UltiMate 3000 Series

Flow Managers

FLM-3x00

Operating Instructions

Revision: 1.2

Date: June 2009

Now sold under the Thermo Scientific brand

Thermo SCIENTIFIC

DIONEX

CE

Declaration of Conformity

Product:	Flow Manager and Column Compartment
Types:	**FLM-3100**, **FLM-3200**, **FLM-3300**
	FLM-3100B, **FLM-3200B**, **FLM-3300B**

Dionex Softron GmbH herewith declares conformity of the above products with the respective requirements of the following regulations:

- Low-Voltage Equipment Directive 73/23/EEC
  changed by 93/68/EEC
- EMC Directive 2004/108/EG

The electrical safety of the products was evaluated based on the following standard:

- EN 61010-1: 2002
  Safety requirements for electrical equipment for measurement, control and laboratory use
  Part 1: General Requirements

The Electromagnetic Compatibility (EMC) of the products was evaluated based on the following standard:

- DIN EN 61326: 2006
  Electrical equipment for measurement, control and laboratory use
  EMC Requirements

This declaration is issued for the manufacturer

Dionex Softron GmbH
Dornierstrasse 4
D-82110 Germering

by the President, Dr. Peter Jochum.
December 1, 2008

Certificate

TÜV

Certificate no. CU 72052439 01

License Holder:
Dionex Softron GmbH
Dornierstr. 4

82110 Germering
Germany

Manufacturing Plant:
Dionex Softron GmbH
Dornierstr. 4

82110 Germering
Germany

Test report no.: USA-RC 30582114 001 **Client Reference:** Burkhard Seyferth

Tested to: UL 61010-1:2004
CAN/CSA-C22.2 61010-1:2004

Certified Product: Flow Manager **License Fee - Units**

Model Designation: FLM-3100, FLM-3200, FLM-3300 7

Rated Voltage: AC 100/120/220/240V, 50-60Hz
Rated Power: 162VA
Protection Class: I

7

Appendix: 1, 1-2

Licensed Test mark:

TUV Rheinland of North America, Inc. C US

Signatures

Stephan Schmitt
President

Dipl.-Ing. M. Raap
QA Certification Officer

Date of Issue (day/mo/yr)
08/11/2005

TUV Rheinland of North America, Inc., 12 Commerce Road, Newtown, CT 06470, Tel (203) 426-0888 Fax (203) 426-4009

Table of Contents

1 Introduction

1.1 Operating Instructions

The layout of this manual is designed to provide quick reference to the sections of interest to the user. However, in order to obtain a full understanding the flow manager and thermostatted column compartment, Dionex recommends that you review the manual thoroughly before beginning operation of the module.

Almost all descriptions in the manual apply to all flow managers of the UltiMate 3000 system and cover both the standard (stainless steel) and biocompatible models. Therefore, the terms "the flow manager" and/or "the FLM" are used throughout the manual. If some detail applies to only one model or version, the model (or version) is identified by name.

Note: The device configuration may vary (e.g., one or two column switching valves); therefore, not all descriptions necessarily apply to your particular instrument.

The descriptions in this manual refer to firmware version 2.30 and Chromeleon version 6.80 Service Pack 6.

The information contained in this manual is subject to change without notice and should not be construed as a commitment by Dionex. Dionex assumes no responsibility for any errors that may appear in this document. This document is believed to be complete and accurate at the time of publication. In no event shall Dionex be liable for incidental or consequential damages in connection with or arising from the use of this document.

1.2 Safety Information

The CE Mark label and cTUVus Mark safety label on the instrument indicate that the instrument is in compliance with the related standards (→ pages I and II).

1.2.1 Symbols on the Instrument and in the Manual

The table below shows the symbols used on the instrument:

Symbol	Description
~	Alternating current—Courant alternatif
	Power supply is on (**–**) — L'instrument est mis sous tension (**–**) and Power supply is off (**O**)— L'instrument est mis hors tension (**O**)
	Surface becomes hot during operation—La surface devient chaude lors du fonctionnement.
	Refer to the operating instructions to prevent risk of harm to the operator and to protect the instrument against damage. Référez-vous au ce manuel pour éviter un risque de blessure à l'opérateur et/ou de protéger l'instrument contre des dommages.
	Label according to the "Measures for Administration of the Pollution Control of Electronic Information Products" (China RoHS) guideline Étiquette "Measures for Administration of the Pollution Control of Electronic Information Products" (China RoHS)
	WEEE (Waste Electrical and Electronic Equipment) label—For more information, refer to the Environmental Information Notice. Étiquette de WEEE (Waste Electrical and Electronic Equipment) —Pour plus d'information, référez-vous à la Environmental Information Notice.

At various points throughout the manual, messages of particular importance are indicated by certain symbols:

Tip: Indicates general information, as well as information intended to optimize the performance of the instrument.

Important: Indicates that failure to take note of the accompanying information could cause wrong results or may result in damage to the instrument.

Important: Indique que ne pas tenir compte de l'information jointe peut conduire à de faux résultat ou endommager l'instrument.

Warning: Indicates that failure to take note of the accompanying information may result in personal injury.

Avertissement: Indique que ne pas tenir compte de l'information jointe peut entraîner des blessures corporelles.

1.2.2 General Safety Precautions

When working with analytical instrumentation, you should know the potential hazards of using chemical solvents.

Tips: Before initial operation of the flow manager, make sure that you are familiar with the contents of this manual.

Observe any warning labels on the device and refer to the related sections in these operating instructions.

For the general safety precautions in French, refer to Consignes Générales de Sécurité (→ page 5).

Please observe the following general safety precautions when operating the instrument or carrying out any maintenance work:

- Install the HPLC system in a well-ventilated laboratory. If the mobile phase includes volatile or flammable solvents, do not allow them to enter the workspace.
- For minimum interference effects, all components of the analytical system should be connected to the same mains output (same phase).
- The flow manager is primed with a mixture of isopropanol and water (20:80). During initial operation of the flow manager, make sure that the used solvents used are miscible. Otherwise, follow the appropriate intermediate steps.
- To prevent damage to the flow manager when lifting or moving, always lift the unit by the bottom sides or sides. Lifting the flow manager by the bottom front or by the front panel door may damage the door.
- The front panel tilts downward. Do not place any heavy objects on the open front panel door. This may damage the door.
- Do not touch any metal parts inside the column chamber while the temperature set point is > 50 °C (122 °F). Wait for the chamber to cool down, for example, before changing a column or before performing any maintenance procedures.
- When operating the HPLC system, always set a lower pressure limit for the system pump. This prevents damage resulting from leakage or from running the pump dry.
- When connecting the capillaries, make sure that the connectors are free from contaminants. Even minute particles may cause damage to the flow splitter, flow control valve, and column.

- Use only standard HPLC solvents (HPLC-grade: 0.2 µm filtered) and buffers that are compatible with components in the flow path of the flow manager. Note the special properties of the solvents such as viscosity, boiling point, UV absorption (UV/VIS detector), and refractive index (refractive index detector).
  Buffer concentration: typically up to 1 mol/L (0.1 mol/L if chloride ions are present).

- After operation, rinse out buffers and solutions that form peroxides from your HPLC system.

- Before switching from buffer to organic solution, rinse the analytical system thoroughly with deionized or HPLG-grade water.

- When switching to another solvent, ensure that the new solvent is miscible with the one contained in the pump. Otherwise, the analytical system can be damaged; for example, by flocculation.

- Avoid open flames and sparks, in particular if the mobile phase includes volatile or flammable solvents.

- If a leak occurs, turn off the flow manager immediately, stop the pump flow, and remedy the situation.

- When the front, side or rear panels are removed, dangerous electrical connections will be exposed. Disconnect the flow manager from all power sources before removing the panels. Remove panels only when instructed to do so in these instructions.

- Always replace blown fuses with the original spare fuses from Dionex (→ Replacing the Fuses, page 77).

- Replace faulty power cords and communication cables.

- Many organic solvents and buffers are toxic. Know the toxicological properties of all mobile phases that you are using.

- If the toxicological properties of a sample are unknown to you, treat it as if it contains a potentially harmful substance.

- Wear goggles when handling mobile phases or operating the instrument. An eye wash facility and a sink should be close to the unit. If any mobile phase splashes on the eyes or skin, wash the affected areas with sufficient water and seek medical attention.

- Dispose of all waste mobile phase in an environmentally safe manner that is consistent with all local regulations. Do not allow flammable and/or toxic solvents to accumulate. Follow a regulated, approved waste disposal program. Never dispose of flammable and/or toxic solvents through the municipal sewage system

- In an UltiMate 3000 system, some tubing is made of PEEK. While this polymer has superb chemical resistance to most organic solvents, it tends to swell when it is in contact with trichlormethane ($CHCl_3$), dimethyl sulfoxide (DMSO), or tetrahydrofuran (THF). In addition, it is attacked by concentrated acids such as sulfuric acid and nitric acid (swelling or attack by acid is not a problem with brief flushing procedures).

- Do not use PEEK tubing that is stressed, bent, or kinked.

- Wear goggles when handling fused silica tubing (e.g., during, installation and cutting).

- Before interrupting operation for several days or more, observe the precautions in Shutting Down the Flow Manager (→ page 63).

- Use original Dionex spare parts only. Substituting non-Dionex parts or using non-Dionex accessories may impair the performance of the instrument.

- Do not use the module in ways other than those described in this manual.

1.2.3 Consignes Générales de Sécurité

Veuillez noter: Avant de commencer à utiliser l'instrument, assurez-vous que vous vous êtes familiarisés avec le contenu de ce manuel.

Observez les étiquettes d'avertissement sur l'appareil et référez-vous aux sections correspondantes dans ce mode d'emploi.

Veuillez observer les consignes générales de sécurité suivantes lorsque vous utilisez l'instrument ou que vous procédez à des opérations de maintenance:

- Installez le système HPLC dans un laboratoire bien ventilé. Si la phase mobile contient des solvants volatils ou inflammables, empêchez qu'ils ne pénètrent dans l'espace de travail.

- Afin d'éviter au maximum les interférences, tous les éléments du système analytique doivent être raccordés à la même ligne secteur (même phase).

- L'instrument est stocké sous isopropanol et eau. Au cours démarrage de l'instrument, assurez-vous que les solvants utilisés soient miscibles. Sinon, suivez les étapes intermédiaires appropriées.

- Lorsque vous soulevez ou l'instrument, tenez-le toujours par le dessous ou par les côtés de l'unité. Soulever l'instrument par la partie avant inférieure ou par le panneau avant peut endommager la porte.

- Ne placez aucun objet lourd sur la porte ouverte du panneau avant. Ceci pourrait endommager la porte.

- Ne touchez à aucune partie en métal à l'intérieur du compartiment de colonne tant que le point de réglage de température est > 50 °C (122 °F). Attendez que le four refroidisse, par exemple, avant de changer une colonne ou avant de procéder à tous travaux de maintenance.
- Réglez toujours une limite de pression minimum pour le système HPLC. Ceci prévient les dommages résultant de fuites ou du fonctionnement à sec de la pompe.
- Lorsque vous connectez les capillaires, assurez-vous que les raccords sont exempts de tout contaminant. Même d'infimes particules peuvent causer des dommages au système (ex. diviseur de débit, vanne de régulation de débit et colonne).
- Utilisez uniquement des solvants HPLC (qualité HPLC : filtrés à 0.2 µm) et des sels compatibles avec les composants des circuits hydrauliques de l'instrument. Vérifiez les propriétés spécifiques des solvants telles que la viscosité, le point d'ébullition, l'absorption UV (détecteur UV/VIS) et l'indice de réfraction (réfractomètre).
  Concentration en sels: généralement inférieure à 1 mol/L (0.1 mol/L si présence d'ions chlorure).
- Après utilisation, purgez le système des tampons et des susceptibles de former des peroxydes.
- Lorsque vous passez d'une solution saline à un solvant organique, effectuez un rinçage intermédiaire du système HPLC à l'eau dé-ionisée ou qualité HPLC.
- Lorsque vous passez à un autre solvant, assurez-vous que le nouveau solvant soit miscible avec celui qui se trouve dans le système HPLC. Dans le cas contraire, le système HPLC peut être endommagé; par exemple, par des floculations!
- Evitez les flammes nues et les sources d'étincelles à proximité, en particulier si la phase mobile contient des solvants volatils ou inflammables.
- Si une fuite se produit, arrêtez immédiatement l'instrument, stoppez le débit de la pompe et remédiez au problème.
- Quand les capots de protection de l'appareil sont démontés, vous êtes exposés à des connexions électriques sous haute tension. Débranchez l'instrument de toute source d'alimentation électrique avant de retirer les capots. Ne démontez les capots de protection que si cela est explicitement demandé au cours de ces instructions.
- Remplacez toujours les fusibles grillés par des fusibles de rechange d'origine Dionex (→ Replacing the Fuses, page 77).
- Remplacez les cordons d'alimentation électrique et les câbles de communication défectueux.
- De nombreux solvants organiques et solutions salines sont toxiques. Informez-vous des propriétés toxicologiques de toutes les phases mobiles que vous utilisez.

- Les propriétés toxicologiques de nombreux échantillons peuvent être mal connues. Au moindre doute concernant un échantillon, traitez-le comme s'il contenait une substance potentiellement dangereuse.
- Portez des lunettes de protection lorsque vous manipulez des phases mobiles ou que vous utilisez l'instrument. Une installation permettant de se laver les yeux ainsi qu'un lavabo doivent se trouver à proximité du système. Si une phase mobile, quelle qu'elle soit, entre en contact avec vos yeux ou votre peau, rincez abondamment la zone affectée à l'eau, puis consultez un médecin.
- Débarrassez-vous de tous les déchets de phase mobile de manière écologique, conformément à la règlementation en vigueur au niveau local. Empêchez impérativement l'accumulation de solvants inflammables et/ou toxiques. Suivez un programme d'élimination des déchets règlementé et approuvé. Ne jetez jamais de solvants inflammables et/ou toxiques dans le système municipal d'évacuation des eaux usées.
- Dans un système UltiMate 3000, certains tubes sont en PEEK. Bien que ce polymère présente une excellente résistance chimique à la plupart des solvants organiques, il a tendance à gonfler lorsqu'il est en contact prolongé avec du chloroforme (CHCl3), du diméthyle sulfoxyde (DMSO) ou du tétrahydrofurane (THF). De plus, il est attaqué par des acides concentrés tels que l'acide sulfurique et l'acide nitrique (ces acides peuvent cependant être utilisés dans le cadre de procédures de nettoyage, à condition que l'exposition soit brève).
- N'utilisez pas de tubes PEEK écrasés, pliés ou abîmés.
- Portez des lunettes de protection lorsque vous manipulez des capillaires en silice fondue (par example pendant l'installation ou découper).
- Avant d'interrompre le fonctionnement pendant plusieurs jours ou plus, observez les précautions figurant en Shutting Down the Flow Manager (→ page 63).
- Utilisez des pièces de rechange d'origine Dionex. Effectuer des remplacements par des pièces ne provenant pas de Dionex ou utiliser des accessoires ne provenant pas de Dionex peut affecter les performances de l'instrument.
- N'utilisez pas l'instrument de manière autre que celles décrites dans ce manuel.

1.3 Intended Use

The flow manager is designed to perform equally well as a dependable system for routine analyses or as a sophisticated research instrument for use in nano, capillary, and micro HPLC (high performance liquid chromatography) applications, especially as part of the UltiMate 3000 system. However, it can also be used with other HPLC systems if adequate control inputs and outputs are available. A PC with USB port is required.

The flow manager is controlled by the **Chromeleon** Chromatography Management System. Being part of the UltiMate 3000 system, the flow manager can also be operated with other data systems, such as Analyst® (Applied Biosystems/MDS Sciex), Compass™/ HyStar™ (Bruker Daltonics), or Xcalibur™ (Thermo Scientific). To do so, installation of the DCMS^{Link} (Dionex Chromatography Mass Spectrometry Link) software is required in addition to the installion of the data system.

Please note that the flow manager may only be operated with the accessories originally supplied with the instrument (→ page 91) and within its technical specifications (→ page 89).

Use only standard solvents and water of at least HPLC grade (0.2 µm filtered), or better LC-MS grade and buffers that are compatible with components in the flow path of the flow manager. If water from water purification systems that are not properly maintained is used, polymeric contamination may seriously damage the column and may rapidly block solvent filters. Note the special properties of the solvents such as viscosity, boiling point, UV absorption (UV/VIS detector), and refractive index (refractive index detector).

Buffer concentration: typically up to 1 mol/L (0.1 mol/L if chloride ions are present).

If there is a question regarding appropriate usage, contact Dionex before proceeding.

Dionex is not liable for any damage, material or otherwise, resulting from inappropriate or improper use of the instrument.

1.4 Federal Communications Commission (FCC) 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 U.S. 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 instruction manual, 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 his expense.

2 Overview

2.1 Unit Description

The flow manager is a reliable module of the UltiMate 3000 system and performs equally well as a dependable system for routine analyses or as a sophisticated research instrument for nano, capillary, and micro HPLC applications. The design has been optimized for minimum dead volume and maximum efficiency.

- The flow splitter (→ Fig. 1, page 11) delivers the low flow rates required for nano, capillary, and micro HPLC applications. The flow manager is fitted with a flow splitter identification system that allows you to store splitter-specific information on a chip card and read it out whenever you want.

- An electronic splitter identification module (→ Splitter Identification System (Splitter ID), page 61) automatically adapts the system settings to the used splitter cartridge. The module also allows you to store splitter-specific information (split ratio, flow control settings) on a chip card and read it out whenever you want. In addition, the parameters required for flow splitting are set automatically.

- UltiFlow™ technology with active control of the splitter flow keeps the set flow rates constant, independent of outside influences. Thus, the flow rate is not influenced by the solvent composition, solvent gradients, different viscosities, or analyses at different temperatures. In the same way, effects from column ageing and partial clogging will be compensated.

- Thermoelectric elements heat or actively cool the column chamber and all internal components to the desired temperature. Heat exchangers allow fast temperature changes and ensure independence from the ambient temperature, even if the temperature set point is below the ambient temperature.

- The flow manager allows compartment cooling by max. 15 °C from the ambient temperature. The lower temperature limit is +5 °C (+41 °F).

- The columns can be warmed up to max. +70 °C (+158 °F). An increase in temperature from 20 °C to 50 °C (68 °F to 122 °F) is realized in less than 25 minutes. This corresponds to an average performance of 2-4 °C per minute.

- Temperature control allows keeping the column temperature constant. If the ambient temperature changes during the analysis, the increased heating or cooling ensures that the column temperature remains constant. The maximum deviation is ± 0.1 °C.

- Several columns of different length (maximum length: 30 cm) can be installed in the column chamber. An electronic column identification module allows GLP-compliant documentation of the column type and all important column parameters (→ Column Identification System (Column ID), page 60).

- Depending on the configuration, the flow manager is equipped with one or two column switching valves (→ Supported Configurations, page 12), e.g., for applications that require different columns at frequent intervals at similar temperatures.

- The flow manager is fully controlled by the Chromeleon Chromatography Management System, providing a high degree of system integration.

- All surfaces in the column chamber are made of materials that provide maximum resistance to the most commonly used HPLC solvents.

- The flow managers of the UltiMate 3000 system are available as biocompatible versions, also. For information about the characteristics of the biocompatible devices, refer to section 2.3.2 (→ page 13).

2.2 Operating Principle (UltiFlow)

The fundamental requirement on a flow manager for liquid chromatography is the ability to create constant low flow rates for nano, capillary, and micro HPLC applications, as well as to equalize the temperature. The flow managers of the UltiMate 3000 system are fitted with a flow splitter with integrated flow control that ensures constant flow rates, ranging from micro liter to nano liter flows. The flow rate is influenced neither by varying column backpressures nor by the temperature or solvent viscosity.

The flow splitter is equipped with two fluidic resistors that split the flow from the pump in the reciprocal ratio of the resistance. To ensure identical pressure drop at both resistors, the outputs of the flow splitter are connected via a cross arm with integrated flow meter. A controller adjusts the unbalance flow to a very low offset value near zero to flush the cross arm with fresh solvent permanently. To ensure this, the waste path includes an adjustable valve that adjusts in dependence of the column pressure (→ Fig. 1).

This innovative method creates constant low flow rates based on the split ratio and the pump flow. Different lowest flow rates are created by different pump flow rates, but they are always split according to the split ratio. This is independent of the solvent composition and the column pressure.

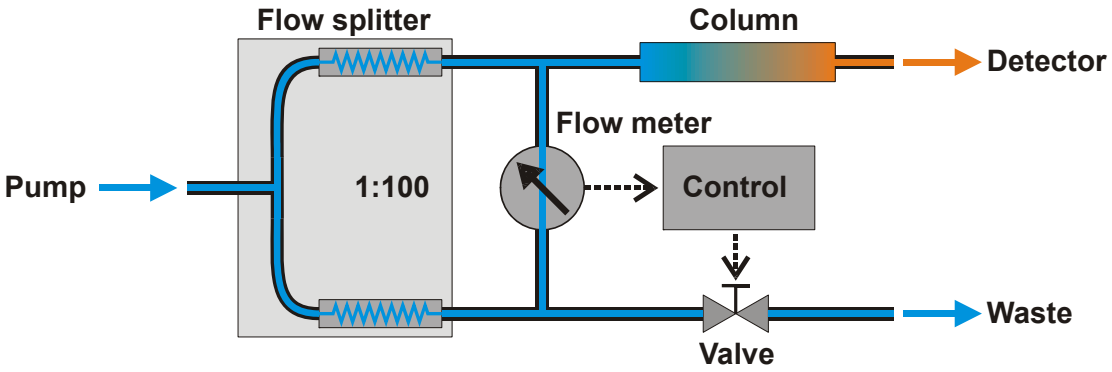


Fig. 1: Operation principle of flow splitting with control

For temperature equalization, temperature stability is more important than the absolute precision of the setting. The flow manager contains advanced electronic circuits that can maintain the selected temperature with a precision of ±0.1 °C.

