiques et porter des EPI appropriés.

8.3 Cleaning and decontamination

Even if contamination is not suspected or seen, the exterior surfaces of the MiDas™ should be wiped down with 10% aqueous IPA to remove any residues. If any parts of the assemblies need to be disturbed then these parts should also be checked for signs of contamination. The fluid lines should be flushed with 10% aqueous IPA to remove any residues inside the system.



WARNING Potentially hazardous chemicals can be used with the MiDas™. Use care when handling chemicals and wear appropriate PPE.

AVERTISSEMENT Des produits chimiques potentiellement dangereux peuvent être utilisés avec le MiD*. Faire preuve de prudence lors de la manipulation des produits chimiques et porter des EPI appropriés.

8.4 Removing and replacing the direct sampling valve

Position valve for replacement

Ensure that the valve driver is in the correct orientation for replacement of the valve (position 1).

Removing valve driver

After positioning valve as described above, remove all fluidics connectors and loosen the spanner that holds the valve in place. Remove spanner completely. Do not use a wrench for this step. Spanner should be tightened and loosened using only your hand.



Fig. 14 Correct orientation of the direct sampling valve with ports 1, 2 and the chocking groove at the top

Inserting replacement valve

The shaft of the replacement valve must be oriented in Position 1 prior to insertion into the valve driver body. In Position 1 the flat of the shaft is oriented perpendicular to the marking on the reverse of the valve body. Insert the valve into the valve driver in the orientation shown in Fig. 13 note the orientation of the numbered ports. Ports 1, 2, and narrow clocking groove will always be at the top when the Valve Driver Body is oriented correctly

8.5 Servicing the attenuator

Normal use of the attenuator will provide one million samplings. The main cause of early failure, which is seen as valve leakage, is abrasive particles in the sample and or mobile phase or precipitation of concentrated solutions. Either can cause scratches on the rotor seal and stator face assembly. In order service the attenuator you will need to obtain an attenuator service kit (contact KNAUER for details)

Valve disassembly

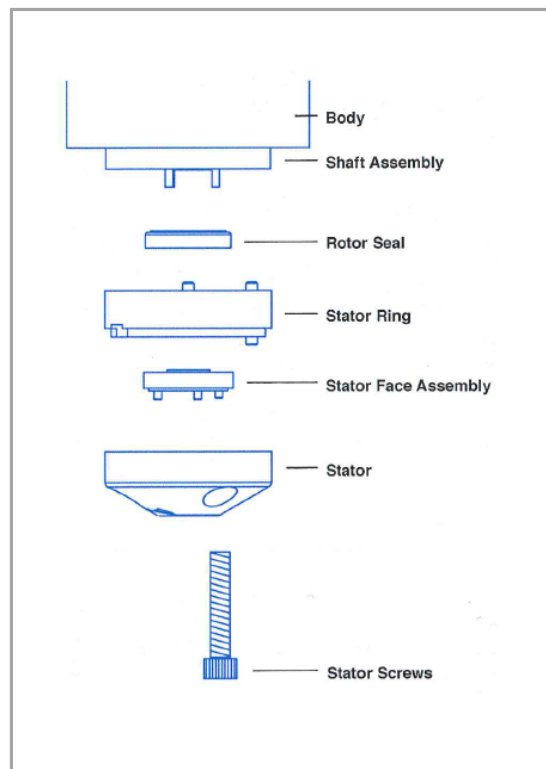


Fig.15 Exploded view of the attenuator

To disassemble refer to Fig. 14 and proceed as follows:

- Procedure**
1. With the Hex Key provided in the attenuator maintenance kit, remove the stator screws from the stator.
 2. Remove the stator and stator face Assembly from the stator ring. The stator face assembly usually remains on the stator.
 3. Remove the stator ring
 4. Remove the rotor seal from the valve body. The rotor seal is mounted on three pins and can be pulled off.

Valve reassembly



Note: Before reassembly, use clean, filtered compressed gas to blow out the shaft Assembly area of the valve.