The thermo-optimized design reduces the time required to equilibrate the temperature between the column and the solvent. The Peltier elements of the flow manager heat up and cool down the columns. The heat exchanger inside the column chamber also helps to bring the air and all components in the chamber to the desired temperature, including the flow splitter and column switching valve(s).

These procedures ensure that

- The temperature of the stationary phase remains constant over the total column length.
- The column and the solvent have the same temperature during the analysis.

In this way, analytical separation is performed at the nominal temperature, thus, minimizing fronting and tailing as well as retention time variations.

2.3 Supported Configurations

2.3.1 General

For an overview of the currently available models, refer to the list below. If you have any questions, do not hesitate to contact your Dionex sales representative or distributor.

Application	Description	Part No.
Nano HPLC	FLM-3100 with two 10-port micro switching valves	5720.0010
	FLM-3100B, same as FLM-3100, but biocompatible version	5721.0010
	FLM-3200 with 10-port micro and 6-port nano switching valves (1 each)	5720.0020
	FLM-3200B, same as FLM-3200, but biocompatible version	5721.0020
	FLM-3300 with one 10-port micro switching valve	5720.0030
	FLM-3300B, same as FLM-3300, but biocompatible version	5721.0030
	Tip: These flow managers are fitted with a splitter cartridge for a split ratio of 1:1000.	
Capillary and/or Monolithic HPLC	FLM-3100 with two 10-port micro switching valves	5720.0015
	FLM-3100B, same as FLM-3100, but biocompatible version	5721.0015
	FLM-3200 with 10-port micro and 6-port nano switching valves (1 each)	5720.0025
	FLM-3200B, same as FLM-3200, but biocompatible version	5721.0025
	FLM-3300 with one 10-port micro switching valve	5720.0035
	FLM-3300B, same as FLM-3300, but biocompatible version	5721.0035
	Tip: These flow managers are fitted with a splitter cartridge for a split ratio of 1:100.	
Micro HPLC	FLM-3100 with two 10-port micro switching valves	5720.0018
	FLM-3100B, same as FLM-3100, but biocompatible version	5721.0018
	FLM-3200 with 10-port micro and 6-port nano switching valves (1 each)	5720.0028
	FLM-3200B, same as FLM-3200, but biocompatible version	5721.0028
	FLM-3300 with one 10-port micro switching valve	5720.0038
	FLM-3300B, same as FLM-3300, but biocompatible version	5721.0038
	Tip: These flow managers are fitted with a splitter cartridge for a split ratio of 1:6.	

Tip: All flow managers are equipped with a flow splitter. When the flow manager is operated with Chromeleon, systems for column and/or splitter identification are supported (→ sections 5.5.4, page 60 and 5.5.5, page 61).

Tip: For Nano LC systems, the reduced solvent consumption mode requires a different splitter cartridge. For more information, refer to section 8 (→ page 87).

For information about how to replace a cartridge, refer to section 7.5 (→ page 80).

For information about the switching valve, refer to section 2.7 (→ page 20).

If you have any questions, do not hesitate to contact your Dionex sales representative or distributor.

2.3.2 Biocompatible Flow Managers

The FLM-3100B, FLM-3200B, and FLM-3300B flow managers extend UltiMate 3000 flow manager series by biocompatible device versions. Except for the flow splitter parts that are exposed to solvent and the switching valve(s) with the connected components, the biocompatible flow managers are identical to the standard devices (stainless steel). Therefore, almost all descriptions of the standard devices apply to the biocompatible versions, also. If some detail applies to only one version, the version will be identified. The differences are as follows:

Switching valve

The biocompatible flow managers are fitted with PAEK switching valves. As PAEK valves have deeper connection ports (→ Fig. 2), preassembled fitting connections (see below) must be used. This is essential for a zero dead volume connection.

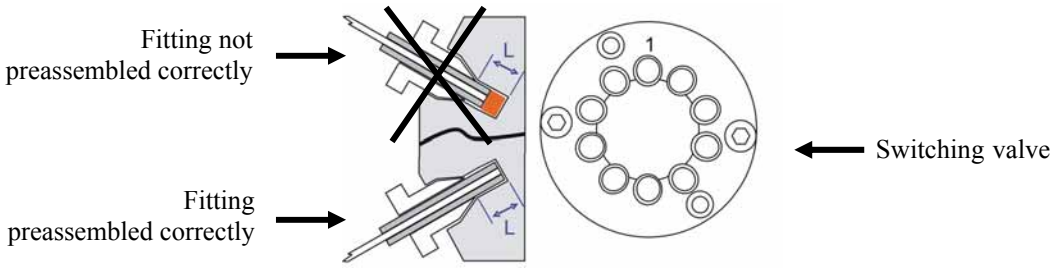


Fig. 2: Capillary connection on the switching valve

Important: Do not use a stainless steel nut and/or ferrule to connect the components to the PAEK valve. To avoid damage to the valve, use only the supplied capillaries and fittings, as well as original Dionex spare parts.

Important: N'utilisez jamais de vis et/ou ferrules métalliques pour les connexions sur une vanne biocompatible en PAEK. Afin d'éviter tout dommage à la vanne, utilisez seulement les capillaires et raccords fournis, ainsi que des pièces d'origine Dionex.

Follow the steps below to connect the components to the biocompatible switching valve. The description refers to the connection of a nano column, but applies to the other components, as well.

1. To establish a zero dead volume fitting connection between the column and the switching valve, a finger-tight nut, ferrule, and sleeve are required. Slide the finger-tight nut and the ferrule onto the sleeve as shown in Fig. 3.

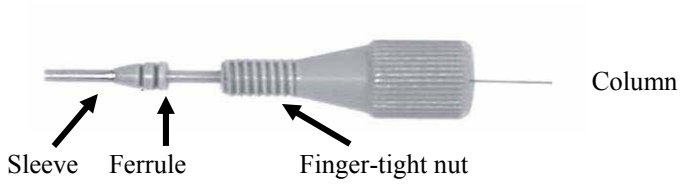


Fig. 3: Fitting connection

2. Insert the sleeve with the nut and the finger-tight nut in a port on the preassembly tool (part no. 6000.0065) and tighten the nut by two or three manual turns. (The pre-assembly tool is included in the application kits for the biocompatible UltiMate 3000 system.)

Fig. 4: Preassembly tool

⚠ **Important:** To avoid damage to the biocompatible switching valve, neither preassemble the fitting connection on the switching valve nor use any tool to tighten the finger-tight nut.

⚠ **Important:** Afin d'éviter tout dommage à la vanne d'injection biocompatible, ne l'utilisez jamais pour le pré-sertissage des raccords, et n'utilisez aucun outil pour visser les raccords à serrage manuel.

3. Push the sleeve all the way into the port. It is essential for a zero dead volume connection that the assembly seats firmly.

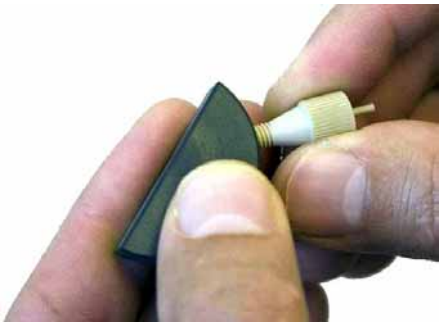


Fig. 5: Preassembling the fitting connection

4. Tighten the nut in the port until it is finger tight.
5. Carefully turn the nut an additional 1/4 turn (90°) past the point at which the ferrule starts to grab the sleeve.

Tip: Dionex cannot provide a torque specification because the force required to tighten the nut can vary due to the friction between nut and the thread, as well as the composition and wall thickness of the component to be connected.

6. Remove the preassembled fitting from the tool and inspect the fitting. When you gently pull the ferrule, you should not be able to move the ferrule on the sleeve. If the ferrule sleeve moves laterally (→ Fig. 6), re-insert the fitting all the way into the preassembly tool and tighten it an additional 1/8 turn past finger-tight.

Fig. 6: Inspecting the fitting

7. Remove and re-inspect the fitting. Repeat the previous step if necessary.
8. Insert the column (or the fused silica capillary) all the way through the sleeve until it extends the sleeve (→ Fig. 7).

Fig. 7: Inserting the column

9. Pull the column back (→ Fig. 8) and install the preassembled fitting with the column to the appropriate port on the switching valve. Make certain that the column does not extend the sleeve when installing it into the port

Fig. 8: Pulling the column back

10. Tighten the nut finger-tight. To avoid the formation of dead volumes, make certain that the column inlet enters all the way to the bottom of the valve port (e.g. push the column into the valve).
11. Tighten the nut additional 1/4 turn past finger-tight.
12. Start flow delivery and check for leakage. In case of any leakage, stop flow delivery and remove the fitting. Repeat steps 8 till 11.

Tip: If you cannot use finger-tight fittings due to limited space, you may use the long hex style nuts, instead (→ Fig. 9; part no. 6721.0017; the nuts are included in the application kits for the biocompatible UltiMate 3000 system, also). Follow the above steps and then connect the hex nut to the appropriate port on the switching valve. Tighten the nut with a ¼" wrench.

Fig. 9: Long hex style nut

2.4 Interior Components

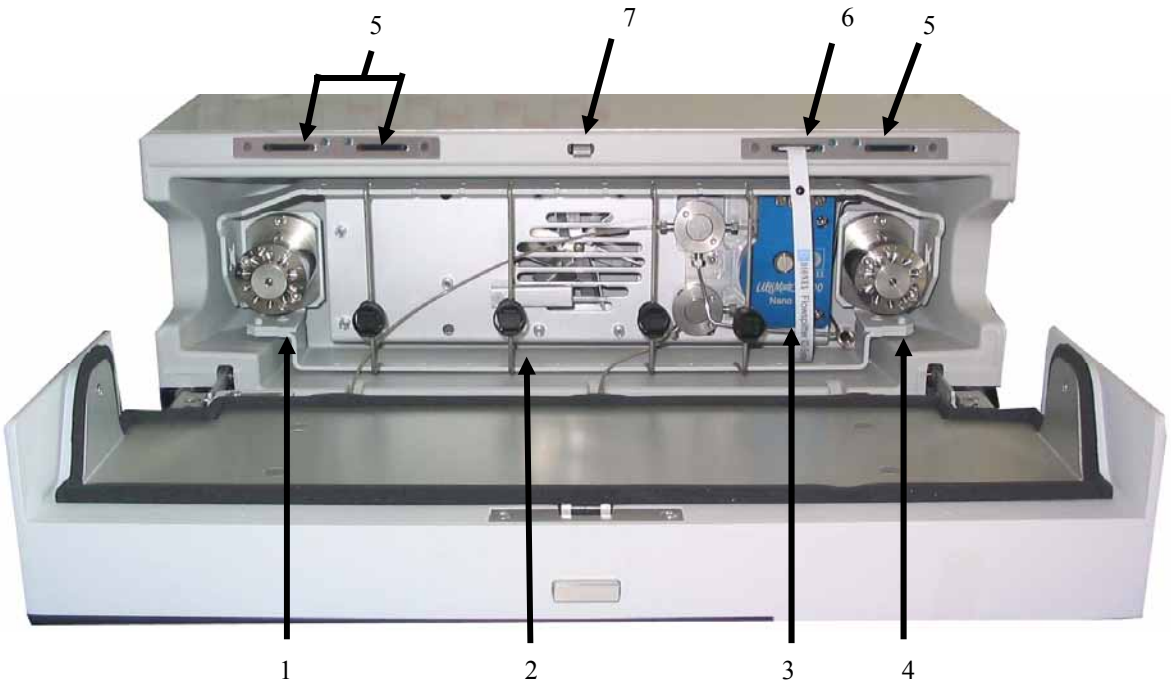


Fig. 10: Open FLM-3100 (here: with two 2-position/10-port switching valves)

No.	Description
1	Switching valve (2-position/10-port micro switching valve) (in Chromeleon: ValveLeft)
2	Column bracket with column clip (→ section 4.6, page 42)
3	Flow splitter (→ section 7.5, page 80)
4	Switching valve (if installed: 2-position/10-port micro valve or 2-position/6-port nano valve) (in Chromeleon: ValveRight)
5	Slots for the column ID chip cards (→ section 5.5.4, page 60)
6	Slot for the flow splitter chip card (→ section 5.5.5, page 61)
7	Locking mechanism for the front panel door (→ section 4.2, page 38)

⚠ **Important:** Use only the capillaries shipped with the flow manager and original spare capillaries from Dionex. Install the capillaries and fittings only at the positions for which they are intended.

Reuse used fittings and ferrules only for the same capillary connection. This is to avoid increased dead volume.

To connect the capillaries to the switching valve, install only the ferrules and fitting screws provided in the accessories kit.

⚠ **Important:** Utilisez uniquement les capillaires fournis avec l'instrument et les capillaires de rechange d'origine Dionex. Installez les capillaires et les raccords uniquement dans les positions pour lesquelles ils sont prévus.

La réutilisation des raccords et ferrules n’est possible que pour la connexion capillaire d’origine, afin d’éviter l’apparition de volumes morts.

Pour brancher les capillaires à une vanne d'injection, installez uniquement les ferrules et les raccords livrés avec la vanne et respectez les instructions d'installation du fabricant.

2.5 Front Panel Elements

Fig. 11: Front panel

No.	Front Panel Element	Description
1	Display	Shows information about the flow manager, e.g.: - General information upon power-up (→ section 5.1, page 49) - Status screen (→ section 5.2, page 49) - Various functions and menus that can be accessed via soft keys (→ section 5.3, page 50) - Error messages (→ section 6, page 67)
2	Standby button	Switches the flow manager to Standby mode (the LED is lighted). To cancel Standby mode and resume operation, press the Standby button again (the LED is not lighted). **Note**: To allow the flow manager to change the mode, press the Standby button for at least 1 second.
3	**LEDs**	
	Power	The LED is blue when the flow manager is on.
	Connected	The LED is green when the flow manager is controlled by Chromeleon.
	Status	The LED is green when the flow manager has reached the target temperature and no error has been detected. The LED is orange when the flow manager has not yet reached the target temperature or when the door is open. The LED is red when an error has been detected, e.g., a leak.

2.6 Rear Panel

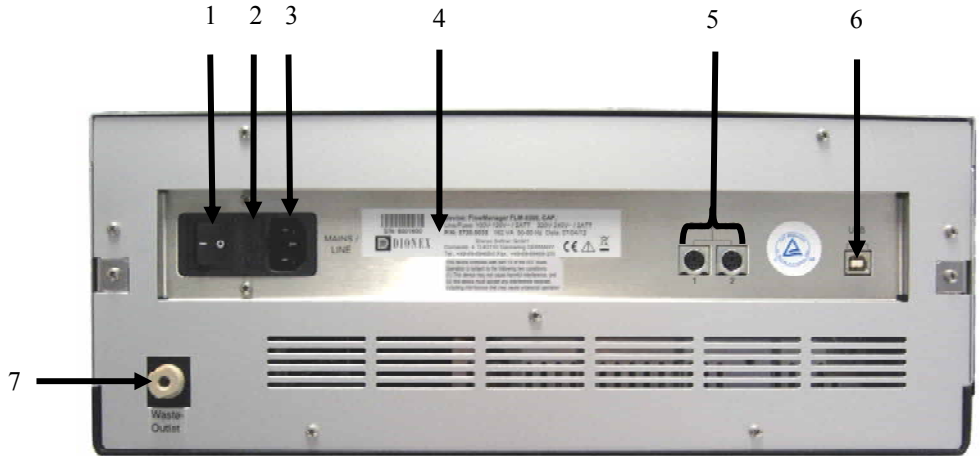


Fig. 12: Rear panel connectors

No.	Description
1	Power switch
2	Fuse holder (→ section 7.2, page 76)
3	Main power receptacle
4	Type label
5	Digital I/O for communication with external devices (→ section 3.4.3, page 28)
6	USB (Universal Serial Bus Interface) port for connection to the server PC (→ section 3.4.1, page 27)
7	Waste port for directing any liquid from the waste path of the flow splitter to an appropriate waste container, page 39)

2.7 Column Switching Valve

Depending on the instrument configuration, the flow manager is equipped with one or two switching valves (2-position/10-port micro and/or 2-position/6-port nano valves), e.g., for applications that require different columns at frequent intervals at similar temperatures.

The switching valve allows automated selection of the column to be used. The valve is installed in the column compartment and is thermostatted as well. The valve positions are programmed and controlled in Chromeleon. (For details, refer to the Chromeleon *online Help*.)

For information about how to connect the capillaries to the valve, refer to Connecting the Capillaries to the Column Switching Valve (→ page 44).

For more information about the valve, refer to page 83.

2.8 Flow Splitter

The flow manager is equipped with a flow splitter (→ Fig. 13) that delivers the low flow rates required for nano, capillary, and micro HPLC applications. Splitter cartridges with different split ratios are available for the different applications.

For information about the cartridge types and installation details, refer to section 7.5 (→ page 80).

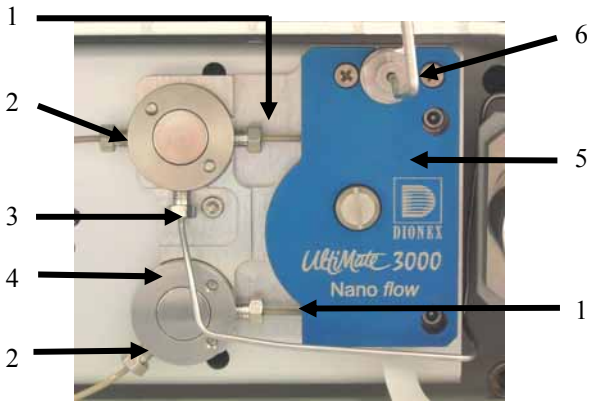


Fig. 13: Flow Splitter

No.	Description
1	Splitter cartridge outlets
2	Flow sensor connectors
3	Connector to flow control valve (via pre-filter)
4	Capillary connector, depending on your application. (The nano (capillary or micro) flow set in Chromeleon is output here.) For the application shown in Fig. 26 (→ page 45), connect the capillary to the flow manager's right switching valve (port 4).
5	Splitter cartridge
6	Pump connector

2.9 Leak Sensors

The flow manager contains two leak sensors to detect any humidity or gases that may accumulate in the column chamber. When a certain humidity or gas concentration is reached in the chamber (while the door is closed), the corresponding sensor is activated. Eliminate the cause for the leakage, wearing the appropriate protective clothing, and ventilate the inside before closing the door.

In addition, the flow manager contains a fluid leak sensor to detect liquid leaks from the flow control valve in the enclosure. The fluid leak sensor is installed in the rear of the enclosure (in a tray on the right). When liquid is detected in tray, e.g., due to clogging of the waste outlet (→ Fig. 20, page 39), the sensor is activated. Eliminate the cause for the leakage and dry the sensor as described in section 7.4 (→ page 78).

On the **Control > Leak control** display menu (→ page 54), set the sensitivity for the sensors and determine whether an acoustic beep shall alert you in case of an alarm. (You can open the **Leak control** display menu also via the **Leak** soft key (→ page 50).)

If one of the sensors detects a leak, the **Status** LED on the instrument's front panel is red and the related error message appears on the front panel display.

Tips: The **Status** LED remains red as long as the sensor is exposed to humidity, gas, or moisture. The **Clear** soft key on the navigation bar (→ page 52) allows you to remove the error message from the front panel display.

If a beep alerts you, you can turn off the beep for the current alarm from the **Control > Leak control** display menu by setting **All leak alarms** to **silent**. If the humidity or gas sensor was activated, you can turn off the alarm also by opening the front panel door. Beeping stops in any case when the cause for the leakage has been eliminated. A new beep sounds when one of the sensors is activated again.

If the flow manager is operated by Chromeleon, you can also determine the leak sensor mode in Chromeleon. If a sensor is activated, the related error message appears on the front panel display and the error is logged in the Chromeleon audit trail.

Inspect the flow manager for leaks every day. Tighten or replace leaking capillary connections if necessary.

2.10 System Wellness and Diagnostics

The flow manager supports several system wellness and reliability features that can help you detect small problems before they turn into big ones:

- Leak detector (→ page 20)
- Door status monitoring
- Column ID features for a GLP-compliant documentation of the column status (→ Column Identification System (Column ID), page 60)
- Flow splitter ID for the documentation of the splitter type and characteristics (→ Splitter Identification System (Splitter ID), page 61)

Tip: If the flow manager is operated by Chromeleon, the system wellness features are also available in Chromeleon (→ Diagnostics, page 62).

If an error occurs, the Status LED on the front panel is red and an error message appears on the front panel display (→ Troubleshooting, page 67). If the flow manager is operated by Chromeleon, the error is also logged in the Chromeleon Audit Trail.

3 Installation

3.1 Facility Requirements

- Make sure that the installation site meets the power and environmental specifications listed in the Technical Information section (→ page 89).
- Install the instrument in the laboratory on a stable surface that is free of vibrations.
- Make sure that the surface is resistant to solvents.
- Avoid locations with extreme changes in temperature (such as direct sunlight or drafts) and high humidity.
- Allow sufficient clearance behind and to the sides of the flow manager for power connections and ventilation. Do not place any objects between the flow manager and the device located under the it in the system stack.

3.2 Unpacking

All electrical and mechanical components of the flow manager are carefully tested before the instrument is shipped from the factory. After unpacking, please inspect the module for any signs of mechanical damage that may have occurred during transit.

Tips: Immediately report any shipping damage to both the incoming carrier and Dionex. Shipping insurance will compensate for the damage only if reported immediately.

Keep the original shipping container and packing material. They provide excellent protection for the flow manager in case of future transit. Shipping the instrument in any other packaging automatically voids the product warranty.

1. Place the shipping container on the floor. Remove the accessories kit and power cord.
2. Grasp the flow manager by the sides. Slowly and carefully, pull the instrument out of the shipping container and place it on a stable surface.

   Important: To prevent the flow manager from falling, only lift by the bottom sides. Do not lift the unit by the packaging material or the front panel door. When lifting or moving the flow manager, always lift it by the bottom or sides of the unit.

   Important: Afin d'empêcher l'instrument de tomber, saisissez-la par les côtés. Ne soulevez l'instrument à l'aide du matériau d'emballage ou par la porte du panneau avant. Lorsque vous soulevez ou déplacez l'instrument, soulevez toujours par le bas ou les côtés.
3. Remove the foam spacers.

4. Remove the foam insert from the door latch. The insert secures the front panel door during shipment.

5. Open the front panel door and remove the accessories for the valve (the accessories are fixed to the inside front panel).

6. Before connecting the flow manager to the power supply, wait approximately 4 hours to allow the instrument to come to room temperature and to allow any condensation that might have occurred during shipping to evaporate. After 4 hours, check the flow manager; if condensation still exists, allow the flow manager to continue to warm up (without connecting it to the power source) until the condensation is completely gone.

3.3 Positioning the Flow Manager in the UltiMate 3000 System

As the flow manager is part of an UltiMate 3000 system, Dionex recommends that you stack the individual modules, for example, as shown in Fig. 14. However, the arrangement of the system modules depends on the application. The UltiMate 3000 Proteomics MDLC system manual provides more application examples and information about how to arrange and/or connect the modules for these applications.

Fig. 14: Example for an UltiMate 3000 system

3.4 Connecting the Flow Manager

3.4.1 USB

The Chromeleon Chromatography Management System can use a USB connection to control the flow manager. Data is transferred digitally via the appropriate USB cable (part no. 6035.9035, USB extension cable, part no. 6000.1005). To ensure trouble-free operation, all USB cables (see above) should be ordered from Dionex.

Tip: If you want to operate the flow manager with Chromeleon, install the Chromeleon software before connecting the flow manager to the USB port on the Chromeleon server PC. When you install the Chromeleon software first, the USB driver for the flow manager is automatically loaded and the Windows operating system can detect the flow manager when the power is turned on.

Connect the flow manager to the server PC via the USB ports on the rear panel (→ Fig. 12, page 20). To do so, select one of the following alternatives:

- Connect the flow manager directly to the USB port on the server PC.
- Connect the flow manager to the server PC via another UltiMate 3000 instrument that is already connected to the server PC.
- Connect the flow manager to server PC via an external USB hub.

Tip: The USB standard limits the USB cable length to 5 meters. Each USB device can be separated from the PC or next USB hub by no more than 5 meters.

Important: Dionex recommends using these USB ports for connections to Dionex instruments only. Dionex cannot guarantee correct functioning if instruments from other manufacturers are connected.

Important: Dionex recommande d'utiliser les ports USB uniquement pour les raccordements aux instruments Dionex. Dionex ne peut garantir le bon fonctionnement si les instruments d'autres fabricants sont raccordés.

3.4.2 Power Connection

Use the power cord shipped with the flow manager to connect the instrument to the main power source. Connect the power cord from the main power receptacle on the rear panel to the power source that is connected to a true ground. No adjustment is required to adapt the line voltage to local voltage requirements.

3.4.3 Digital I/O

The two 6-pin Mini-DIN (→ Fig. 12, no. 5) ports can be used in Chromeleon to exchange digital signals with external instruments. A 6-core Mini-DIN signal cable (part no. 6000.1004) can be used for the connection. For information about the port and pin assignment, refer to the technical appendix (→ page 97).

3.5 Setting Up the Flow Manager in Chromeleon

This section provides brief instructions for setting up Chromeleon. For details, see the Chromeleon Help.

Tip: When the flow manager is connected to the Chromeleon computer, verify that the Chromeleon software is installed *before* turning on the flow manager power for the first time. Only then, the USB driver for the flow manager is automatically loaded and the Windows operating system detects the flow manager when the power is turned on.

3.5.1 Loading the USB Driver for the Flow Manager

1. Turn on the computer power, if it is not already on.
2. Under the Windows operating system (Vista, XP, or 2000), log on as a
   - local administrator if the computer is a local computer.
   - user with local computer administrator privileges if the computer is a network computer.
3. Open the **Chromeleon Server Monitor** program by double-clicking the Chromeleon Server Monitor icon  on the Windows taskbar.

   If the Server Monitor icon is not on the taskbar, click **Start** on the taskbar, point to **Programs** (or **All Programs**, depending on the operating system), point to **Chromeleon,** and then click **Server Monitor**.
4. Click **Start** to start the server.Click **Start** to start the server.
5. Click **Close** to close the Server Monitor window. The Server Monitor icon  appears on the taskbar.

   Tip: Clicking the **Quit Monitor** button quits (exits) the Server Monitor program, but does not stop the server. To stop the server, click **Stop**.
6. Turn on the main power switch on the rear panel of the flow manager.

7. *Windows Vista*
will automatically detect the new flow manager and perform the USB installation.

If Windows Vista fails to detect the flow manager and launches a wizard instead, this indicates that you connected the flow manager to the computer and turned on the power for the first time before you installed Chromeleon. To resolve the problem:

a) Click Cancel to exit the wizard.

b) Turn off the flow manager.

c) Install Chromeleon.

d) Turn on the power to the flow manager. Windows Vista will now detect the flow manager and install the USB software for the flow manager automatically.

Windows XP and 2000
will automatically detect the new flow manager and launch the **Found New Hardware Wizard**, which guides you through the USB installation. Select the following options:

a) If asked whether Windows can connect to Windows Update to search for software, select **No, not this time**.

b) Accept the default option (**Install the software automatically**) and click **Next>**.

c) Click **Finish** when the wizard reports that the software for the flow manager has been installed.

If Windows XP or 2000 fails to detect the flow manager and a message box asks for a USB configuration file (cmwdmusb.inf), this indicates that you connected the flow manager to the computer and turned on the power for the first time before you installed Chromeleon. To resolve the problem:

a) Click **Cancel** in the Windows message box.

b) Turn off the flow manager.

c) Install Chromeleon.

d) Turn on the power to the flow manager. Windows will now automatically detect the flow manager and launch the **Found New Hardware Wizard.**

3.5.2 Installing the Flow Manager

After the USB software for the flow manager has been installed (→ page 28), install and configure the flow manager in Chromeleon:

1. Start the Chromeleon **Server Monitor** (→ page 28) and the Chromeleon server if they are not yet running.
2. Start the Chromeleon Server Configuration program by clicking **Start** on the taskbar. Point to **Programs** (or **All Programs**, depending on the operating system), point to **Chromeleon**, and then click **Server Configuration**.
3. If necessary, click the plus sign next to the server name to display the items underneath.
4. Select the timebase to which the flow manager will be assigned, or create a new timebase (on the **Edit** menu, click **Add Timebase**).
5. Open the **Add device to timebase** dialog box. To do so, click **Add Device** on the **Edit** menu or right-click the timebase and click **Add Device** on the menu.
6. On the **Manufacturers** list, click **Dionex HPLC: UltiMate 3000** and on the **Devices** list, click **FLM-3000 Flow Manager**.
7. A wizard guides you through the installation. Chromeleon connects to the flow manager and transfers the settings from the instrument firmware to Chromeleon, setting the options on the pages accordingly. Confirm the related message with OK.
8. On each page, verify that the settings are correct and select additional settings if needed. For a description of the pages, see section 3.5.3.1 (→ page 31).
9. Click **Finish** to complete the installation of the flow manager.
10. On the **File** menu, click **Save Installation** and then close the Server Configuration program.

3.5.3 Configuring the Flow Manager

3.5.3.1 Initial Installation

During the installation, Chromeleon connects to the flow manager and transfers the settings from the instrument firmware to Chromeleon, setting the options on the wizard pages accordingly. Verify that the default settings are correct and make additional settings if needed. You may reopen the configuration pages later again to change the settings (→ page 33).

Tip: Changing the settings for a specific application in the **Commands** dialog box, in a program file (PGM), or on a control panel will not change the default settings on the configuration pages.

For additional information about a page, click **Help**.

General Page

Shows the general instrument parameters.

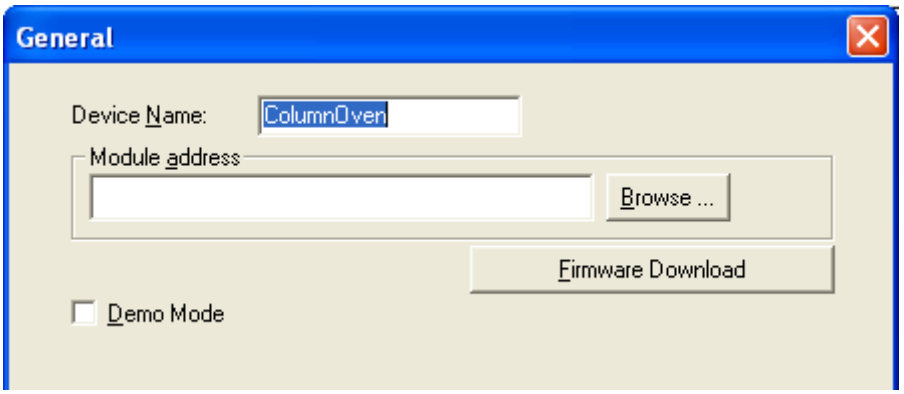


Fig. 15: General page

- **Device Name**
  Displays the name used to identify the FLM in the installation environment and in the Chromeleon Client program. To control the FLM with the existing control panels, accept the default name. If you enter a different name, you may have to re-link the controls on the control panels and edit the name of the FLM in the program files.
- **Demo Mode**
  This check box should be cleared because Chromeleon only simulates the functions of the FLM when the demo mode is active. If the Demo Mode is enabled, the **Module address** input field will be unavailable. If you exit this page without having entered a module address, the Demo Mode will be enabled automatically.

- **Module address**
  Select the module address of the FLM if necessary. Click **Browse** and then double-click the FLM that you want to use on the **Device List**. The address is automatically entered in the **Module address** field.

- **Firmware Download**
  Click this button to update the FLM firmware with the version available in Chromeleon. (The button appears dimmed if the Demo Mode is enabled.)

  The FLM is shipped with the most recent firmware version. If a firmware update is ever required, follow the steps in section 7.7 (→ page 85).

When you leave the **General** page during initial installation of the FLM (with the Demo Mode being disabled), Chromeleon attempts to connect to the FLM, retrieve the settings from the FLM firmware, and set the options on the corresponding wizard pages. Confirm the related message with OK.

Components Page

This page shows which components are installed. In addition, you can select the columns for which to enable column identification.

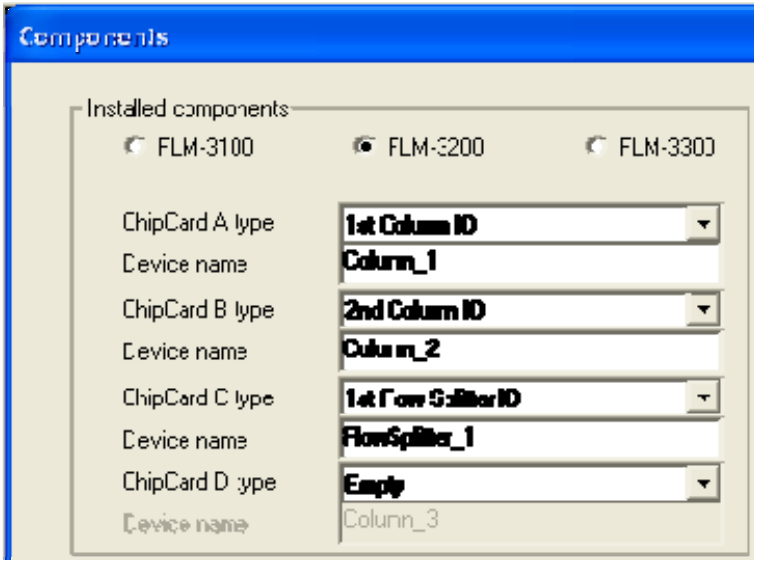


Fig. 16: Components page

- **FLM-3100, FLM-3200, FLM-3300**
  Indicates which flow manager is part of your system.

- **ChipCard A type** through **ChipCard D type**
  The flow manager is fitted with a column identification system (→ page 60) and a flow splitter identification system (→ page 61). Specify in which slot the chip cards for column and/or splitter identification are installed.

  As standard, the two slots on the left (ChipCard A type and ChipCard B type) and the rightmost slot (ChipCard D type) are for the column ID memory cards. The second slot from the right (ChipCard C type) is for the splitter ID memory card. Nevertheless, you can install the memory chip cards in any other slot instead, if necessary.
  Click the arrow next to the corresponding input field and select an entry from the list. If no chip card is installed, select **Empty**. In this case, the associated **Device name** field is disabled.

- **Device name**
  Indicates the name under which the column or flow splitter is identified in the installation environment and in the Chromeleon client.

  Tip: Accept the default device name. If you change the default name, you have to re-link the corresponding controls of the related control panel(s).

Click **Finish** to complete the basic configuration of the flow manager.

3.5.3.2 Changing the Basic Configuration or Selecting Advanced Settings

You may reopen the configuration settings later again to change the basic configuration settings or select advanced settings.

1. Start the **Server Configuration** program (→ page 30).
2. Right-click the FLM in the timebase and click **Properties** on the menu.
3. In addition to the pages of the installation wizard (→ page 31), configuration pages for the advanced settings are available (→ page 34). Select the additional settings or change the basic settings as needed.
4. To save the configuration, click **Save Installation** on the **File** menu and then close the Server Configuration program.

Configuration Tab Page

Use this tab page to determine whether Chromeleon shall record the temperature and/or column pressure as a separate channel:

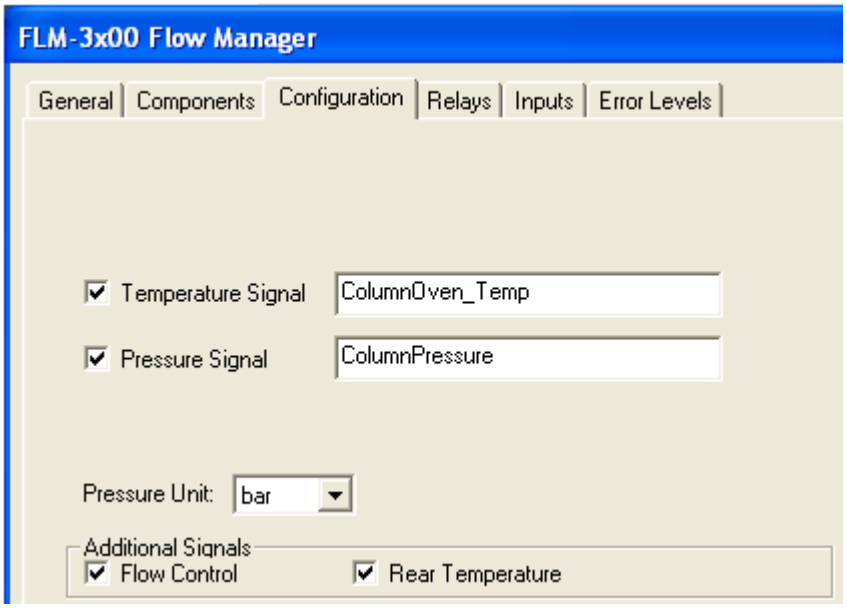


Fig. 17: Configuration tab page

- **Temperature Signal**
  The check box is selected by default. Accept this setting if you want to record the temperature as a separate channel. Accept the default name (**ColumnOven_Temp**) under which this temperature signal is identified in the installation environment and in the Chromeleon client. If you change the default name, you may have to re-link the corresponding controls of the related control panels.

- **Pressure Signal**
  The check box is selected by default. Accept this setting if you want to record the column pressure as a separate channel.
  Accept the default name (**ColumnPressure**) under which this temperature signal is identified in the installation environment and in the Chromeleon client. If you change the default name, you may have to re-link the corresponding controls of the related control panels.

- **Pressure Unit**
  Select the pressure unit to be used for storing the pressure values on the column ID chip card.

- **Flow Control**
  The check box is selected by default. Accept this setting. The additional channels that are recorded and displayed under **Column Details** on the FLM control panel are required when performing Operational Qualification or running a Flow Control Test for the flow manager. In addition, some of the recorded values provide valuable information to Dionex Service for troubleshooting in case the flow manager does not pass Operational Qualification successfully.

- **Rear Temperature**
  The check box is selected by default. Accept this setting. . If the check box is cleared, you cannot run the diagnostics test for the thermal unit in Chromeleon (→ page 62).

Relays Tab Page

The **Relays** tab page lists all available relays (FLM3x00_RELAY_1 and FLM3x00_RELAY_2). Select a check box to enable or disable the corresponding relay. Make sure that the required relays are selected; if they are not, they will not be available in Chromeleon.

Inputs Tab Page

The **Inputs** tab page lists all available remote inputs (FLM3x00_INPUT_1 and FLM3x00_INPUT_2). Select a check box to enable or disable the corresponding remote input. Make sure that the required inputs are selected; if they are not, they will not be available in Chromeleon.

Error Levels Tab Page

The **Error Levels** tab page classifies the severity of any errors that occur. It is generally not necessary to change the default settings.

Tip: Before turning off the flow manager by the power switch, always "**disconnect**" the module in Chromeleon. Disconnecting the module in Chromeleon is not required to set the flow manager to the Standby mode.

3.5.4 Assigning the Flow Splitter

If the UltiMate 3000 system includes a flow manager and a pump (DGP-3600M, LPG-3400M or HPG-3x00A/M), use the **Devices** tab page of the pump's properties to indicate which pump is fluidically connected with the flow splitter:

1. In the Chromeleon **Server Configuration** program, select the pump and click **Properties** on the pump's context menu.

2. On the **Devices** tab page, specify which pump is connected with the flow splitter:

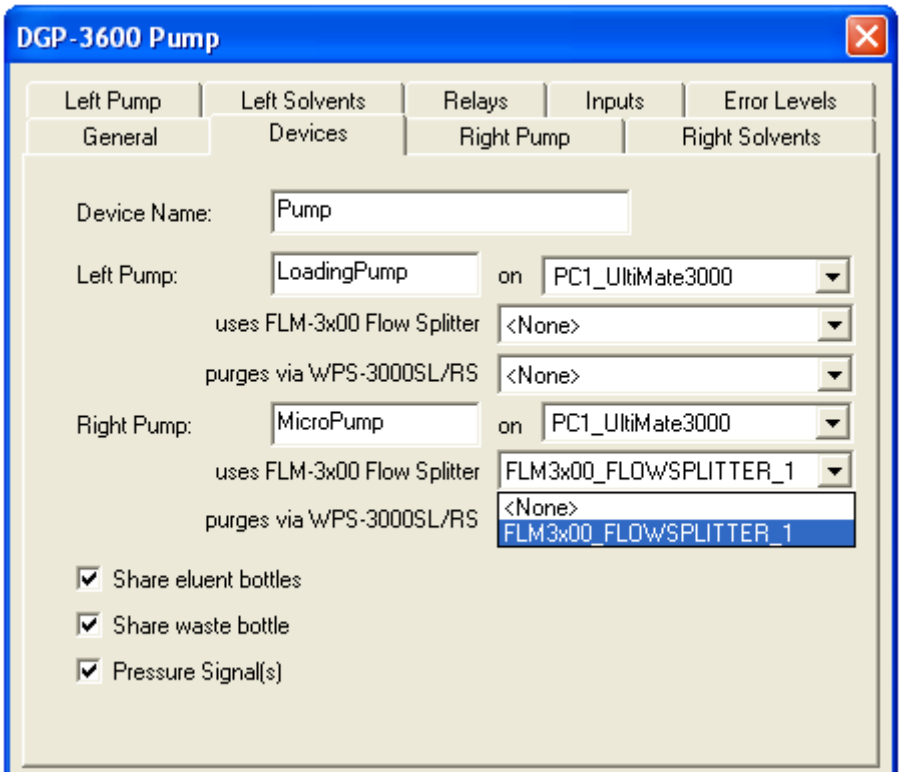


Fig. 18: Devices tab page (here: DGP-3600)

The default entry in the **uses FLM-3x00 Flow Splitter** field is **<None>** (no splitter). To change the setting, click the arrow next to the input field and select a flow splitter from the drop-down list.