- Procedure**
1. Mount the new rotor seal with the slots facing the stator. The three pins on the shaft assembly fit into the mating holes in the rotor seal only one way.
 2. Replace the stator ring so the two short pins enter the mating holes in the body.
 3. Mount the new stator face assembly onto the stator. The pins on the assembly fit into the mating holes on the stator only one way.
 4. Replace the stator and stator face assembly on the valve so that the pin in the stator ring enters the mating hole in the stator.
 5. Replace the stator screws into the stator. Tighten each an equal amount until the screws are fingertight, then turn another half turn.

8.6 Servicing the make-up pump

8.6.1 Back-flushing the pistons

When you flush the pistons regularly, the service life of the seals and pistons increases. While flushing, contaminants are washed from the rear piston area. Refer to Fig. 15 when attempting this operation.

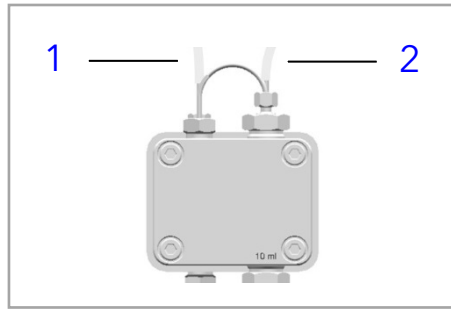


Fig.16 Flushing the pistons in the pump head

Flushing solution

The following solvents are recommended for flushing the pistons:

- Solvents**
- Water
 - Mixture of 80 % water and 20 % ethanol
 - Isopropanol

- Procedure**
1. Open the black venting screw adjacent to the pump head.
 2. Connect the outlet to the waste container with a length of hose ① .
 3. Connect the inlet to the syringe filled with flushing solution with the supplied silicone hose ② .
 4. Fill up flushing solution with the syringe through the pump head until there are no more air bubbles running through the waste bottle.
 5. Remove the hoses and connect inlet and outlet with a hose.

8.6.2 Switching off the pump

If you want to switch off the pump for a longer term, flush the pump head with isopropanol.

8.6.3 Replacing the pump head



Warning

WARNING Aggressive or toxic solvent residue can irritate the skin! Wear appropriate PPE.

AVERTISSEMENT Les résidus de solvant agressif ou toxique peuvent irriter la peau! Porter des EPI appropriés.



Caution

CAUTION Miss-handled piston rods can break. Before disassembling the pump head, remove the two piston rods and deposit in the correct orientation. When assembling the pump head, the piston rods must be inserted on the same side they have been removed from.

ATTENTION Les tiges de piston maltraitées peuvent se briser. Avant de démonter la tête de pompe, enlever les deux tiges de piston et posez-les dans le bon sens. Lors du montage de la tête de pompe, les tiges de piston doivent être insérés sur le même côté dont ils ont été retirés.

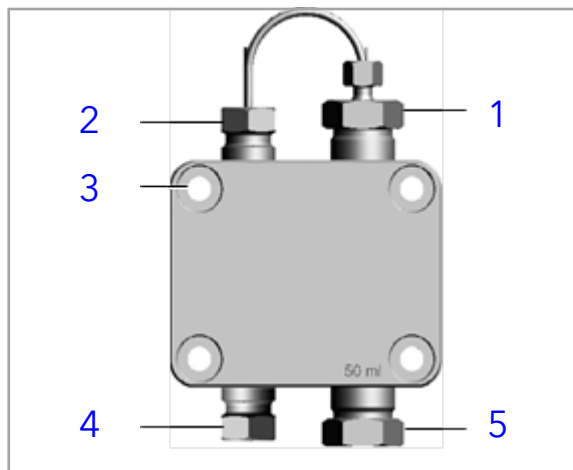


Fig.17 The pump head

Removing the pump head



Note: The pump head has been flushed with suitable solvent.