Tips: When you assign a flow splitter to the pump, the pump flow settings apply directly to the flow on the splitter outlet, i.e., the split ratio is considered automatically.

In the standard configuration of the UltiMate 3000 system with a DGP-3600M, Dionex recommends assigning the flow splitter to the right pump (MicroPump).

4 Preparation for Operation (Startup)

4.1 Overview of Actions

⚠ **Important:** The flow manager is filled with a mixture of isopropanol and water (20:80) when being shipped from the factory. During initial operation, make sure that the solvents used are miscible. Otherwise, use an appropriate intermediate solvent.

When you operate a biocompatible flow manager, observe the instructions for connecting the capillaries to the switching valve and/or flow splitter (→ Biocompatible Flow Managers, page 13).

⚠ **Important:** L'instrument est stocké sous isopropanol et eau. Au cours démarrage de l'instrument, assurez-vous que les solvants utilisés soient miscibles. Sinon, suivez les étapes intermédiaires appropriées.

Afin de raccorder les capillaires à la vanne d'injection ou au diviseur de débit biocompatible, veuillez respecter les instructions d'installation (→ Biocompatible Flow Managers, page 13).

After you have unpacked, positioned and connected the flow manager as described in sections 3.1 through 3.4, prepare the flow manager for operation. Follow the sequence of steps below.

1. Connect a waste tubing to the waste port on the instrument's rear panel (→ page 39).
2. Connect the drain system (→ page 40).
3. Turn on the FLM power (→ page 49).
4. *If you want to operate the FLM with Chromeleon*
   Set up the flow manager in Chromeleon if it is not already set up (→ page 28).
5. Connect the pump to the flow splitter (→ page 40).
6. Install the separation columns (→ page 42).
7. Establish the fluid connections between the column(s), switching valve(s), and flow splitter according to your application. For information about the connections on the column switching valves, refer to section 4.7 (→ page 44). For information about the connections on the flow splitter, refer to section 4.5 (→ page 40).
8. Install a trap column, if required for the application (→ page 46).
9. Connect the flow manager to the other components of your UltiMate 3000 system, as required by your application (→ *UltiMate 3000 Proteomics MDLC system manual*).
10. *(Optional)* Connect a manual injection port (→ page 47).

11. Turn on and set the temperature for column thermostatting if applicable (→ page 59).
12. Before using the FLM for sample analysis, equilibrate the entire system.
13. Activate column identification if required (→ page 60).
14. Adjust the brightness and contrast of the FLM display if necessary (→ page 49).

4.2 Opening the Front Panel Door

The front panel tilts downward to provide easy access to the components in the column chamber. Tilting down the front panel automatically moves the valves and the column carrier approximately 3.5 cm out of the enclosure, thus facilitating capillary connection.

To open the front panel door, press the release button on top of the enclosure. If the door lock is not released immediately, press the front panel against the enclosure.

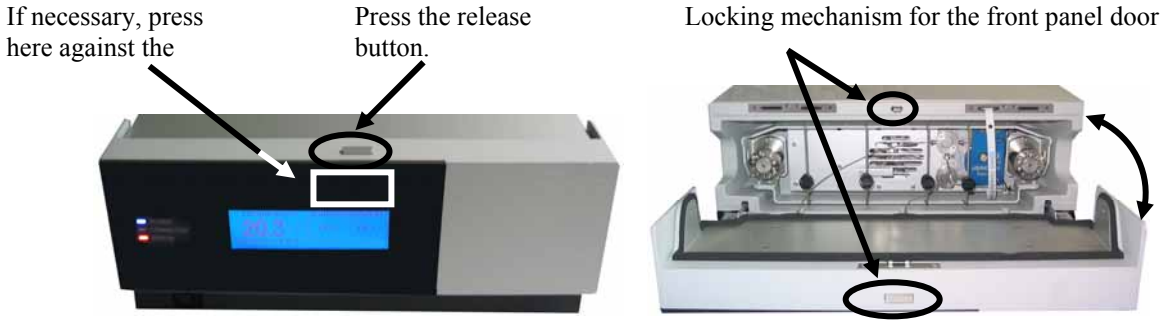


Fig. 19: Tilting the front panel downward

To close the column chamber, tilt the front panel upward until you hear the locking mechanism engage.

⚠ **Important:** When lifting or moving the flow manager, always lift the unit by the bottom sides or the sides. Lifting the flow manager by the bottom front or by the front panel may damage the door.

Do not place any heavy objects on the open front panel door. This may damage the door.

⚠ **Important:** Lorsque vous soulevez ou l'instrument, tenez-le toujours par le dessous ou par les côtés de l'unité. Soulever l'instrument par la partie avant inférieure ou par le panneau avant peut endommager la porte.

Ne placez aucun objet lourd sur la porte ouverte du panneau avant. Ceci pourrait endommager la porte.

4.3 Connecting a Waste Tubing

Connect a waste tubing to the waste port on the instrument's rear panel (→ Fig. 20) to direct any liquid from the waste path of the flow splitter to an appropriate waste container. Dionex recommends connecting, for example, PTFE tubing with an inner diameter of 1 mm (minimum 0.5 mm). Make sure that the tubing is long enough to reach the bottom of the waste container.

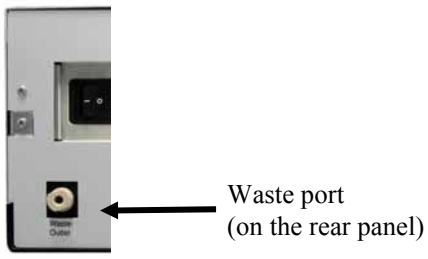


Fig. 20: Waste port

⚠ **Important:** Make sure the waste port and waste tubing are not blocked during operation of the flow manager and that the tubing is not bent.

For optimum chromatographic results, you should not change the position of the tubing and/or the waste container during the analysis or direct the liquid to a capped waste container because this might impair flow control performance.

⚠ **Important:** Assurez-vous que la tubulure d'évacuation (Waste) est libre en toutes circonstances. Vérifiez que les tubes ne sont ni pliés, ni bouchés.

Pour des résultats chromatographiques optimaux, vous ne devez ni modifier les positions de la tubulure d'évacuation et du flacon egout pendant l'analyse, ni diriger le liquide dans un récipient hermétiquement clos; ceci risque d'affecter les performances du contrôle du débit.

4.4 Connecting the Drain System

To discharge condensing water and/or liquid leaks that might have accumulated in the interior, the flow manager has two drain ports at the bottom right of the instrument (→ Fig. 21).

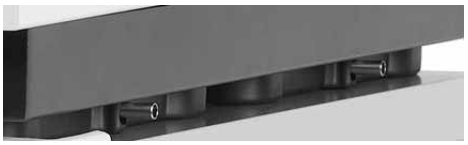


Fig. 21: Drain ports at the bottom right of the flow manager

Direct liquid leaks to waste via the drain system of the UltiMate 3000 system, using the components from the drain kit. The kit is shipped with the pump of the UltiMate 3000 system and can be ordered separately (part no. 6040.0005). The kit includes all required components and detailed installation instructions.

4.5 Connecting the Flow Splitter

⚠ **Important:** The flow sensor connectors (→ Fig. 13, no. 2) and the flow control valve connector (→ Fig. 13, no. 3) are installed in the factory. They should not be opened by the user.

⚠ **Important:** Les raccordements au capteur de débit (→ Fig. 13, no. 2) et à la vanne de régulation de débit (→ Fig. 13, no. 3) sont effectués en usine. Ils ne doivent pas être modifiés par l'utilisateur.

Follow the steps below to connect the capillaries to the flow splitter:

STOP **Warning:** Before carrying out any work in the column chamber, wait for the column chamber to cool down. Do not touch any metal parts inside the column chamber while the temperature set point is > 50 °C (122 °F).

STOP **Avertissement:** Avant de procéder à toute modification dans le compartiment de colonne, attendez que celui-ci refroidisse. Ne touchez aucune partie en métal à l'intérieur du four, tant que l'affichage de la température est > 50 °C (122 °F).

⚠ **Important:** When connecting the capillaries, make sure that the connectors are free from contaminants. Even minute particles may cause damage to the flow splitter, flow control valve, and column.

When you operate a biocompatible flow manager, observe the instructions for connecting the capillaries (→ page 13).

⚠ **Important:** Lorsque vous connectez les capillaires, assurez-vous que les raccords sont exempts de tout contaminant. Même d'infimes particules peuvent causer des dommages au système (ex. diviseur de débit, vanne de régulation de débit et colonne).

Afin de raccorder les capillaires à la vanne d'injection biocompatible, veuillez respecter les instructions d'installation (→ page 13).

1. Use the special capillary that is shipped with the Application Kit to connect the pump to the flow manager (→ Fig. 13, page 21).

Description	Part No.
Long capillary for connecting the pump to the flow splitter (including the appropriate fittings and ferrules) Standard version Biocompatible version Use this capillary, for example, when the system modules are stacked as shown in Fig. 14 (→ page 26).	 6035.2550 6037.2550
Short capillary for connecting the pump to the flow splitter (including the appropriate fittings and ferrules) Standard version Biocompatible version Use this capillary, for example, when the pump is directly on the flow manager.	 6035.2553 6037.2553

⚠ **Important:** Do not substitute the capillaries mentioned in the above table for any other capillary.

- Connect the capillary to the pump. Bend the capillary for connection to the flow splitter if necessary.
- Rinse the capillary with isopropanol, via the pump (maximum flow rate, 5 minutes).
- Connect the capillary to the flow splitter (→ pump connector, Fig. 13, no. 6).

Tip: The pump outlet connector and flow splitter are equipped with a filter frit to catch any particles that might have entered the capillary during installation. Usually, it is not necessary to change these frits.

2. Establish the connection to the capillary connector (→ Fig. 13, no. 4) as required by your application. For the system structure shown in Fig. 14, connect the capillary to the flow manager's right switching valve (port 4; → page 45).

4.6 Installing a Separation Column

Warning: Before carrying out any work in the column chamber, wait for the column chamber to cool down. Do not touch any metal parts inside the column chamber while the temperature set point is > 50 °C (122 °F).

Avertissement: Avant de procéder à toute modification dans le compartiment de colonne, attendez que celui-ci refroidisse. Ne touchez aucune partie en métal à l'intérieur du four, tant que l'affichage de la température est > 50 °C (122 °F).

Four column brackets are installed in the column chamber at the factory. Attach the columns to the brackets using the special column clips from the accessories kit.

1. The column clip consists of two pieces.
   To remove the ring from the bottom part, slightly press the ring in the direction of the arrows, which are printed on the ring.

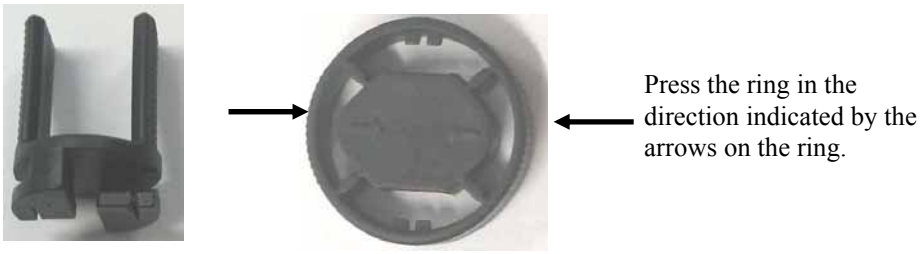


Fig. 22: Two-piece column clip

2. When installing the column clips for the first time: the kit includes self-adhesive foam pads to protect the column. Place one pad on the inner side of the bottom part of each clip.

3. Attach the bottom part of the clip to the bracket and turn it 90° clockwise.

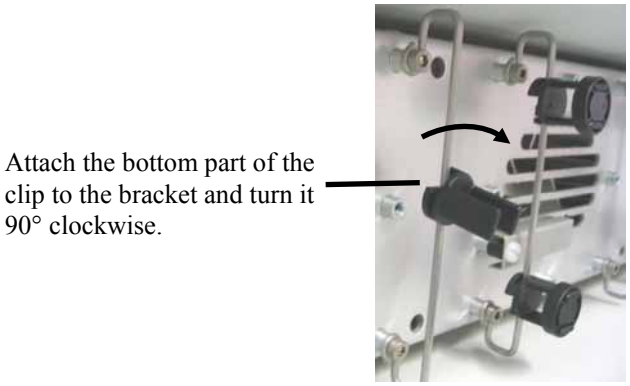


Fig. 23: Installing the bottom part

4. *If you want to use column identification*
   Attach the column ID chip card to the column. Two chip cards are provided in the accessories kit. Wrap the ribbon around the column, pass the shank of the rivet through a hole, and press down to unite the two parts (→ section 5.5.4, page60).

5. Press the column into the clip and reinstall the ring.

6. Connect the capillaries to column.

   Tip: For information about the connections on the column switching valve(s), refer to section 4.7 (→ page 44). For information about the connections on the flow splitter, refer to section 4.5 (→ page 40).

   You can guide the capillaries out of the interior at any position between the enclosure and the front panel door. To thread the capillaries out of the interior on the left or right side of the enclosure, direct them through the respective capillary guide.

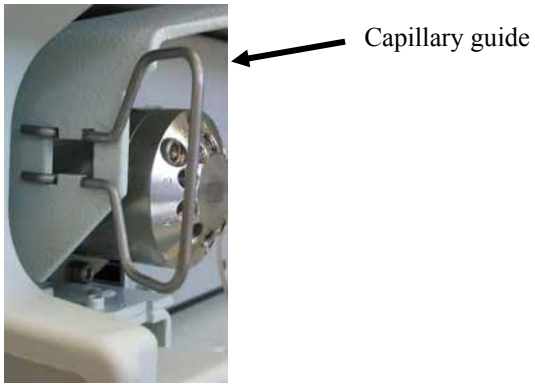


Fig. 24: Capillary guide installed on the carrier

   Dionex recommends guiding the capillaries out of the interior in such a way that the connections are as short as possible.

   Tip: Place the capillaries in such a manner (i.e., preferably 90-degree angle related to the door seal) that they do not open a small path for ambient air into the column chamber. This will prevent a proper seal and thus, impair the heating and cooling performance of the flow manager. When cooling, an improper seal may lead to a considerable amount of condensed water.

   An electronic column identification module allows GLP-compliant documentation of the column type and the most important column parameters. For more information, refer to section 5.5.4 (→ page 60).

You may move the preinstalled brackets as required by your application:

The bracket for the column clips is installed in the column carrier as shown in Fig. 25. To remove the bracket, slightly push it downward. You can now remove the bracket at the top. Then, remove it at the bottom of the carrier. To install the bracket at the new position, proceed in the reverse order.

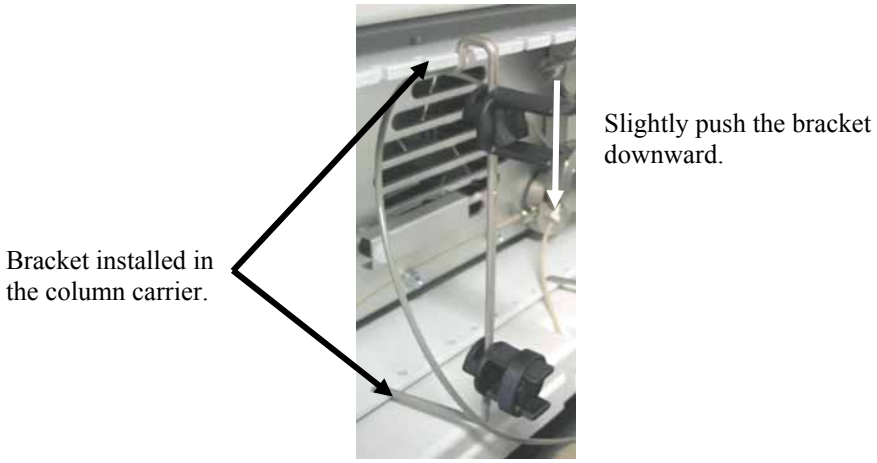


Fig. 25: Bracket installed in the column carrier

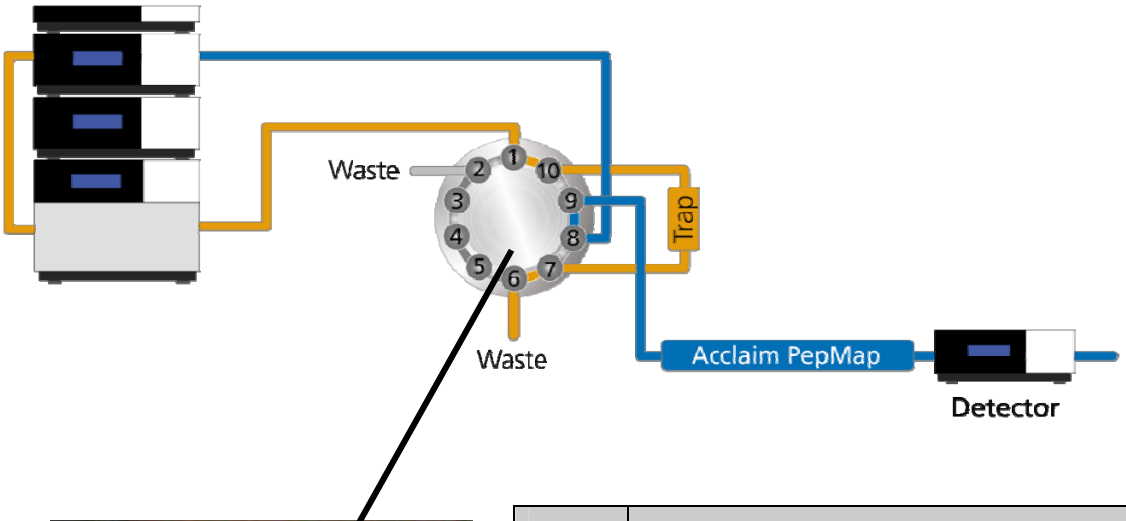
4.7 Connecting the Capillaries to the Column Switching Valve

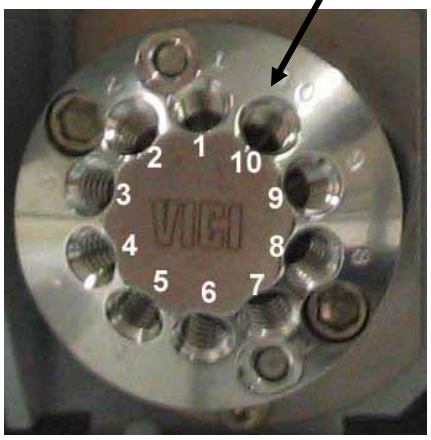
Depending on the instrument configuration, the flow manager is fitted with one or two column switching valves (2-position/10-port or 2-position/6-port). Valve switching is programmed and controlled via Chromeleon. (For more information, refer to the Chromeleon online Help.) Establish the fluid connections:

1. Remove the plastic cap that protects the switching valve during shipment.
2. Connect the capillaries, using an appropriate tool. For an example, refer to Fig. 26.

⚠ **Important:** When you operate a biocompatible flow manager, observe the instructions for connecting the capillaries to the switching valve (→ page 13).

⚠ **Important**: Afin de raccorder les capillaires à la vanne d'injection biocompatible, veuillez respecter les instructions d'installation (→ page 13).





Port	Connect the capillary ….
1	from the autosampler
2	to the waste
3-5	not used
6	to the waste
7	from the trap column
8	from the flow splitter
9	to the separation column
10	to the trap column

Fig. 26: Example for the connections on a 2-position/10-port column switching valve

⚠ **Important:** To connect the capillaries to the switching valve, install only the ferrules and fitting screws provided in the flow manager's accessories kit.

⚠ **Important:** Pour raccorder les capillaires à la vanne d'injection, installez uniquement les ferrules et les raccords fournis dans le kit d'accessoires.

4.8 Installing a Trap Column

Warning: Before carrying out any work in the column chamber, wait for the column chamber to cool down. Do not touch any metal parts inside the column chamber while the temperature set point is > 50 °C (122 °F).

Avertissement: Avant de procéder à toute modification dans le compartiment de colonne, attendez que celui-ci refroidisse. Ne touchez aucune partie en métal à l'intérieur du four, tant que l'affichage de la température est > 50 °C (122 °F).

Follow the steps below if your application includes a trap column:

1. To install the trap column a column holder is required.
   The application kits for the UltiMate 3000 nano and cap system include a trap column holder with the appropriate capillaries.
2. Insert the trap column in its holder and connect the capillaries directly to the column switching valve, e.g., to ports 2 and 5 (→ Fig. 26, page 45) as described in the UltiMate 3000 Proteomics MDLC system manual.

Important: When you operate a biocompatible flow manager, observe the instructions for connecting the capillaries to the switching valve (→ page 13).

Important: Afin de raccorder les capillaires à la vanne d'injection biocompatible, veuillez respecter les instructions d'installation (→ page 13).

4.9 Connecting a Manual Injection Port

A manual injection port (→ Fig. 27) is available from Dionex as an option for the flow manager:

Part No.	Description
6720.9007	Manual Injection Port, standard flow manager
6721.9007	Manual Injection Port, biocompatible flow manager

The injection port can be installed if you want to perform the injection manually instead of using an autosampler.

Fig. 27: Flow Manager with manual injection port

5 Operation and Maintenance

5.1 Power-Up

Use the main power switch on the rear panel to turn the flow manager on and off. The device type, serial number and firmware version are displayed on the display.