- Procedure**
1. Unscrew inlet fitting ② and outlet fitting ①.
 2. Unscrew the inlet fitting ⑤ to the eluent.
 3. Unscrew the outlet fitting ④ to the pressure sensor.
 4. Alternately unscrew the four fastening screws ③.
 5. Hold the pump head and consecutively pull out all fastening screws.

Installing the pump head

- Procedure**
1. Insert the fastening screws ③ and tighten alternately.
 2. Tighten the outlet fitting ④ to the pressure sensor.
 3. Tighten the inlet fitting ⑤ to the eluent.
 4. Tighten the inlet fitting ② and the outlet fitting ① of the piston.



Caution

CAUTION Over tightening capillary fittings can damage the pump head. Check the torque of screw fittings. Appropriate torques is 5 Nm for stainless steel fittings and 0.5 Nm for PEEK fittings.

ATTENTION Le serrage des raccords capillaires peut endommager la tête de la pompe. Vérifiez le couple des raccords vissés. Les couples appropriés sont de 5 Nm pour des raccords en acier inoxydable et 0,5 Nm pour les raccords en PEEK.

8.6.4 Exchanging the check valves

Dirty check valves do not open and close properly. They can cause pressure fluctuations and irregular flow.



Note: Insert the valves in the direction of flow as shown in Fig. 17.



Fig.18 The check valve showing ball ① and flow direction ②

Removing the check valves



Note: Loosen the screw fittings of the capillary connections alternately, to prevent the capillaries from bending.



Note: Pump head should be flushed prior to procedure.

- Procedure**
1. Unscrew the inlet fitting ① and the outlet fitting ②. Remove the check valve.
 2. Unscrew the inlet fitting ⑤ to the eluent and remove the check valve.

Cleaning the check valves

- Procedure**
1. Fill a beaker with solvent.
 2. Place the valve in the beaker.
 3. Put the beaker in an ultrasonic bath for at least 10 minutes.

Installing the check valves

- Procedure**
1. Insert the check valve and tighten the inlet fitting ⑤ to the eluent.
 2. Insert the check valve. Tighten the inlet fitting ① and the outlet fitting ②.
 3. Tighten the outlet fitting ② and the inlet fitting ⑤ with 7.5 Nm.

8.6.5 Verification of the safe state of the MiDas™ after maintenance

After maintenance the MiDas™ should be tested to verify it is in a safe state.

- Procedure**
1. Follow the instructions in Section 2: Setting up MiDas™.
 2. Monitor the make-up pump pressure at 1,000 µL/min when infusing methanol, 0.1% FA through the SFI. If the pressure is not in the range 10 to 25 bar then immediately switch off the MiDas™, disconnect the instrument from the mains power supply and any attached equipment. Do not use the instrument. Please contact KNAUER for further advice using the contact details given on the first-page of these instructions.



Caution

CAUTION When operating MiDas™ it must be possible to disconnect the instrument from mains supply at any time. In the event of an emergency the power connector of the instrument must be easily accessible and removable.

ATTENTION Lors de l'utilisation MiDas™ il doit être possible de déconnecter l'appareil de l'alimentation secteur à tout moment. En cas d'urgence, le connecteur d'alimentation de l'instrument doit être facilement accessible et débranchable.




WARNING Potentially hazardous chemicals can be used with the MiDas™. Use care when handling chemicals and wear appropriate PPE.

AVERTISSEMENT Des produits chimiques potentiellement dangereux peuvent être utilisés avec le MiD*. Faire preuve de prudence lors de la manipulation des produits chimiques et porter des EPI appropriés.

9. Troubleshooting

Make sure the 4000 MiD® is fully operational first. Refer to the 4000 MiD® instructions own troubleshooting section for details.