Tips: The noise that is heard for a few seconds after turning on the flow manager is normal and does not impair the flow manager's performance.

Each time the flow manager power is turned on, the flow manager runs a series of internal tests. During these self-diagnostics, all of the main components are checked. If an error is detected, the flow manager is not yet ready for analysis. The **Status** LED on the front panel is red and an error message appears on the front panel display. If the flow manager is operated by Chromeleon, an error message is also logged in the Chromeleon audit trail. Turn off the flow manager, take appropriate remedial action (→ Troubleshooting, page 67), and turn on the flow manager again.

5.2 Status Screen

If the self-test was successful, the initial screen changes to the status screen:

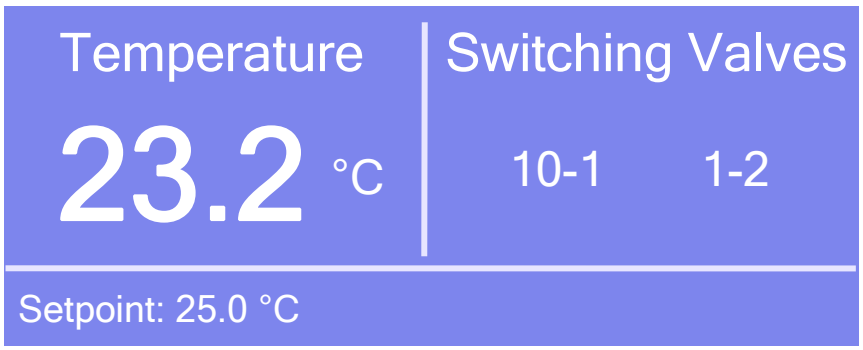


Fig. 28: Front panel display (here: for an FLM with two 2-position/10-port switching valves)

On the left side, the current temperature and the target temperature are displayed (in °C). The information about the column switching valves appears on the right side. The numerical values indicate the valve position.

Tip: Adjust the screen brightness and/or contrast on the **Configuration** display menu (→ page 56).
If the flow manager is operated by Chromeleon, you can adjust the settings also via the **Brightness** and **Contrast** parameters in the **Commands** dialog box.

5.3 Soft Key Menus

Four soft keys under the front panel display provide access to various menus, allowing you to perform specific commands directly from the flow manager's front panel. White dots on the front panel mark the positions of the soft keys. To show the soft key menus, select the position of a white dot on the front panel display with the Dionex menu pen. The menu pen (part no. 6300.0100) is included in the accessories kit.

Fig. 29: Showing the soft keys

The bottom status screen line changes to show the **Menu**, **Temp**, **Valve**, and **Leak** soft keys:

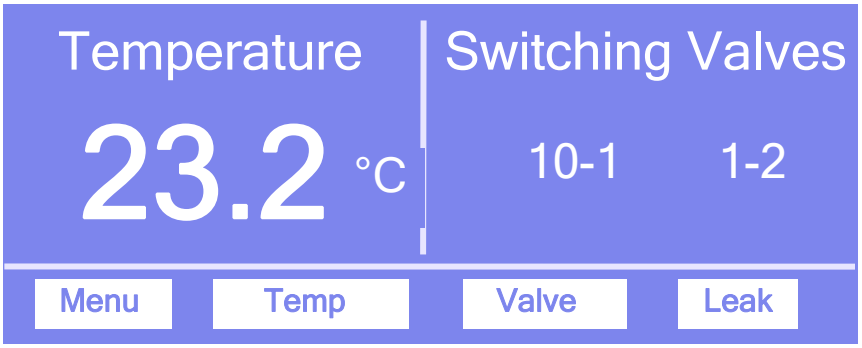


Fig. 30: Soft keys

Select a soft key with the menu pen:

Soft Key	Description
Menu	Opens the **Main** menu (→ page 53)
Temp	Opens the **Temperature control** menu (→ page 54).
Valve	Opens the **Valve control** menu (→ page 54).
Leak	Opens the **Leak control** menu (→ page 54).

Tips: If no option is selected, the original status screen line is restored after about 5 seconds.

When the flow manager is connected in Chromeleon, front panel input related to the measurement is disabled to prevent changes to the operating parameters. (Operating parameters are set to read-only.)
Parameters that do not interfere with the measurement, such as, the screen brightness or contrast can still be changed.

5.4 Menu Structure and Layout

Fig. 31 shows the menu structure:

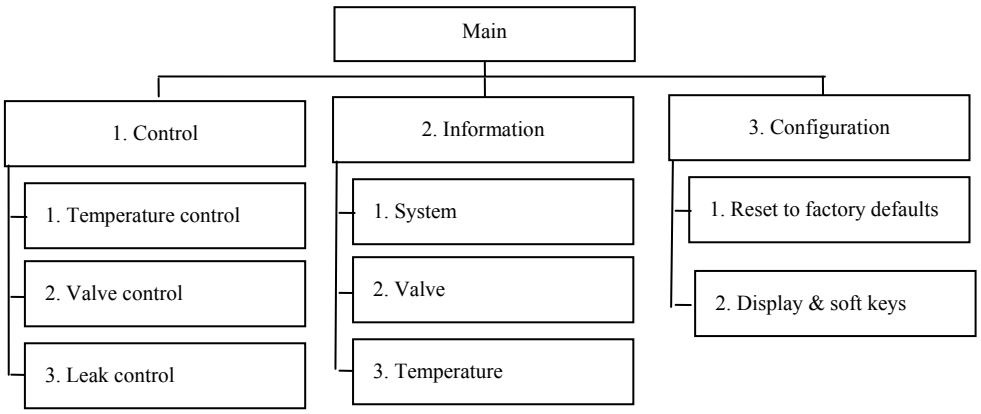


Fig. 31: Menu structure

In general, the menu layout is as follows:

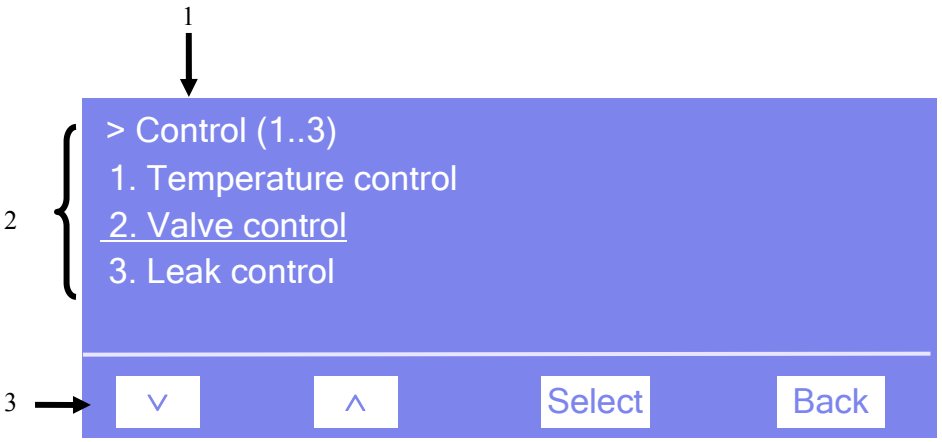


Fig. 32: Menu layout (here: Control menu)

No.	Description
1	Reports the menu name and the number of items on the menu list.
2	The menu items appear on a list and are numbered consecutively. The selected item is underlined.

3	Navigation bar (see below)

The selected menu item or parameter determines which soft keys appear on the navigation bar:

Soft Key	Description
∧	- Returns you to the previous entry on a list. If the list contains 5 or more items, the arrow up key can be used to page through the entries on the list (after reaching the first line) (→ **Key autorepeat**, page 56). - Increments numerical values. - Toggles between operating states e.g., on and off.
∨	Takes you to the next entry on a list. If the list contains 5 or more items, the arrow up key can be used to page through the entries on the list (after reaching the first line) (→ **Key autorepeat**, page 56). - Toggles between operating states, e.g., on and off.
>	Takes you to the next figure in a number. Any decimal point is skipped.
Select	Confirms the selection and activates the input field if applicable. **Note:** If an item is read-only (e.g., because the device is connected in Chromeleon), the **Select** key will not be available.
Back	Returns you to the previous menu level.
Toggle	Toggles between two operating states, e.g., between on and off.
OK	Confirms the selection and/or input.
Cancel	Cancels the action and restores the last value.
Note: Depending on the selected option, specific soft keys may replace these general soft keys.	

Tip: If an error is found, one or more error messages appear on the front panel display. In this case, the following soft keys appear on the navigation bar:

Soft Key	Description
Prev	Returns you to the previous error message.
Next	Takes you to the next error message.
Clear	Remove an error message from the display.

5.4.1 Main Menu

Open the **Main** menu from the bottom line of a status screen (→ Fig. 30, page 50). To do so, select the **Menu** soft key. The **Main** menu provides top-level access to the menu structure:

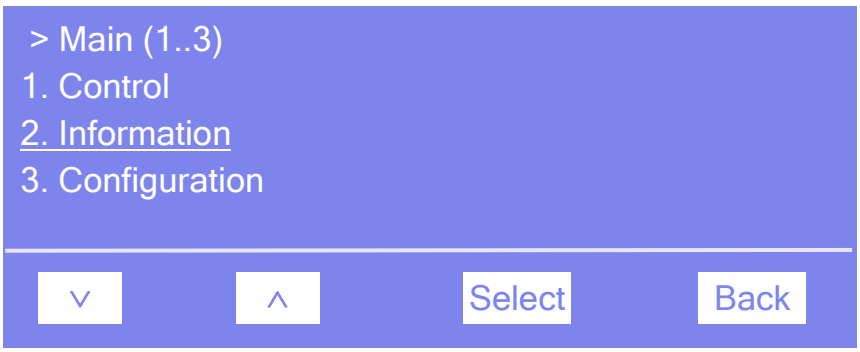


Fig. 33: Main menu

Select an item with the arrow up or down key—the selected item is underlined. Confirm your selection with **Select**. **Back** returns you to the status screen.

For information about the menus, refer to:

- Control menu (→ page 54)
- Information menu (→ page 55)
- Configuration menu (→ page 56)

5.4.2 Control Menu

On the **Control** menu, you can make the temperature and valve settings. In addition, you can determine the behavior for a leak alarm:

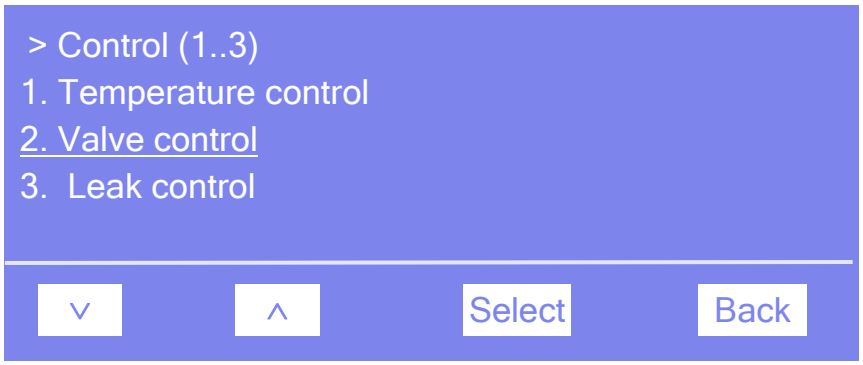


Fig. 34: Control menu

Menu Item	Description
Temperature control	Determine the setpoint temperature and turn temperature control on or off.
Valve control	Determine the valve position of the related valve.
Leak control	Determines if and how the corresponding sensor responds to gas, humidity or leaks and how you are alerted in case of an alarm: **Low**, **standard,** or **high**—enables leak detection and sets the sensitivity with which the sensor responds. When the sensor responds, a message appears on the front panel display and an acoustic beep sounds. **Low silent**, **standard silent,** or **high silent**— enables leak detection and sets the sensitivity with which the sensor responds. When the sensor responds, a message appears on the front panel display, but no beep sounds. **Off**—disables leak detection.

5.4.3 Information Menu

The **Information** menu provides general information about the flow manager, e.g., for diagnostic purposes:

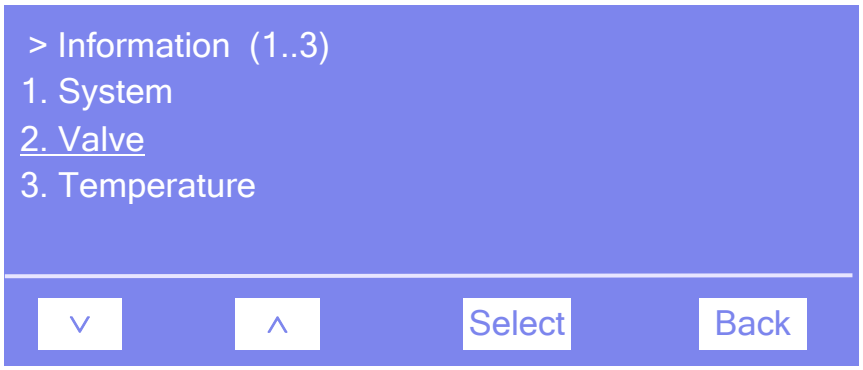


Fig. 35: Information menu

Menu Item	Description
System	Shows general information about the flow manager, e.g., firmware version, serial number, operating hours, etc.
Valve	Shows general information about the switching valves, e.g., configuration, switching cycle counter, etc.
Temperature	Shows general information about the temperature e.g., working load and cooling load, hours that the flow manager was operated in a certain temperature range, etc.

5.4.4 Configuration Menu

The **Configuration** menu provides information about the instrument configuration and/or allows you to the make the related settings:

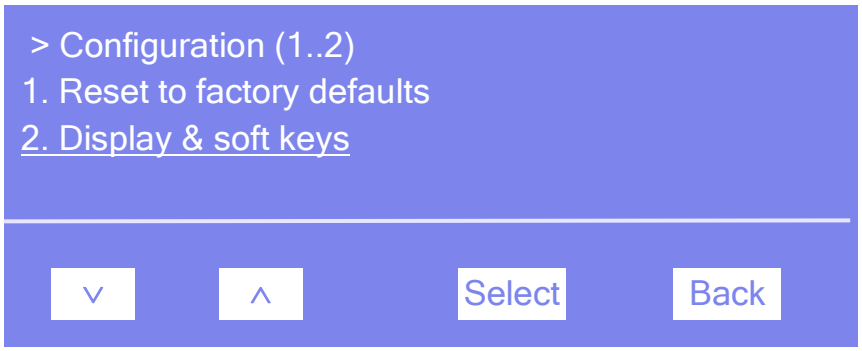


Fig. 36: Configuration menu

Menu Item	Description
Reset to factory defaults	Select to restore the Dionex standard settings. The **Reset to factory defaults?** dialog is opened. To confirm the restore, select **OK**. Else, select **Cancel**.
Display & Soft keys	Sets the display and soft key parameters: **Brightness**— Sets the screen brightness. **Contrast**— Sets the screen contrast. **Key sound**— Sets whether an acoustic beep sounds when you select a soft key. **Key autorepeat**—Sets wether the arrow up and arrow down keys can be used to page through the items on a menu list if the list contains 5 or more entries: **On**—yes or **Off**—no.

5.5 Operation with Chromeleon

5.5.1 General

The flow manager can be controlled by the Chromeleon Chromatography Management System. To control the flow manager, an appropriate Chromeleon version and an appropriate Chromeleon license are required. (If you have any questions, please contact your Dionex sales representative.)

All software details in this manual refer to Chromeleon 6.80. If you want to operate your module with *Chromeleon 7*, refer to the following documents for information about how to perform the related processes in Chromeleon 7 (all documents are included in the Chromeleon 7 shipment):

- *Chromeleon 7 Help*
  The Help provides extensive information and comprehensive reference materials for all aspects of the software.
- *Quick Start Guide*
  The guide describes the main elements of the user interface and guides you step-by-step through the most important workflows.
- *Reference Card*
  The reference card provides a concise overview of the most important workflows.
- *Installation Guide*
  The guide provides basic information about module installation and configuration. For specific information about how to install and configure a certain module, refer to the Chromeleon 7 Help.

Please also note the following:

- Chromeleon 7 terminology is different from the terminology used in Chromeleon 6.80. For details, refer to the 'Glossary - Chromeleon 7.0,' which is available in the Documents folder of your Chromeleon 7.0 installation.
- Diagnostic tests are not yet supported in Chromeleon 7.0.

5.5.2 Operating the Flow Manager with Chromeleon

Before you begin, verify that

1. The Chromeleon software is installed on the computer and the license code is entered.
2. The flow manager is connected to the Chromeleon computer via a USB connection.

   Tip: Verify that Chromeleon is installed on the computer and that the license code is entered before you connect the flow manager to the USB port on the Chromeleon computer and turn on the flow manager power. Only then, the USB driver for the flow manager is automatically loaded and the Windows operating system detects the flow manager when the power is turned on.

3. The flow manager is set up in Chromeleon, as described in section 3.5 (→ page 28).

Chromeleon can control the flow manager in two ways:

- **Direct Control**
  With direct control, you select operating parameters and commands from control panels or the **Commands** (F8) dialog box. Direct commands are executed as soon as they are entered. (To open the **Commands** dialog box, open a Chromeleon control panel. Select **Command** on the **Control** menu. The **Commands** dialog box is opened. You can also open this box by pressing the F8 key. To display the commands and properties that are available for the flow manager, click the "+" sign beside **ColumnOven** in the left list box.)
- **Automated Control**
  With automated control, you create a program (or PGM File). This is a list of control commands, executed in chronological order, for automated operation of the flow manager. Programs can be created automatically with the help of a software wizard or manually by editing an existing program.

For more information about how to operate the flow manager with Chromeleon, as well as for a list of the commands and properties supported for the instrument, refer to the *Chromeleon online Help* and/or *User Manual*.

When the flow manager is correctly connected to Chromeleon:

- The **Connected** LED on the instrument's front panel is green.
- Front panel input related to the measurement is disabled to prevent changes to the operating parameters. (Operating parameters are set to read-only.) Parameters that do not interfere with the measurement, such as, the screen brightness and/or contrast can still be changed.
- Various monitoring and diagnostic features are provided for system wellness (→ page 62).

Tips: The **Standby** button on the instrument's front panel remains active when the flow manager is operated by Chromeleon.

Before turning off the flow manager by the power switch, always **disconnect** the module in Chromeleon. Disconnecting the module in Chromeleon is not required to set the flow manager to the Standby mode.

If the flow manager is controlled by Chromeleon as part of the HPLC system, the program file (PGM File) can include a command that automatically restarts operation as desired after a power failure. (For details, refer to the *Chromeleon online Help*.)

Operational and/or Performance Qualification allows you to check and document the quality of your HPLC system. All required materials and detailed instructions are available from Dionex on request.

5.5.3 Turning On Column Thermostatting

You can turn column thermostatting on and off and set the desired temperature in Chromeleon.

4. In Chromeleon, open the **Commands** dialog box.
5. Select **ColumnOven** and **Temperature**.
6. Under **Nominal**, enter the desired temperature. Chromeleon sets **TempCtrl** automatically to **On**. Column thermostatting is active.

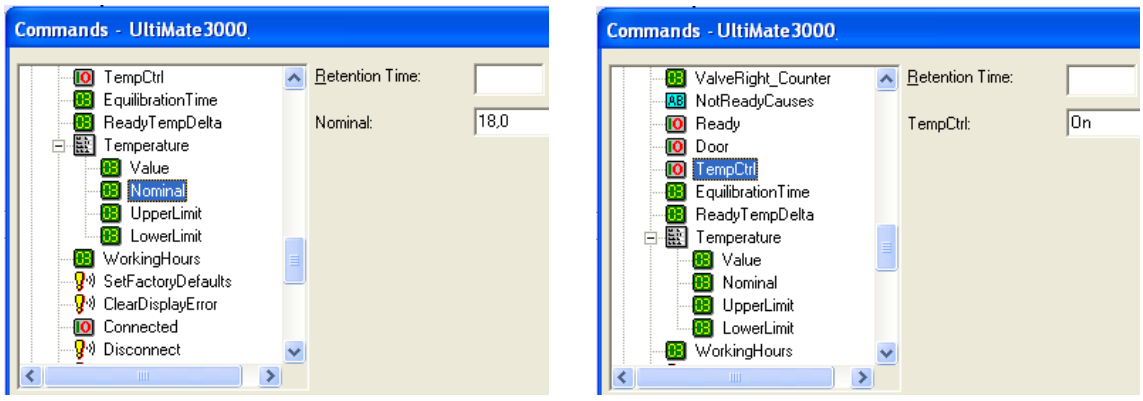


Fig. 37: Turning on column thermostatting

Set **TempCtrl** to **Off** if you do not want to use column thermostatting for a certain application.

If you want to work with column thermostatting later again, reset **TempCtrl** to **On**. When you change the temperature setting under **Nominal**, Chromeleon sets **TempCtrl** automatically to **On** again.

5.5.4 Column Identification System (Column ID)

The flow manager is fitted with a column identification system (column ID) that allows you to store column-specific information on a chip card and read it out whenever you want. The column is shipped with the chip card attached.

1. Insert the chip card in one of the four memory card slots (→ Fig. 38). Make sure that the Dionex logo faces upward.

Fig. 38: Inserting a memory chip card in a memory card slot

Tips: Column identification is supported for more than one column simultaneously. When the chip card is installed correctly in the slot, the slot LED is green.

As standard, the second slot from the right is intended for the splitter ID chip card (→ Splitter Identification System (Splitter ID), page 61). Nevertheless, you may use this slot also for the column ID chip card if you have specified this on the **Components** page (→ page 32) in the Server Configuration program.

2. To store and read out the column-specific information, use the related **Column** commands and properties in the Chromeleon **Commands** dialog box. These entries are available only if you have made the relevant settings in the flow manager's properties (on the **Components** tab page in the Server Configuration program; → page 32). The stored information can then provide a GLP-compliant overview of the column status.

Tip: To open the **Commands** dialog box, open a Chromeleon control panel and select **Command** on the **Control** menu or press the F8 key. In the left list box, click the "+" sign beside **ColumnOven** to display the items underneath.

For more information about the column identification system, refer to the *Chromeleon online Help*.

5.5.5 Splitter Identification System (Splitter ID)

The flow manager is fitted with a flow splitter identification system (similar to the column ID system in Column Identification System (Column ID), page 60). This splitter ID system allows you to store splitter-specific information (e.g., the split ratio and the flow control settings) on a chip card and access this information in Chromeleon. The memory chip card is fitted to the splitter cartridge in the factory.

1. Insert the chip card (with the Dionex logo facing up; → Fig. 38, page 60) in the second memory card slot from the right. As standard, this slot is for the splitter ID chip card. Nevertheless, you may use any other slot instead if you have specified this on the **Components** page (→ page 32) in the Server Configuration program.

2. To store and read out splitter-specific information, use the related flow splitter commands and properties in the Chromeleon **Commands** dialog box. This entry is available only if you have made the relevant settings in the flow manager's properties (on the **Components** tab page in the Server Configuration program; (→ page 32).

   The correct configuration of the flow splitter is important to ensure correct operation of the nano pump (MicroPump) in an UltiMate 3000 system. Also, refer to the notes in Assigning the Flow Splitter (→ page 36).

Tip: To open the **Commands** dialog box, open a Chromeleon control panel and select **Command** on the **Control** menu or press the F8 key. In the left list box, click the "+" sign beside **ColumnOven** to display the items underneath.

For more information about the flow splitter identification system, refer to the *Chromeleon online Help*.

5.5.6 Diagnostics Tests

With Chromeleon 6.80 service pack 2, Chromeleon supports Diagnostics functions for the flow manager. These tests allow you to check the performance of certain device components. For information about how to run the tests, refer to the Chromeleon online Help.

Run the …	**To check the …**
Gas Sensor Test	gas sensor for correct functioning
Thermo Unit Test	heating and cooling performance of the column compartment. During this test, the heating and cooling elements, their thermal connections, and the device fan are checked. Verify that the **Rear Temperature** check box is selected on the **Configuration** tab page (→ page 34) for the flow manager. If the check box is cleared, the test will not appear on the diagnostics tests list.
Flow Control Valve Test	integrity of the flow control valve. Verify that the **Flow Control** check box is selected on the **Configuration** tab page (→ page 34) for the flow manager. If the check box is cleared, the test will not appear on the diagnostics tests list.

If a test fails, information about possible causes along with recommended courses of action is generated on the diagnostics panel and in the report (→ Chromeleon Diagnostics Messages, page 72).

5.6 Shutting Down the Flow Manager

Caution must be taken to avoid the accumulation of micro-particles in the flow control valve (FCV). If the system is not used and kept in improper conditions for an extended period of time, these particles can originate from micro-organisms growth in the solvent, precipitation of salts or corrosion of tubing in the system. Therefore, please observe the following precautions before interrupting operation for more than a few days or before shipping the flow manager:

Tip: In case buffers (phosphate) or salt containing solutions are used, flush the system and column for 30 minutes with a salt-free solution first. In this case, Dionex recommends flushing the system before overnight inactivity also.

Ship the unit only in the original shipping container and observe the packing instructions. Shipping the unit in any other packaging automatically voids the warranty. Refer to the warranty statement in the terms of sale for more information.

5.6.1 Medium term interruptions of a few days

To shut down the flow manager:

1. Flush the column(s) according to manufacturer recommendations and the system (30 minutes) with an eluent containing more than 40% organic solvent (e.g. methanol).
2. Switch off the system.

To start up the flow manager:

1. In the Chromeleon **Commands** dialog box (F8), select **ColumnOven -> FlowSplitter_1** and set the **FSControlMode = Off** *before* starting the pump.
2. Flush the system thoroughly at 1000 µL/min Master flow for 5 minutes.
3. Stop the pump flow.
4. Set **FSControlMode = Auto** to restore normal operation of the system.

5.6.2 Long term interruptions of over a week

To shut down the flow manager:

1. Flush the column(s) according to manufacturer recommendations.
2. Prime all lines with an eluent containing more than **40% isopropanol**.
3. Stop the pump flow.
4. In the Chromeleon **Commands** dialog box (F8), select **ColumnOven -> FlowSplitter_1** and set **FSControlMode = Off**.
5. Run the pump at a 1000 µL/min Master flow for 5 minutes to flush the FCV.
6. Stop the pump and switch the system off.

To start up the flow manager:

1. Set the **FSControlMode = Off** *before* starting the pump.
2. Flush the system thoroughly at 1000 µL/min master flow for 5 minutes.
3. Stop the pump flow.
4. Set **FSControlMode = Auto** to restore normal operation of the system.
5. To check if the FCV achieves sufficient restriction for typical nano LC conditions before reconnecting the column, set **FSColPressDesired = 150 bar** and **FSControlMode = Pressure** with a master flow of 300 µL/min.

5.7 Routine and Preventive Maintenance

The flow manager is made of high-quality components and materials to minimize maintenance requirements. The painted surfaces, as well as the display, are relatively resistant to weak acids, alkali, and organic solvents. Nevertheless, immediately wipe up all liquids spilled onto the flow manager's surface, using lint-free cloth or paper. If surfaces are exposed for longer periods, these liquids can cause damage.

Perform the maintenance procedures listed below at regular intervals to ensure optimum performance and maximum uptime of the flow manager. The exact maintenance schedule for the flow manager will depend on a number of factors.

Frequency	What you should do...
Daily	Inspect the flow manager for signs of leakage. Tighten leaking capillary connections. If necessary, replace the fittings and/or ferrules.
	Observe the instructions for shutting down the flow manager on page 63.
Periodically	Clean the column chamber, using a lint-free cloth. Use paper to absorb any humidity in the column chamber. The cleaner the column chamber is, the better the leak sensor is at detecting leaks.
	Empty the waste container for the liquid from the waste outlet (→ Fig. 20, page 39).
	Inspect the seal installed in the front panel door. A defective door seal impairs the performance of the instrument. If the seal is defective, please contact your Dionex service representative.
	Check the drain tube(s) connected to the drain port(s) on the bottom right of the flow manager (→ Fig. 21, page 40). Verify that the tubing is unclogged and is routed below the drain port(s). Check the volume of the liquid in the waste container and empty as needed.
	When you use saliferous buffers, rinse the flow manager with de-ionized water.
Annually	Have a Dionex service representative check the FLM once a year to prevent, for example, contamination and excessive wear.

Tip: Chromeleon supports diagnostic tests to check the performance of certain components (→ page 62).

6 Troubleshooting

6.1 Overview

The following features help you to identify and eliminate the source for problems that may occur during the operation of the flow manager.

Status Indicators

The status indicators on the front panel provide a quick visual check of the operational status of the flow manager. They indicate whether the flow manager is turned on, connected in Chromeleon, and operating properly (→ Front Panel , page 19).

Error Messages

If a fault or mechanical error is detected during the operation of the flow manager, an error message is generated on the user interface. Check the Error Messages section (→ page 68) for a short description of possible causes along with recommended courses of action. If the flow manager is operated by Chromeleon, the error is also logged in the Chromeleon Audit Trail.

Tip: For information about common operating problems that might occur with the UltiMate system, probable causes, and remedial actions, refer to the UltiMate 3000 Proteomics MDLC system manual.

Diagnostics Tests

If the flow manager is connected in Chromeleon, Chromeleon provides several diagnostic tests allowing you to check the performance of certain device components (→ Diagnostics, page 62). If a test fails, check the Chromeleon Diagnostics Messages section (→ page 72) for a short description of possible causes along with recommended courses of action.

If you are unable to eliminate a problem following the instructions given here, contact Dionex Service.

6.2 Error Messages

Each time a fault or mechanical failure occurs during the operation of the flow manager, the **Status** LED on the instrument's front panel is red and an error message appears on the front panel.

Tips: Select **Clear** to remove an error message from the display. If several error messages appear, select **Prev** to view the previous message. **Next** takes you to the next message. (These soft keys are active also when the column compartment is operated by Chromeleon.)

When the column compartment is operated by Chromeleon

- The error is also logged in the Chromeleon audit trail.
- Error messages on the front panel display can also be removed via the **ClearDisplayError** command in Chromeleon.

The table below lists flow manager-related error messages along with possible causes and suggests appropriate remedial actions. In addition to the messages below, other messages may appear. In this case, please note the exact wording of the message and contact Dionex Service if you are unable to eliminate the problem.

Message	Remedial Action
Chip card communication error!	The chip card is not installed properly or defective. Verify that the chip card is installed properly.
Column pressure too high!	The column pressure is too high. The column might be blocked. Regenerate the column or use a new column.
Column pressure too low!	The back pressure at the column outlet is too low. Probable causes are a leak in the column flow path or a leak in the flow sensor. Connect the column directly to the splitter outlet. If the pressure is normal, there is a leak between flow splitter and column. Check the connections between the splitter outlet and the autosampler and between the autosampler and the column (incl.switching valves) and eliminate the cause for the leak. If the pressure is still too low, check whether the flow sensor leaks and eliminate the cause for the leak.
	The flow splitter may be blocked. Exchange the flow splitter cartridge (→ section 7.5, page 80).
Compartment temperature sensor communication error!	Turn the flow manager off and on again.
Error while programming flash! (This message may be extended by additional text.)	Turn the flow manager off and on again.

Message	Remedial Action
Flash object error! (This message may be extended by additional text.)	Turn the flow manager off and on again.
Flow control valve failure!	The flow control valve is dirty or defective. Test and clean the Flow Control Valve (→ section 7.2, page 76)
Flow control valve limit!	The flow from the pump is insufficient. The pump might not be ready for operation. Check the pump and/or the master flow from the pump.
	Leakage occurs in the system. Eliminate the cause for the leakage. Tighten leaking connections.
	The flow control valve is dirty or defective. Test and clean the Flow Control Valve (→ section 7.2, page 76).
Flow sensor fail!	Check any connections for leakage. Turn the flow manager off and on again.
Gas leak alarm!	The gas sensor detected an increased concentration of gas in the column chamber. Eliminate the cause. Tighten the leaking connection and vent the column chamber (→ section 2.6, page 20).
	The gas sensor may be influenced by the drain tubing from other modules in the UltiMate 3000 system. Verify that the drain tubing is connected as described in the installation instructions from the drain kit. As an alternative, connect separate drain tubing to the system module stacked upon the FLM.
Gas leak sensor error!	Turn the flow manager off and on again
Humidity leak alarm!	The humidity sensor detected an increased concentration of humidity in the column chamber. Eliminate the cause. Tighten leaking connection and vent the column chamber (→ section 2.6, page 20).
Humidity leak sensor error!	Turn the flow manager off and on again.
I2C bus error! (This message may be extended by additional text.)	Turn the flow manager off and on again.
Leak temperature sensor communication error!	Turn the flow manager off and on again.
Left chip card communication error!	The left chip card (slot A or B) is not inserted properly or defective. Verify that the chip card is installed properly
Left MSV communication error!	Turn the flow manager off and on again
Left MSV controller error!	The left switching valve is installed but cannot be accessed. Retry.
Left MSV error!	Contact Dionex Service if the messages appears reapeatedly.
Left MSV error! Retrying… and/or Left MSV position error!	The left switching valve cannot be switched to the desired position. Switching is repeated automatically. If this is not successful, the **Left MSV position error!** message appears.

Message	Remedial Action
MSV communication error!	Turn the flow manager off and on again. Contact Dionex Service if the message appears again.
Rear temperature sensor communication error!	Turn the flow manager off and on again.
Right chip card communication error!	The left chip card (slot C or D) is not inserted properly or defective. Verify that the chip card is installed properly
Right MSV communication error!	Turn the flow manager off and on again.
Right MSV controller error!	The right switching valve is installed but cannot be accessed. Retry.
Right MSV error!	Contact Dionex Service if the messages appears reapeatedly.
Right MSV error! Retrying…. and/or Right MSV position error	The right switching valve cannot be switched to the desired position. Switching is repeated automatically. If this is not successful, the **Right MSV position error!** message appears.

If communication between Chromeleon and the flow manager cannot be established, related error messages may appear in the Chromeleon audit trail.
Refer to the table below for the most important error messages, along with possible causes and the corresponding remedial actions. (The number 1610103 in the table below is the serial number of the instrument.)

Message	Remedial Action
FLM-3x00@USB-1610103 - Device not found on the USB.	The USB connection between the flow manager and the Chromeleon server is interrupted. Check the USB connection. The power supply to the flow manager is interrupted. Check the mains connection of the flow manager.
Error opening FLM-3x00@USB-1610103 – The System cannot find the file specified	The USB connection between the flow manager and the Chromeleon server is interrupted. Check the USB connection. The power supply to the flow manager is interrupted. Check the mains connection of the flow manager.
Error issuing control request to FLM-3x00@USB-1610103	The Chromeleon server cannot connect to the specified flow manager. Check the USB connection. Check the mains connection of the flow manager. Remove the flow manager specified in the message from the server configuration. Or else, select a different flow manager from the list of available flow managers in the server configuration (via Properties/ Browse).
Error reading from FLM-3x00@ USB-1610103 Data error (cyclic redundancy check)	There is a transmission error between the flow manager and the Chromeleon server. Check the USB connection. The connection to the next hub must not exceed 5 m. The overall connection length, including the hub connections must not exceed 30 m (→ page 27). Replace any defective USB cable or hub.
Error reading from FLM-3x00@ USB-1610103	The connection between the flow manager and the Chromeleon server is interrupted. Check the USB connection. The power supply to the flow manager is interrupted. Check the mains connection of the flow manager.

6.3 Chromeleon Diagnostics Messages

If the flow manager fails a diagnostics test, locate the test result in the table below and perform the instructions given there. If the flow manager still fails the test, contact Dionex Service.

Flow Control Test failed

Test Result	Possible Cause	Remedial Action
FCV broken.	The FCV valve seat is broken.	Contact Dionex Service.
FCV control failed.	A communication error or hardware defect has occurred.	Turn FLM off and on. Repeat the test.
FCV does not completely open. Minimum pressure: %	The FCV may have been damaged during maintanance.	No action required. The FCV can be used as long as no error message appears during operation.
FCV does not generate sufficient backpressure.	The FCV is dirty or defective.	Clean the FCV.
FCV fault: does not build up sufficient pressure. / FCV fault: does not hold pressure or system not tight	The system leaks.	Check the connections and the blind nut at the splitter outlet for leakage.
	The pump does not work properly.	Check if the pump works properly on the selected eluent channel. Purge the system if necessary.
	The FCV is dirty or defective.	Clean the FCV.
FCV fault: unable to open completely	The FCV was damaged during maintanance.	Contact Dionex Service.
FCV pressure not stable.	There is air in the system.	Purge the system.
	The system leaks.	Check the connections and the blind nut at the splitter outlet for leakage.
	The FCV is dirty.	Clean the FCV.
FCV pressure sensor offset calibration failed.	The FCV pressure sensor is not connected or defective.	Check the pressure sensor connection. Repeat the test.
FCV will work for column pressure % to % bar.		The FCV can be used as long as the actual column pressure does not exceed the specified value. If the column pressure is higher, clean the FCV.
Flow = %. Flow sensor flow is too high.	The wrong flow sensor capillaries are used.	Contact Dionex Service.
Flow = %. Flow sensor flow is too low.	A blind nut is installed at the splitter outlet.	Remove the blind nut.
	The flow sensor or flow sensor capillary is clogged or the wrong flow sensor capillaries are used.	Contact Dionex Service.

Test Result	Possible Cause	Remedial Action
Flow = %. Wrong flow direction.	The blind nut leaks.	Check the blind nut at the splitter outlet for leakage.
	The flow sensor is not connected or defective	Turn FLM off and on. Repeat the test.
Flow sensor offset error.	The blind nut leaks.	Check the blind nut at the splitter outlet for leakage.
	The flow sensor is not connected or defective.	Turn FLM off and on. Repeat the test.
Flow Sensor status: %. Flow Sensor not found.	A communication error has occurred, or the flow sensor is not connected or defective.	Turn FLM off and on. Repeat the test.
Pressure drop at splitter too low.	Wrong solvent type or solvent reservoir empty	Check that the solvent reservoir used is filled with HPLC-grade water.
	The pump does not work properly.	Check if the pump works properly on the selected eluent channel. Purge the system if necessary.
	The system leaks.	Check the connections for leakage.
Splitter flow too high.	The waste capillary is clogged.	Replace the splitter cartridge.
Splitter flow too low.	No blind nut installed at the splitter outlet.	Install a blind nut.
	Wrong solvent type	Check that the solvent reservoir used is filled with HPLC-grade water.
	The calibrator capillary is clogged.	Replace the splitter cartridge.
Unable to apply correct pressure.	The system leaks.	Check the connections for leakage.
	The pump does not work properly.	Check if the pump works properly on the selected eluent channel. Purge the system if necessary.
	Wrong solvent type or solvent reservoir empty	Check that the solvent reservoir used is filled with HPLC-grade water. Repeat the previous tests.
	The FCV is dirty or defective.	Clean the FCV.

Gas Sensor Test failed

Test Result	Possible Cause	Remedial Action
Error gas leak detected!	The gas sensor detected an increased concentration of gas in the column chamber.	Eliminate the cause. Tighten leaking connection and vent the column chamber.
	The gas sensor may be influenced by the drain tubing from other modules in the UltiMate 3000 system	Connect the drain tubing for the FLM as shown in the UltiMate 3000 Proteomics MDLC system manual. As an alternative, connect separate drain tubing to both the column compartment and the system module stacked upon the column compartment.
Error, gas leak sensor error!	The gas sensor is defective.	Repeat the test.
Error, gas leak sensor not ready!	The temperature set point has not been reached. The thermal unit may be defective.	Repeat the test.
Error, no gas leak detected.	During the test the gas sensor should have detected an increased concentration of gas in the column chamber. The gas sensor may be defective.	Repeat the test.

Thermo Unit Test failed

Test Result	Possible Cause	Remedial Action
Poor heating (or cooling) performance.	The heating (or cooling) elements may be defective.	Repeat the test.
Rear temperature stabilisation not reached within 20 minutes.	The thermal unit may be defective.	Repeat the test.
Suitable temperature not reached.	The exhaust fan is not working properly. The thermal unit may be defective.	Repeat the test.
Temperature not stable at 22 °C withing 40 minutes.	The thermal unit may be defective.	Repeat the test.
Timeout waiting for temperature to reach (exceed, approach) room temperature during heating (or cooling) phase.	The thermal unit may be defective.	Repeat the test.

7 Service

7.1 General Notes

The following sections describe all service and repair procedures that can be carried out by the user. All other maintenance and service procedures must be performed by Dionex personnel.

Observe the following precautions:

- Observe all warning notes when carrying out maintenance or repair work.
- Do not touch any metal or plastic parts inside the column chamber while the temperature set point is > 50 °C (122 °F). Wait for the chamber to cool down before you carry out any work in the column chamber.
- Keep in mind that the fluid components of the flow manager may be filled with toxic solvents. Therefore, purge the flow manager with an appropriate solvent and put on protective clothing.
- Use original Dionex spare parts only. Substituting non-Dionex parts may impair flow manager performance, thereby voiding the product warranty. . For more information, see the warranty statement in the terms of sale.
- Before you return a flow manager to Dionex for repair, contact Dionex Service or your local distributor. An RMA number (Return Material Authorization number) is required in order to track your instrument. Always use the original shipping container and observe the packing instructions) when shipping the flow manager. Shipping the instrument in anything other than the original packaging will void the warranty. For more information, see the warranty statement in the terms of sale.

For instructions on shutting down the flow manager, refer to page 63.

7.2 Cleaning the Flow Control Valve

The flow manager uses a Flow-Control Valve (FCV) installed in the rear of the enclosure (on the right) to control the column flow. Minute particles that may be contained in the solvents or be caused by the unavoidable abrasion of the pump seals may cause damage to the flow control valve. Most of these particles are retained in the built-in filters, however, some particles may have passed the filter and accumulated in the FCV. After some time, the FCV cannot build up the required pressure. Chromeleon recognizes this problem and displays a "Flow Control Valve Failure" or "Flow Control Valve Limit".

The FCV is designed in such a way that it can easily be removed and cleaned. For detailed cleaning instructions, refer to the Maintenance Instructions for the Flow Control Valve (they can be found as a PDF file on the CD shipped with your FCV Maintenance Kit and as a printed version in this manual).

Tip: If you are using Chromeleon version 6.80 Service Pack 2 or higher, an integrated diagnostic test is available for testing the correct functioning of the Flow Control Valve (→ page 62).

7.3 Replacing the Fuses

Warning: Before replacing the fuses, turn off the flow manager. Be sure to disconnect the power cord from its source.