Symptom	Cause	Remedy
MiDas™ does not respond to commands issued in the software.	No communications (communication LED on MiDas™ front panel flashes constantly).	Check USB connection from MiDas™ to the 4000 MiD®. Check that the correct fluidics smartlock (supplied on installation) has been fitted and the software rebooted.
	MiDas™ is not powered up (communication LED on MiDas™ front panel is off).	Check power connection.
I have no signal during sampling acquisition.	The 4000 MiD® is not ready for a sampling experiment	Refer to the 4000 MiD® instructions for troubleshooting advice
I have signal but can't see my Direct Sample / Batch Sample.	Excessive chemical noise is swamping signal.	Refer to the 4000 MiD® for instructions troubleshooting advice.
	The attenuator is not operating (MiDas™ is generating a constant 'pulsing' sound)	Contact KNAUER
	The loop injection is not operating (MiDas™ should emit an audible 'click' at the start of a direct sampling method).	Contact KNAUER
Make-up is not dispensed when commanded in the software or flow rate / pressure is erratic.	Pump not primed.	See section „Priming the make-up pump“ on page 20.
	Inlet solvent flow blocked	Check reservoir level. Check reservoir filter and replace if necessary
	Check valves blocked	See section Cleaning the Check Valves 28. If this fails try contacting KNAUER for replacement check valves.
	Check valves defective	See section “Exchanging the Check Valves” on page 27
	Pump head seals are defective	If liquid emerges behind the pump head in the back flush contact KNAUER.

Attenuator leaks between the stator and stator ring.	The pressure rating of the valve has been exceeded	Check that the flow path is not blocked causing abnormal back pressure and then reduce flow rates to the Attenuator to reduce pressure.
	The rotor seal and stator face assembly have been damaged by abrasive particles in the sample and/or mobile phase or crystallisation of buffer solutions.	Replace the stator/rotor and contact KNAUER for a maintenance kit.  Note: Flush the valve frequently to prevent crystallization.

10. Technical data

Requirement	Description	
Indoor Use	The MiDas™ can only be used in an indoor environment	
Bench space	Required:	360 mm x 400 mm
	MiDas™ weight:	11.8 kg
Power Requirements	Line voltage:	100-240 V AC ±10%
	Line Frequency:	50/60 Hz
	Power:	50 W
	Overvoltage	For transient overvoltages typically present on the mains supply
	Category II:	For temporary overvoltage on the mains supply
Altitude	Operation:	Up to 2000 m
Temperature	Operation:	15 - 30 °C
	Storage:	4 - 40 °C
Relative Humidity	Operation:	40 - 80 %
	Pollution	Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected
	Degree 2:	
	Storage:	10 - 90 %

Appendices

Appendix A: Chemical compatibility chart

This Chemical Compatibility section will allow you to either check what materials will work with the chemicals you are using or planning to use; or to view what compatibility rating given to a material you are planning to use. Provided courtesy of IDEX Health & Science LLC

Chemical rating key:

A = Minor issue.

Note: the substance has little interaction with the material. Prolonged exposure may cause material deterioration.

B = Use caution.

Note: the substance has slight interaction with the material. Be cautious when using with tubing and frits. Exposure may cause material deterioration.

C = Incompatible.

Note: the substance is not recommended to be used with the material.

Substance	Fraction	Severity	Material	Notes
Acetic anhydride		B	Stainless Steel	
Aluminum acetate	100%	B	Stainless Steel	
Aluminum chloride		C	Stainless Steel	
Aluminum hydroxide	10%	B	Stainless Steel	
Aluminum sulfate	100%	B	Stainless Steel	
Ammonium bicarbonate	90%	B	Stainless Steel	
Ammonium carbonate		B	Stainless Steel	Elevated temperatures may reduce resistance.
Ammonium chloride	10%	B	Stainless Steel	Elevated temperatures may reduce resistance.
Ammonium oxalate	10%	B	Stainless Steel	
Ammonium sulfite	10%	B	Stainless Steel	
Aniline	10%	B	Stainless Steel	
Anisole		B	UHMWPE	Elevated temperatures may reduce resistance.
Aqua regia		C	PEEK, UHMWPE	
Barium carbonate		B	Stainless Steel	
Barium chloride	10%	B	Stainless Steel	
Barium nitrate		B	Stainless Steel	
Barium sulfate		B	Stainless Steel	
Benzene		B	Stainless Steel, UHMWPE	
Benzene sulfonic acid		C	PEEK	
Benzoic acid	60%	B	Stainless Steel	
Benzoyl chloride		B	UHMWPE	
Boric acid	100%	B	Stainless Steel	
Bromine (dry)		C	PEEK	