Avertissement: Avant de remplacer les fusibles, arrêtez l'instrument. Assurez-vous de bien débrancher le cordon d'alimentation de la source secteur.

To replace the fuses:

1. Remove the fuse holder, using a small screwdriver.

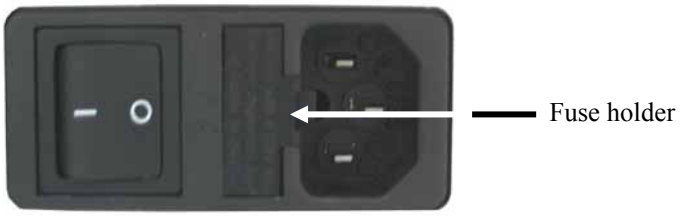


Fig. 39: Fuse holder

2. Replace the fuses with fuses of the appropriate rating.

Important: Always install two new fuses.

Use only the fuses indicated below or those listed in the Accessories/Spare Parts List (→ page 91).

Important: Installez toujours deux nouveaux fusibles. Ne faites pas fonctionner l'instrument avec seulement un fusible.

Utilisez uniquement les fusibles indiqués ci-dessous ou ceux qui sont répertoriés dans la liste des accessoires/pièces de rechange (→ page 91).

Description	Part No.
2A Fuse, slow-blow, 5 x 20 mm	Included in Fuses Kit, part no. 6710.9001 For information about which fuses are included in the kit, refer to section 10.2 (→ page 92).

3. Reinstall the fuse holder.
4. Reconnect the power cord to its source and turn on the flow manager.

7.4 Drying the Fluid Leak Sensor

Tips: Inspect the connections for signs of leakage every day and tighten leaking connections. **Important:** Also, inspect the waste port and waste tubing for indications of blockage. If the waste tubing is blocked or bent, the waste cannot run out of the instrument, causing a leak alarm.

The cleaner the columns and capillaries are, the more reliable is the operation of the leak sensors. If columns and capillaries are wetted with solvent during installation, reliable leak detection is possible only with restrictions.

The fluid leak sensor is activated when it is exposed to moisture. When the sensor detects a liquid leak, the **Status** LED on the instrument's front panel is red and the error message appears on the front panel display. If the flow manager is operated by Chromeleon, the error is also logged in the Chromeleon audit trail.

Put on protective clothing as appropriate and eliminate the cause of the leakage. Follow the steps below to dry the leak sensor and remove any liquid in the drip tray. (The sensor and drip tray are situated on the right in the rear of the enclosure.)

Warning: Turn off the flow manager and disconnect the power cord from its source.

Avertissement: Arrêtez l'instrument. Assurez-vous de bien débrancher le cordon d'alimentation de la source secteur.

1. On the rear panel, remove the screw for the right-side panel (→ Fig. 40).

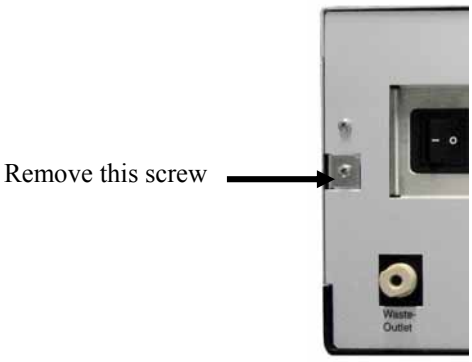


Fig. 40: Screw for the right-side panel

2. Push and remove the side panel backward, toward the rear panel (→ Fig. 41).

Fig. 41: Removing the side panel towards the rear panel

3. Dispose of any liquid in the tray and dry the sensor (→ Fig. 42), using lint-free cloth or paper.

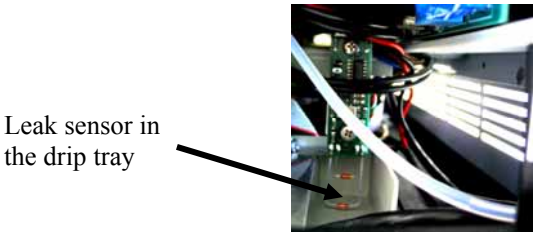


Fig. 42: Leak sensor

⚠ **Important:** Make sure that you do not bend or damage the sensor.

⚠ **Important:** Assurez-vous que vous ne tordez, ni n'endommagez le capteur.

4. Install the side panel in the reverse order.

Tip: The **Status** LED on the front panel remains red and the error message is flashing on the front panel display as long as the leak sensor is exposed to moisture.

7.5 Exchanging the Splitter Cartridge

The following splitter cartridges are available from Dionex:

Part No.	Description
Standard Flow Managers:	
6720.3150A	Splitter cartridge for a split ratio of 1:1000
6720.3155A	Splitter cartridge for a split ratio of 1:300
6720.3160A	Splitter cartridge for a split ratio of 1:100
6720.3165A	Splitter cartridge for a split ratio of 1:15
6720.3170A	Splitter cartridge for a split ratio of 1:6
Biocompatible Flow Managers:	
6721.3150A	Splitter cartridge for a split ratio of 1:1000
6721.3155A	Splitter cartridge for a split ratio of 1:300
6721.3160A	Splitter cartridge for a split ratio of 1:100
6721.3165A	Splitter cartridge for a split ratio of 1:15
6721.3170A	Splitter cartridge for a split ratio of 1:6

Warning: If you are using harmful solvents, thoroughly flush the system with water before exchanging the splitter cartridge.

Avertissement: Si vous utilisez des solvants potentiellement dangereux, rincez le système à l'eau avant de remplacer la cartouche.

Important: After an exchange of the splitter cartridge, particles may pollute the Flow Control Valve. If you observe problems with the Flow Control Valve during operation after exchanging the splitter cartridge, clean the valve (→ section 7.2, page 76).

Important: Après le remplacement de la cartouche, des particules peuvent obstruer la vanne. Si vous rencontrez des problèmes avec la vanne de débit après avoir changé la cartouche, nettoyez la vanne (→ section 7.2, page 76).

To remove the splitter cartridge

1. Remove memory chip card from the chip card reader.
2. Disconnect the capillary on the flow splitter inlet (→ no. 5, Fig. 43).

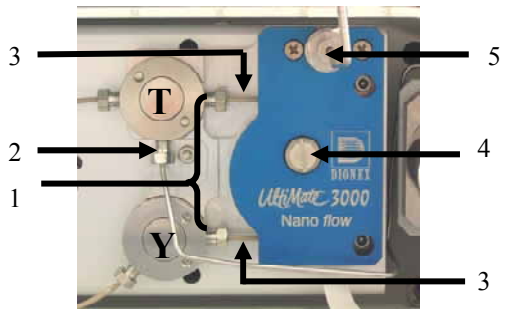


Fig. 43: Splitter cartridge

No.	Description
1	Splitter cartridge outlets
2	Connector to flow control valve (via pre-filter)
3	Peek sleeve
4	Cartridge screw
5	Splitter inlet with inlet filter (pump connector)

3. Disconnect the fittings on the splitter cartridge outlets (→ no. 1, Fig. 43).
4. Loosen the cartridge screw (→ no. 4, Fig. 43).
5. Remove the splitter cartridge.

To install the new splitter cartridge

1. Reconnect the capillary to the flow splitter inlet. Make sure that the capillary end is not contaminated.
2. Insert the memory chip card for the flow splitter ID in an appropriate slot (→ Splitter Identification System (Splitter ID), page 61).
3. Attach a piece of waste tubing to the upper (high flow) outlet of the flow splitter cartridge. To absorb the solvent that leaks out with the following flush step, place a lint-free cloth under the splitter (→ Fig. 44).

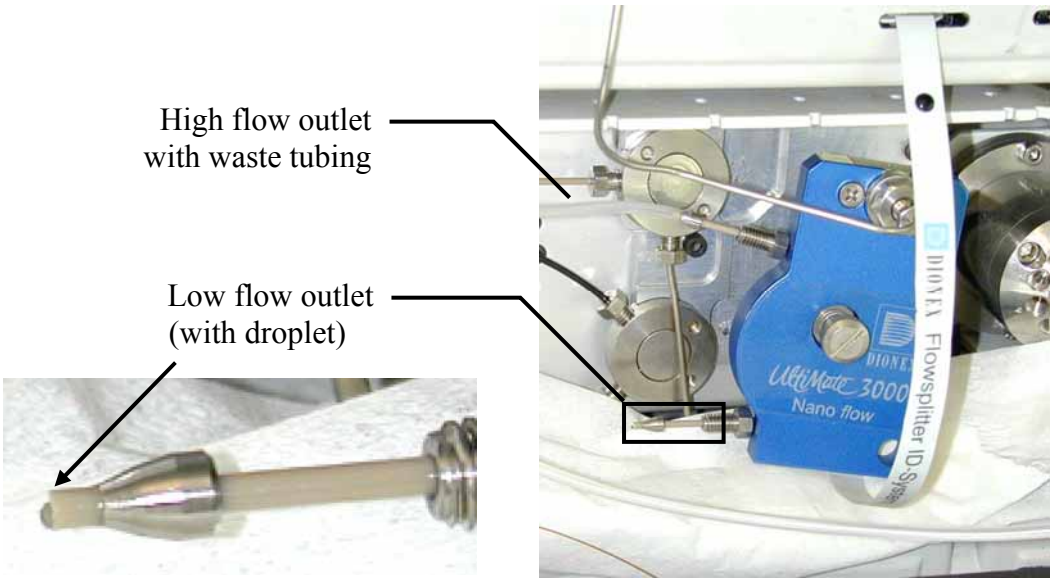


Fig. 44: Flushing the (nano) flow splitter cartridge

4. Connect the instrument in Chromeleon and close the front panel (to allow Chromeleon reading the chip card).

5. In the Chromeleon **Commands** dialog box (F8), select **ColumnOven -> FlowSplitter_1** and set **FSControlMode** to **Off**.

6. Flush the splitter at the typical column flow rate to remove any particles that may have polluted the splitter during the exchange of the cartridge.

7. Open the front panel again.

   Tip: If pure water is used to flush the flow splitter, the micro pump should now build up a back pressure of about 20 bar per 100 µL/min of pump flow (Masterflow).

8. Verify after approximately 2 minutes that there is a little droplet at the low flow outlet of the splitter cartridge (→ Fig. 44).

   - If no droplet is visible, flush for additional 2 – 5 minutes
   - If then still no droplet is visible, most likely the flow splitter cartridge is blocked and must be replaced.

9. Stop the flow.

10. Reinstall the cartridge screw to fix the cartridge to the splitter base part and reconnect the splitter cartridge outlets.

11. Flush for additional 2 minutes. Remove the tubing and the cloth.

12. In the Chromeleon **Commands** dialog box (F8), select **ColumnOven -> FlowSplitter_1** and set **FSControlMode** back to **Auto**.

7.6 Column Switching Valve

Maintenance requirements are kept to a minimum. In most instances, it will be sufficient to clean the valve by flushing all lines with an appropriate solvent. The nature of the solvent to be used depends on the sample(s) and the mobile phase(s) that are used. Use a common solvent such as methanol or acetonitrile or an 80/20 mixture of methanol or acetonitrile and water.

Tip: A detailed discussion on the installation, use and maintenance of the valve is presented in Technical Note 801 from Valco Instruments, Co. Inc. and can be obtained at the Valco website (www.vici.com).

Two parts of the valve, the rotor and the stator, are subject to wear. The degree of wear depends on the application. Both parts can be replaced independently from each other.

Description	Part No.
Rotor seal for 2-position/10-port C2 switching valve (standard valve)	6720.0110
Rotor seal for 2-position/10-port C2 switching valve (biocompatible valve)	6720.0092
Stator for 2-position/10-port C2 switching valve (standard valve)	6720.0111
Stator for 2-position/10-port C2 switching valve (biocompatible valve)	6720.0091
Stator (titanium) for 2-position/10-port C2 switching valve, (biocompatible valve)	6720.0112
Rotor seal for 2-position/6-port CN2 switching valve (biocompatible valve)	6720.0109
Stator for 2-position/6-port CN2 switching valve (biocompatible valve)	6720.0108

To dissemble the valve:

1. Use a 9/64" hex driver to remove the socket head screws that secure the stator to the valve.

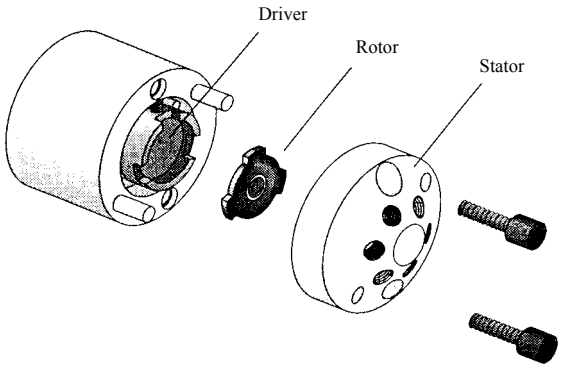


Fig. 45: Exploded view of the Valco model C2 6-port valve

2. To ensure that the sealing surface of the stator cap is not damaged, rest the stator on its outer face. If the tubing is still attached, leave it suspended by the tubing.

3. Gently pry the rotor away from the driver with your fingers or a small screwdriver.

4. Examine the rotor and stator sealing surfaces for scratches:

   - If scratches are visible to the naked eye, the rotor/stator must be replaced.
   - If no scratches are visible, clean all parts thoroughly with an appropriate solvent. Take care that no surfaces are scratched while you are cleaning the components. (The most common problem in the use of the valve with HPLC is the formation of buffer crystals, which are usually water soluble.) After cleaning, it is not necessary to dry the rotor.

To reassemble the valve:

1. Insert the rotor in the driver, making sure that the rotor sealing surface with its engraved flow passages is facing out. The pattern is asymmetrical to prevent improper placement.
2. Reinstall the stator. Insert the two socket head screws and tighten them gently until both are snug. Do not overtighten the screws. They simply hold the assembly together and do not affect the sealing force, which is automatically set as the screws close the cap against the valve body.
3. Test the valve by pressurizing the system. If the valve does not hold pressure, it should be returned for repair.

⚠ **Important:** To connect the capillaries to the switching valve, install only the ferrules and fitting screws recommended by the valve manufacturer, observing the manufacturer's installation instructions.

⚠ **Important:** Afin de raccorder les capillaires à la vanne d'injection, installez uniquement les ferrules et les raccords recommandés par le fabricant de la vanne, en respectant les instructions d'installation du fabricant.

7.7 Updating the FLM Firmware

The flow manager is shipped with the most recent firmware version. The firmware is also included in Chromeleon.

To check which firmware version is installed in the flow manager and which version is included in Chromeleon:

Firmware version installed in the FLM

Turn on the flow manager by pressing the power switch on the rear of the flow manager. General information about the flow manager appears on the display, including the firmware version.

- On the flow manager display, select the **Main** menu and **Information** (→ page 53), and then select **System** and **Firmware version**.

Firmware version in Chromeleon

In the Windows Explorer, locate the **IQReport.log** file in the **IQ** folder of your Chromeleon installation. In the file, search for UM3_FLM.hex.

Tip: When updating the FLM firmware via Chromeleon, this information will also be provided during the download (see later in this section).

Whenever a new firmware version is released for the flow manager, the new version will be provided with the next Chromeleon Service Pack release and described in the related release notes.

The new firmware will *not* be downloaded automatically to the flow manager when you install a Chromeleon Service Pack. To update the firmware in the flow manager, follow the steps below:

Important: To ensure that the download is successful, make sure that the communication between the flow manager and Chromeleon is *not* interrupted during the download and do *not* turn off the flow manager.

Important: Au cours du téléchargement, assurez-vous que la communication entre l'instrument et Chromeleon n'est pas interrompue et n'arrêtez pas l'instrument. Ceci peut entraîner des dysfonctionnements de l'instrument.

1. Before you begin, verify that

   - The flow manager is connected in Chromeleon.
   - The Chromeleon server is in *running idle* mode. All processes on the Chromeleon server PC and in Chromeleon have been stopped.

2. Start the **Server Configuration** program (→ page 30).

3. Right-click the FLM in the timebase and click **Properties** on the menu.

4. On the **General** page(→ page 58), click **Firmware Download**. A message displays the firmware version that is currently installed in the FLM and the version that will be downloaded from Chromeleon

   Tip: If the FLM comes with a newer firmware than the version included in Chromeleon, do *not* downgrade the firmware. Older firmware may be incompatible with new hardware revisions.

5. Click **Yes** to start the download. (Click **No** to cancel the action.)

The download may take several minutes. The download is complete when **Download finished successfully** appears in the **Messages Server** window in the Chromeleon Server Configuration program. The message appears also in the Chromeleon Audit Trail.

If the download is not successful, the related messages appear in the Audit Trail. In this case, repeat the above steps. If this download is not successful either, turn the FLM off and on again, and repeat the download. If the download fails again, contact Dionex Service.

8 Special Configuration: Reduced Solvent Consumption Mode

The reduced solvent consumption mode allows continuous operation of the system of up to one month without refilling solvents. In this mode, the Nano LC system is operated with a lower input flow rate. Typically, the UltiMate 3000 system in a standard Nano LC setup is equipped with a 1:1000 flow splitter cartridge. In reduced solvent consumption mode, the cartridge is replaced by a 1:300 or 1:100 cartridge, thus reducing the required input (master) flow rate accordingly. For example, the 1:300 cartridge reduces the input flow rate by almost 70%, the 1:100 cartridge by 90%. As a result the system can operate 3 to 10 times longer with the same solvent amount.

The reduced solvent consumption mode is designed for UltiMate 3000 systems that work continuously ('24/7' mode), preferably performing extended gradients of 1 hour or more. In these cases, the required small increase in runtime will be negligible on the longer runs.

Tip: When systems are operated with intervals (for example, if the systems are idle or flow delivery is stopped for a considerable time), Dionex recommends operating such systems in standard mode. The solvents saved by the solvent reduction mode may be consumed in the necessary purge step when re-starting the system.

Required Modifications

To operate the UltiMate 3000 nano system in reduced solvent consumption mode, the following modifications are required.

1. Replace the 1:1000 flow splitter cartridge by a 1:100 or 1:300 splitter cartridge.
2. Replace the connecting tubing from the pump outlet to the flow splitter inlet by a 130 µm I.D. PEEK tubing (L=75 cm).

Description	Part No.
Capillary from pump to flow manager, 130 µm ID x 75 cm, PEEK, including the appropriate fittings and ferrules	6720.0032
Capillary from pump to flow manager (biocompatible devices), 130 µm ID x 75 cm, PEEK, including the appropriate fittings and ferrules	6721.0032
Splitter cartridge, standard, for a split ratio of 1:300	6720.3155A
Splitter cartridge, biocompatible, for a split ratio of 1:300	6721.3155A
Splitter cartridge, standard, for a split ratio of 1:100	6720.3160A
Splitter cartridge, biocompatible, for a split ratio of 1:100	6721.3160A

Hints for Operation

The reduction of the input (master) flow rate may increase the overall delay of the system. The replacement of the connecting capillary between the micro pump and the flow splitter inlet by a 130 µm I.D. PEEK capillary will compensate for this extra delay, but not entirely. Dionex recommends extending the equilibration time by 10 minutes.

Also, a lower input flow rate will reduce the pressure drop over the splitter. As a result, the pressure difference between **ColumnPressure** and **MicroPump_MasterPressure** will be considerably smaller. With a column flow rate of 300 nL/min, the typical pressure drop is as follows:

Nominal Split Ratio	Pressure Drop
1:1000	5 - 6.5 MPa (50 - 65 bar)
1:300	1.5 - 20 MPa (15 - 20 bar)
1:100	0.4 - 0.8 MPa (4 - 8 bar)

The UltiMate 3000 system features the **HoldPressure** mode as a special mode to improve flow stability when valves are switched. In **HoldPressure** mode, the FLM maintains the column pressure for a certain period of time defined by the **DisableRegulationTime** property. The FLM switches automatically into this mode each time a valve is switched (for example, upon injection). The value of **DisableRegulationRime** is initially defined by the nominal split ratio of the currently installed flow splitter cartridge.

Nominal Split Ratio	DisableRegulationTime [ms]
1:1000	10000
1:300	5000
1:100	5000

When running nano flow rates with either the 1:100 or the 1:300 flow splitter cartridge installed, Dionex recommends increasing the **DisbableRegulatingTime** to 10000 ms.

Inject synchronization delays the switching of the injection valve until the pump reaches a specified position of its stroke. In reduced solvent consumption mode, the pump is operated at lower flow rates, which results in longer pump stroke cycle. Therefore the injection delay could become longer. Dionex recommends that you do not disable injection synchronization as this feature improves reproducibility.

For more information about reduced solvent consumption mode, see Technical Note 72 under www.dionex.com.