Substance	Fraction	Severity	Material	Notes
Bromine (wet)	saturated	C	PEEK, UHMWPE	
Bromine water		C	Stainless Steel	
Bromochloromethane		C	UHMWPE	
Butyric acid	100%	B	Stainless Steel	
Calcium carbonate	100%	B	Stainless Steel	
Calcium chlorate	10%	B	Stainless Steel	
Calcium chloride	10%	C	Stainless Steel	
Calcium hydroxide	50%	B	Stainless Steel	
Calcium sulfate		B	Stainless Steel	
Carbolic acid	100%	B	Stainless Steel	Subject to pitting.
Carbon disulfide		B	Stainless Steel, UHMWPE	
Carbon tetrachloride		B	Stainless Steel, UHMWPE	Elevated temperatures and prolonged exposure may reduce resistance.
Carbonic acid		B	Stainless Steel	
Chloric acid		C	Stainless Steel	
Chlorinated water	saturated	B	Stainless Steel	Subject to pitting.
Chlorine		C	PEEK, UHMWPE	
Chlorine gas		B	Stainless Steel, UHMWPE	
Chlorine liquid		B	PCTFE, UHMWPE	Elevated temperatures may reduce resistance.
Chlorobenzene		B	PCTFE	Elevated temperatures reduce resistance.
Chloroform		B, A, B	PCTFE, PEEK, UHMWPE	Not recommended for use with PEEK rotor seals.
Chlorosulfonic acid	10%	C	PEEK, UHMWPE	
Chlorotrifluoroethylene		B	PCTFE	
Chromic acid	conc.	B, C	Stainless Steel, PEEK	
Citric acid	10%	B	Stainless Steel	
Copper carbonate	10%	B	Stainless Steel	
Copper chloride	5% aerated	C	Stainless Steel	Subject to pitting.
Copper cyanide	100%	B	Stainless Steel	
Copper sulfate	100%	B	Stainless Steel	
Creosote oil		B	Stainless Steel	
Cyanogen gas		B	Stainless Steel	
Dichlorobenzene (o-)		B	UHMWPE	Elevated temperatures may reduce resistance.
Dichlorobenzene (p-)		B	UHMWPE	Elevated temperatures may reduce resistance.
Dichloroethylene		C	UHMWPE	
Dimethylsulfoxide (DMSO)		B	PEEK	Be cautious when using with tubing and frits.
Diphenylsulfone (DPS)		B	PEEK	Be cautious when using with tubing and frits; elevated temperatures reduce resistance.
Dowtherm A		C	PEEK	
Dowtherm G		B	PEEK	
Dowtherm HT		B	PEEK	
Dowtherm LF		B	PEEK	

Substance	Fraction	Severity	Material	Notes
Ethyl acetate		B	Stainless Steel	
Ethyl ether		B	PCTFE	Elevated temperatures reduce resistance.
Ethyl glycol		B	Stainless Steel	
Ethylene bromide		B	PCTFE	Elevated temperatures reduce resistance.
Ethylene chloride (dichloro-ethane)		B	UHMWPE	
Ethylene oxide		C	PCTFE	
Ferric chloride		B, C	PEEK, Stainless Steel	
Ferric nitrate	10%	B	Stainless Steel	
Ferric sulfate	100%	B	Stainless Steel	
Ferrous chloride		C	Stainless Steel	
Ferrous sulfate		B	Stainless Steel	
Fluorine		C	PEEK, UHMWPE	
Formic acid		B	Stainless Steel, PEEK	
Freon 11		B	PCTFE	Room temperature only.
Furfural		B	Stainless Steel	
Gallic acid	100%	B	Stainless Steel	
Glycerin	100%	B	Stainless Steel	
Halothane		B	UHMWPE	Elevated temperatures may reduce resistance.
Hydrobromic acid	10% conc.	C	PEEK	
Hydrochloric acid		C	Stainless Steel	
Hydrocyanic acid		B	Stainless Steel	
Hydrofluoric acid (40%)		C	PEEK	
Hydrofluosilic acid		C	Stainless Steel	
Hydrogen peroxide	100%	B	Stainless Steel	
Hydrogen sulfide	100%	B	Stainless Steel	
Iodine		B, C	PEEK, Stainless Steel	Room temperature only.
Lactic acid	100%	B	Stainless Steel	
Magnesium chloride	50%	B	Stainless Steel	
Magnesium sulfate	100%	B	Stainless Steel	
Malic acid		B	Stainless Steel	
Mercuric chloride	10%	B, C	PCTFE, Stainless Steel	
Mercury	100%	B	Stainless Steel	
Methyl alcohol	100%	B	Stainless Steel	
Methylcyclohexane		B	UHMWPE	Elevated temperatures may reduce resistance.
Methylene chloride		A, B	PEEK, UHMWPE	Be cautious when using with tubing and frits; Room temperature only. Not recommended for use with PEEK rotor seals.
Muriatic acid		C	Stainless Steel	
Naptha	100%	B	Stainless Steel	
Nickel chloride	100%	B	Stainless Steel	
Nitric acid	30% conc.	B	PEEK, Stainless Steel, UHMWPE	Prolonged exposure may cause deterioration.

Substance	Fraction	Severity	Material	Notes
Nitrogen tetroxide		B	PCTFE	Below Room Temperature
Oils (linseed and olive)		B	UHMWPE	
Oleic acid		B	Stainless Steel	
Oleum		C	PEEK, UHMWPE	
Oxalic acid	10%	B	Stainless Steel	Elevated temperatures may reduce resistance.
Ozone	liquid	B	UHMWPE	Elevated temperatures may reduce resistance.
Phenol	100%	B, C	Stainless Steel, PEEK	Be cautious when using with tubing and frits; room temperature only.
Phosphoric acid	10%	B	Stainless Steel	
Picric acid		B	Stainless Steel	
Potassium bichromate		B	Stainless Steel	
Potassium bromide		B	Stainless Steel	Subject to pitting.
Potassium carbonate		B	Stainless Steel	
Potassium chloride	10%	B	Stainless Steel	
Potassium ferricyanide	10%	B	Stainless Steel	
Potassium ferrocyanide	10%	B	Stainless Steel	
Potassium hydroxide	10%	B	Stainless Steel	(C @ 100%)
Potassium nitrate	100%	B	Stainless Steel	Elevated temperatures may reduce resistance.
Potassium oxalate		B	Stainless Steel	
Potassium permanganate	10%	B	Stainless Steel	
Potassium sulfide		B	Stainless Steel	
Pseudocumene		B	UHMWPE	
Pyrogallic acid		B	Stainless Steel	
Quinine Bisulfate		B	Stainless Steel	
Quinine sulfate		B	Stainless Steel	
Rosin		B	Stainless Steel	
Silver chloride		C	Stainless Steel	
Silver nitrate		B	Stainless Steel	
Sodium (hot)		C	PEEK	
Sodium acetate		B	Stainless Steel	
Sodium carbonate	10%	B	Stainless Steel	
Sodium chloride	10%	B	Stainless Steel	
Sodium chlorite Bleach	50%	B	UHMWPE	Elevated temperatures may reduce resistance.
Sodium hyposulfite	100%	B	Stainless Steel	
Sodium nitrate	50%	B	Stainless Steel	
Sodium peroxide		B	UHMWPE	Room temperature only.
Sodium sulfate	20%	B	Stainless Steel	
Sodium sulfide	50%	B	Stainless Steel	
Stannic chloride		C	Stainless Steel	
Stearic acid		B	Stainless Steel	
Sulfur chloride		B	Stainless Steel	

Substance	Fraction	Severity	Material	Notes
Sulfur dioxide	100%	B	Stainless Steel	
Sulfur trioxide	10%	C	UHMWPE	
Sulfuric acid	> 40% conc.	B	PEEK	Prolonged exposure may cause deterioration. (C @ 100%)
Sulfuric acid (aerated)		B	Stainless Steel	Elevated temperatures may reduce resistance.
Sulfuric acid (air free)		B	Stainless Steel	Elevated temperatures may reduce resistance.
Sulfurous acid	100%	B	Stainless Steel	
Sulfuryl chloride		C	UHMWPE	Room temperature only.
Tanic acid	100%	B	Stainless Steel	
Tartaric acid	50%	B	Stainless Steel	
Tetrabromoethane		B	UHMWPE	Elevated temperatures and prolonged exposure may reduce resistance.
Tetrahydrofuran (THF)		A	PEEK	Be cautious when using with tubing and frits; room temperature only. Not recommended for use with PEEK rotor seals.
Tetrahydrofuran (THF)		B	PCTFE	
Thionyl chloride		C	UHMWPE	Room temperature only.
Thionyl chloride		B	PCTFE	
Thiophene		B	UHMWPE	
Toluene		B	UHMWPE	Elevated temperatures may reduce resistance.
Trichlorethylene		B	Stainless Steel	
Trifluoromethyl sulfonic acid		C	PEEK	
Xylene (p-)		B	UHMWPE	Elevated temperatures may reduce resistance.

Appendix B: Appropriate delivery rates

At low attenuation, hence high attenuator frequency, sample has to be supplied at a higher rate to fill the rotor groove on each cycle. If this is not ensured a higher attenuation than expected is observed. Refer to the table below when selecting your delivery rate.

Attenuation at 0.5 mL/min make-up pump rate	Attenuation at 1 mL/min make-up pump rate	Attenuation at 2 mL/min make-up pump rate	Minimum required delivery rate (µL/min)
1669	3337	6675	50
1250	2500	5001	50
984	1968	3935	50
833	1665	3330	50
681	1363	2725	50
644	1288	2577	50
493	985	1970	50
341	682	1364	50
265	530	1060	50
189	379	758	50
167	333	667	100
133	267	533	100
125	250	500	100
100	200	400	100
83	167	333	100
67	133	267	100
50	100	200	100
42	83	167	100
33	67	133	200
25	50	100	200
19	39	78	200
17	33	67	200
13	25	50	200

In Batch and Direct Sampling a fixed volume of sample is being delivered to attenuator. This will be analysed by the 4000 MiD[®] over a number of scans obtained from the following relation:

$$\text{scans} = \frac{60 \cdot V_{\text{sample}}}{F t}$$

Where F is the delivery rate (in µL/min) and t is the scan time (in seconds). It is recommended that analysis is performed over at least 10 scans for reproducible results.



Note: This simplistic treatment does not include any dispersion effects which will extend the number of scans actually observed.

Appendix C: Calculating loop volume

The volume of a cylinder is given by the following relation:

$$V = \pi r^2 h$$

Where r is the radius and h is its height. This relation forms a good approximation in when estimating the volume of a section of tubing. Replacing the radius with the more commonly specified internal diameter, d , (in microns) and length, l , (in mm) one obtains the volume of the loop, V_{loop} , (in μL) from the following relation:

$$V_{\text{loop}} = \frac{\pi d^2 l}{4 \cdot 10^6}$$

This volume will be analysed by the 4000 MiD® over a number of scans obtained from the following relation:

$$\text{scans} = \frac{60 \cdot V_{\text{loop}}}{F t}$$

Where F is the delivery rate (in $\mu\text{L}/\text{min}$) and t is the scan time (in seconds). It is recommended that analysis is performed over at least 10 scans for reproducible results.



Note: This simplistic treatment does not include any dispersion effects which will extend the number of scans actually observed.

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