9 Technical Information

Temperature range:	5–70 °C (max. 15 °C below ambient)
Temperature accuracy:	±0.5 °C
Temperature stability:	±0.1 °C
Temperature precision:	±0.1 °C
Column capacity:	Up to 3 columns, max. 30-cm length
Heatup time:	From 20 to 50 °C in less than 25 min (at 23 °C ambient temperature, ±0.5 °C)
Cooldown time:	From 50 to 20 °C in less than 35 min (at 23 °C ambient temperature, ±0.5 °C)
Control:	All functions software controlled via USB 1.1
I/O interfaces:	2 digital inputs, 2 programmable relay outputs
Column recognition:	Electronic identification system for 3 columns
Switching valves:	1 or 2 low-dispersion thermostatted micro valves (10 ports or 6 ports)
Flow splitter:	Nano, capillary, or micro thermostatted splitter with splitter identification system
Flow control:	Electronically controlled and actively balanced flow splitter, independent from solvent composition and backpressure
Column flow range:	50 nL/min to 2.5 mL/min using predefined splitter and active flow control
Flow range selection:	50 nL/min to 1000nl/min (using a nano LC splitter) 0.5 µL/min to 10 µL/min (using a capillary LC splitter) 10 µL/min to 160 µL/min (using a micro LC splitter)
Gradient delay time:	Typically < 1.5 min at 200 nL/min to splitter outlet
Max. column pressure:	35 MPa (4900 psi)
Wetted parts:	Fused Silica, stainless steel (1.4571, 316L), PEEK; Waste line: PTFE, aluminum oxide (Al_2O_3)
Safety features:	Humidity sensor, gas sensor, and leak sensor for the flow control valve

User input/display:	LCD indicating system parameters Standby button 3 LEDs for status monitoring (Power, Connected, Status) 4 soft keys for operation during initial installation and maintenance
GLP features:	In Chromeleon: Full support of automatic equipment qualification (AutoQ) and System Wellness monitoring All system parameters are recorded in the Chromeleon audit trail.
Power requirements:	162 VA Automatic voltage selection
Environmental conditions:	Range of use: Indoor use Temperature: 10 to 35 °C (50 °F to 95 °F) Air humidity: 80% relative humidity, non-condensing Overvoltage category: II Polution degree: 2
Dimensions (h × w × d)	17 x 42 x 51 cm (6.7 x 16.5 x 20 in)
Weight	FLM-3100: 17 kg (37.4 lbs) FLM-3200: 16.3 kg (35.8 lbs) FLM-3300: 16.3 kg (35.8 lbs)

Technical information: June 2009.
All technical specifications are subject to change without notice.

10 Accessories, Consumables and Spare Parts

Accessories and spare parts for the flow manager are always maintained at the latest technical standard. Therefore, part numbers are subject to alteration. However, updated parts will always be compatible with the parts they replace.

For a list of available Application Kits for nano and cap HPLC applications, refer to the UltiMate 3000 Proteomics MDLC system manual.

10.1 Standard Accessories (included in the shipment)

The following accessories are shipped with the flow manager. (Note: The list is subject to change without notice.) Some parts listed below are included in one of the spare part kits. For information about these kits, refer to section 10.2 (→ page 92).

Description	Part No.*	Quantity in the accessories kit
FLM-3x00 accessory kit (all versions), including:	**5720.8910**	
2A fuse, slow-blow, 5x20 mm	Included in 6710.9001	2
6.3A fuse, slow-blow, 5x20 mm	Included in 6710.9001	1
Open-end wrench (1/4" x 5/16")	6000.0051	1
Wrench (size 3.0 mm)	6000.0050	1
Solvent line (analytical)	6030.2548	1
Capillary cutting tool	6720.0016	1
Micro flow waste container	6720.0011	1
Module spacers 10 mm (spacers used between detector and FLM)	6160.1004	4
USB cable (1m, type A to type B)	6035.9035	1
Column clips kit FLM (6 clips)	6720.9002	1
Column brackets	Included in 6720.0293	2 brackets
Column ID	Included in 6710.1505	2
Flow Control Valve Maintenance Kit	6720.3195	1
Dionex menu pen	6300.0100	1
Assortment box for accessories	6000.0043	1

* The part number always refers to the packing unit. For more information, please contact your Dionex sales representative.

10.2 Consumables, Spare Parts, and Optional Accessories

Description	Part No.*
Adaptor from capillary column to flow manager switching valve (standard valve) (PeekSil, 50 µm ID, 10 cm long, 1/16")	6720.0040
Adaptor from capillary column to flow manager switching valve (biocompatible valve) (PeekSil, 50 µm ID, 10 cm long, 1/16")	6721.0040
Capillary cutting tool	6720.0016
Capillary (long) from pump to flow manager (standard devices), including the appropriate fittings and ferrules	6035.2550
Capillary (long) from pump to flow manager (biocompatible devices), including the appropriate fittings and ferrules	6037.2550
Capillary (long) from pump to flow manager (standard devices), for LC Comprehensive applications, including the appropriate fittings and ferrules	6035.2556
Capillary (long) from pump to flow manager (biocompatible devices), for LC Comprehensive applications, including the appropriate fittings and ferrules	6037.2556
Capillary (short) from pump to flow manager (standard devices), including the appropriate fittings and ferrules	6035.2553
Capillary (short) from pump to flow manager (biocompatible devices), including the appropriate fittings and ferrules	6037.2553
Capillary (short) from pump to flow manager (standard devices) for LC Comprehensive applications, including the appropriate fittings and ferrules	6035.2554
Capillary (short) from pump to flow manager (biocompatible devices) for LC Comprehensive applications, including the appropriate fittings and ferrules	6037.2554
Capillary (PEEK, 130 µm ID, 75 cm long) from pump to flow manager for Nano LC reduced solvent consumption mode, including the appropriate fittings and ferrules	6720.0032
Capillary (PEEK, 130 µm ID, 75 cm long) from pump to flow manager (biocompatible devices) for Nano LC reduced solvent consumption mode, including the appropriate fittings and ferrules	6721.0032
Capillary from autosampler switching valve to flow manager switching valve (20 µm ID x 50 cm, PeekSil) for nano HPLC applications, standard devices,	6720.0036
Capillary from autosampler switching valve to flow manager switching valve (20 µm ID x 50 cm, PeekSil) for nano HPLC applications, biocompatible devices	6721.0036
Capillary from autosampler switching valve to flow manager switching valve (50 µm ID x 50 cm, PeekSil) for capillary HPLC applications, standard devices	6720.0037
Capillary from autosampler switching valve to flow manager switching valve (50 µm ID x 50 cm, PeekSil) for capillary HPLC applications, biocompatible devices	6721.0037
Capillary from autosampler switching valve to flow manager switching valve (75 µm ID x 50 cm, PeekSil) for micro HPLC applications, standard devices	6720.0038
Capillary from autosampler switching valve to flow manager switching valve (75 µm ID x 50 cm, PeekSil) for micro HPLC applications, biocompatible devices	6721.0038
Capillary from autosampler to capillary column in flow manager	6720.0058

Description	Part No.*
(50 µm ID, 70 cm long), including zero dead volume union (1/16"), standard devices	
Capillary from autosampler to capillary column in flow manager (50 µm ID, 70 cm long), including PEEK union (1/16"), biocompatible devices	6721.0058
Capillary from capillary column to (standard) autosampler (50 µm ID x 50 cm, PeekSil)	6720.0025
Capillary from capillary column to (biocompatible) autosampler (50 µm ID x 50 cm, PeekSil)	6721.0025
Capillary from flow splitter and flow manager switching valve (20 µm ID x 30 cm, PeekSil) for nano HPLC applications, standard device	6720.0033
Capillary from flow splitter and flow manager switching valve (20 µm ID x 30 cm, PeekSil) for nano HPLC applications, biocompatible device	6721.0033
Capillary from flow splitter and flow manager switching valve (50 µm ID x 30 cm, PeekSil) for capillary HPLC applications, standard device	6720.0034
Capillary from flow splitter and flow manager switching valve (50 µm ID x 30 cm, PeekSil) for capillary HPLC applications, biocompatible device	6721.0034
Capillary from flow splitter to autosampler for capillary applications (50 µm ID x 50 cm, PeekSil), standard devices	6720.0028
Capillary from flow splitter to autosampler for capillary applications (50 µm ID x 50 cm, PeekSil), biocompatible devices	6721.0028
Capillary from flow splitter to autosampler for micro HPLC applications (75 µm ID x 50 cm, PeekSil), standard devices	6720.0029
Capillary from flow splitter to autosampler for micro HPLC applications (75 µm ID x 50 cm, PeekSil), biocompatible devices	6721.0029
Capillary from flow splitter to autosampler for nano HPLC applications (20 µm ID x 50 cm, PeekSil), standard devices	6720.0027
Capillary from flow splitter to autosampler for nano HPLC applications (20 µm ID x 50 cm, PeekSil), biocompatible devices	6721.0027
Capillary from flow splitter to flow manager switching valve (75 µm ID x 30 cm, PeekSil) for micro HPLC applications, standard devices	6720.0035
Capillary from flow splitter to flow manager switching valve (75 µm ID x 30 cm, PeekSil) for micro HPLC applications, biocompatible devices	6721.0035
Capillary from loading pump to flow manager switching valve (PEEK, 130 µm ID, 45 cm long), including appropriate fitting connections	6720.0057
Capillary from micro column to (standard) autosampler (75 µm ID x 50 cm, PeekSil)	6720.0026
Capillary from micro column to (biocompatible) autosampler (75 µm ID x 50 cm, PeekSil)	6721.0026
Capillary from nano column to (standard) autosampler (20 µm ID x 50 cm, PeekSil)	6720.0024
Capillary from nano column to (biocompatible) autosampler (20 µm ID x 50 cm, PeekSil)	6721.0024
Capillary union (1/16", zero dead volume)	6720.0039
Column bracket, set of 4	6720.0293

Description	Part No.*
Column clips kit (6 clips)	6720.9002
Column for capillary HPLC applications (PepMap C18, 300 µm ID x 15 cm)	160295
Column for micro HPLC applications (PepMap C18, 1.0 mm ID x 15 cm)	160282
Column for nano HPLC applications (PepMap C18, 75 µm ID x 15 cm)	160321
Column ID, set of 5	6710.1505
Ferrule (1/16") for 2-position/10-port or 2-position/6-port switching valve, standard (set of 10)	6720.0017
Ferrule and nut (1/16", PEEK, long HEX nut and ferrule) for 2 position/10-port or 2-position/6-port switching valve, biocompatible (3 sets with 2 pieces each)	6721.0017
Fitting (1/32") for nano switching valve (set of 6)	6720.0080
Fitting, universal finger-tight fitting (1/16"), set of 4	6720.0015
Fitting, universal fitting (1/16", finger-tight, extra long body; set of 2)	6720.0072
Flow control valve maintenance kit including: Special clean-foam swab Cleanroom tissue 4" x 4" Allen wrench (size 2.5mm) PEEK blind nut 12 mL plastic syringe 4 screws M3 x 16 mm	6720.3195
Fuses (EU/US), kit including: 10 2A fuses, slow-blow, 5 x 20 mm 5 6.3A fuses, slow-blow, 5 x 20 mm	6710.9001
Ion exchange column (ID 1mm x 10 cm), packed with Poros 10 S with connections	163030
Ion exchange column (300 µm ID x 10 cm) packed with Poros 10 S with connections, 130 µm ID PEEK inlet (30cm) and outlet (10 cm)	162152
Ion exchange column (300 µm ID x 15 cm) packed with Poros 10 S with connections	162122
Manual injection port, standard FLM	6720.9007
Manual injection port, biocompatible FLM	6721.9007
Menu pen	6300.0100
Micro flow waste container	6720.0011
Module spacers 10 mm (spacers used between detector and FLM)	6160.1004
Nut (1/16", 19 mm long, SS) (set of 10)	6720.0019
Nut (1/16", L=5", SS) (set of 10; recommended by Dionex)	6720.0020
Nut (1/16", standard, SS) (set of 10)	6720.0018
PEEK tubing (130 µm I.D. x 75 cm) including appropriate fittings	6720.3220
PEEK sleeve (1/32", 300 µm ID, 3 cm; set of 6)	6720.0079
PEEK sleeve (1/32", ID 400 µm, 3 cm; set of 6)	6720.0041
PEEK sleeves for connection with fused silica capillaries (280 µm O.D., set of 5)	6720.0064

Description	Part No.*
PEEK sleeves for connections with fused silica capillaries (360 µm OD, set of 5)	6720.0078
PEEK sleeves for connections with micro-tight union (280 µm OD; set of 10)	6720.0075
PEEK sleeves for connections with micro-tight union (380 µm OD; set of 10)	6720.0076
PEEKsil bridge (standard) between left and right flow manager switching valves (75 µm ID, 50 cm long), including appropriate fittings	6720.0060
PEEKsil bridge (biocompatible) between left and right flow manager switching valves (75 µm ID, 50 cm long), including appropriate fittings	6721.0060
PEEKsil bridge (standard) between left and right switching valves in flow manager (30 µm ID, 15 cm long), including appropriate fitting connection	6720.0061
PEEKsil bridge (biocompatible) between left and right switching valves in flow manager (30 µm ID, 15 cm long), including appropriate fitting connection	6721.0061
PEEKsil bridge (standard) between left and right switching valves in flow manager (30 µm ID, 30 cm long), including appropriate fitting connection	6720.0062
PEEKsil bridge (biocompatible) between left and right switching valves in flow manager (30 µm ID, 30 cm long), including appropriate fitting connection	6721.0062
PEEKsil bridge (standard) from flow manager to flow manager (75 µm ID, 30 cm long), including appropriate fitting connections	6720.0059
PEEKsil bridge (biocompatible) from flow manager to flow manager (75 µm ID, 30 cm long), including appropriate fitting connections	6721.0059
Rotor seal for 2-position/10-port C2 switching valve, biocompatible valve	6720.0092
Rotor seal for 2-position/10-port C2 switching valve, standard valve	6720.0110
Rotor seal for 2-position/6-port CN2 switching valve, biocompatible valve	6720.0109
Signal cable (Mini DIN, 6-pin, 5 m)	6000.1004
Solvent line (analytical)	6030.2548
Splitter cartridge, standard, for a split ratio of 1:1000	6720.3150A
Splitter cartridge, biocompatible, for a split ratio of 1:1000	6721.3150A
Splitter cartridge, standard, for a split ratio of 1:300	6720.3155A
Splitter cartridge, biocompatible, for a split ratio of 1:300	6721.3155A
Splitter cartridge, standard, for a split ratio of 1:100	6720.3160A
Splitter cartridge, biocompatible, for a split ratio of 1:100	6721.3160A
Splitter cartridge, standard, for a split ratio of 1:15	6720.3165A
Splitter cartridge, biocompatible, for a split ratio of 1:15	6721.3165A
Splitter cartridge, standard, for a split ratio of 1:6	6720.3170A
Splitter cartridge, biocompatible, for a split ratio of 1:6	6721.3170A
Stator for 2-position/10-port C2 switching valve, biocompatible valve	6720.0091

Description	Part No.*
Stator for 2-position/10-port C2 switching valve, standard valve	6720.0111
Stator for 2-position/6-port CN2 switching valve, biocompatible valve	6720.0108
Stator (titanium) for 2-position/10-port C2 switching valve, biocompatible valve	6720.0112
Tool for preassembly of biocompatible fittings	6000.0065
Trap column holder (5 mm, including appropriate capillaries (30µm I.D.))	6720.0012
Trap column holder (15 mm, including appropriate capillaries (60µm I.D.))	6720.0013
Tubing, fused silica, 5m (75 µm ID ± 3 µm; 280 µm OD ± 10 µm)	6720.0081
Tubing, Teflon® (500 µm ID, 100 cm long) for use as waste tubing	6720.0077
Tubing, Teflon® (250 µm ID., TF-250, 5 pcs.)	6720.0030
Union (micro-tight), including 2 fittings and 1 gauge plug	6720.0074
USB cable (1m, type A to type B)	6035.9035
USB cable (0.5 m, type A to type B)	6720.8910
Waste fluidics kit, including 2 m tubing and 5 Tee pieces	6000.5001
Wrench (size 3.0 mm)	6000.0050
Wrench, open-end (1/4" x 5/16")	6000.0051
Wrench, box wrench (slotted head, size 1/4")	6000.0052

* The part number always refers to the packing unit. For more information, please contact your Dionex sales representative.

11 Technical Appendix - Pin Assignment

Two 6-pin Mini-DIN ports on the instrument's rear panel (→ Fig. 12, page 20) can be used in Chromeleon to exchange digital signals with external instruments.

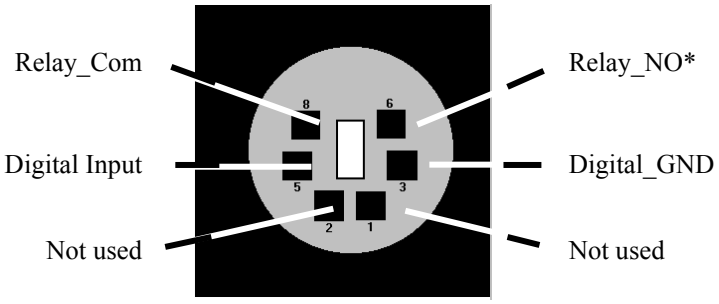


Fig. 46: Digital I/O (view from the rear)

* NO = normally open contact

If the relay is activated, the connection is between Com and NO.

	Description
Digital Input ↔ Digital_GND	0 to +5V
Relay_Com ↔ Relay_NO	Switching voltage: 100 V_{DC}; switching current: 0.25 A Carry current: 0.5 A; Switching capacity: 3 W Contact resistance: max. 150 mΩ

Fig. 47: Digital I/O

The table below lists the functions assigned to the connector pins and the color and label of the cable wire connected to each pin:

Pin	**Signal Name**	**Signal Level**	**Core Color**	**Core Label**
1	Not occupied		Pink	Analog High
2	Not occupied		Gray	Analog Low
3	Digital_GND	0V	Green	Digital GND
5	Digital Input	0 to +5V	Yellow	Digital Input
6	Relay_NO	100V_{DC}/0.25A/3W	Brown	Digital Output
8	Relay_Com		White	Dig./Out (GND)
			Black	Shield

Fig. 48: Pin assignment (6-pin Mini-DIN port and cable)

12 Index

L

M

O

P

R

S

T

U

V

W

UltiMate 3000 Series

Flow Managers

Maintenance Instructions for the Flow Control Valve (FCV)

Revision: 1.3

Date: May 2008

Table of Contents

1 Introduction

1.1 How to Use This Manual

The flow manager uses a Flow-Control Valve (FCV) installed in the rear of the enclosure (on the right) to control the column flow. In the same way as even minute particles may cause damage to the pump's inlet and outlet valves, they may cause damage to the flow control valve. These particles may be contained in the solvents or be caused by the unavoidable abrasion of the pump seals.

Most of these particles are retained in the built-in filters, however, some particles may have passed the filter and accumulated in the FCV. After some time, the FCV cannot build up the required pressure. Chromeleon recognizes this problem and displays a "Flow Control Valve Failure" or "Flow Control Valve Limit". In this case, you can clean the FCV as described here. However, to reduce the amount of maintenance in the future, read the section on *Shutting down the Flow Manager* in the *Operating Instructions* of the flow manager.

The FCV is designed in such a way that it can easily be removed and cleaned. The cleaning instructions below give a detailed description of the required steps. The dirt particles are usually so small that they are not visible to the naked eye. Therefore, even if you cannot see any dirt, follow the steps below carefully to ensure proper cleaning of the valve. Almost all descriptions in the manual apply to all flow managers of the UltiMate 3000 system and cover both the standard (stainless steel) and biocompatible models. Therefore, the terms "the flow manager" and/or "the FLM" are used throughout the manual. If some detail applies to only one model or version, the model (or version) is identified by name.
At various points throughout the manual, messages of particular importance are indicated by certain symbols:

Tip:	Indicates general information intended to optimize the performance of the instrument.
Important:	Indicates that failure to take note of the accompanying information may result in damage to the instrument.
Warning:	Indicates that failure to take note of the accompanying information may result in personal injury.

The information contained in this manual is subject to change without notice and should not be construed as a commitment by Dionex. Dionex assumes no responsibility for any errors that may appear in this document. This document is believed to be complete and accurate at the time of publication. In no event shall Dionex be liable for incidental or consequential damages in connection with or arising from the use of this document.

1.2 Required Materials

The following materials are required:

- FCV Maintenance Kit (→ section 1.3)
- Small beaker or similar vessel
- Phillips screw-driver
- Wrench (size ¼“) for high-pressure fitting screws
- Approx. 10 ml clean isopropyl alcohol
- Goggles
- Compressed air for cleaning optical parts, e.g., "Dust Off" by Falcon Safety Products

1.3 FCV Maintenance Kit

An FCV Maintenance Kit (Dionex P/N 6720.3195) is required to clean the flow control valve. It contains the following materials:

- Pointed compressed clean-foam swab
- Cleanroom tissue 4“ x 4“
- Allen wrench (size 2.5 mm)
- PEEK blind nut
- 12 ml plastic syringe
- 4 screws M3 x 16 mm
- CD "FCV Maintenance Kit"

The clean-foam swab and the tissue can be reused if stored in an absolutely clean environment.

Do not clean the FCV with materials other than those contained in the FCV Maintenance Kit. When using cleaning tools such as conventional cotton swabs, the cleaning might not be successful.

1.4 Installation of the Chromeleon Program Files

Tip: If you are using Chromeleon version 6.80 Service Pack 2 or higher, an integrated diagnostic test is available for testing the flow control valve. Installation of the program files is no longer required. For information about running the test using the software, refer to the Chromeleon online Help.

The CD included in this kit contains a "FCV Flushing and Test Programs.cmb" Chromeleon backup file. This backup file includes test programs (→ section 2) and flushing programs (→ section 3.4). To download the program files to your computer, follow the steps below:

1. Open Chromeleon.
2. Open the Chromeleon Server Configuration Program and verify that the **Flow Control** check box is selected on the **Configuration** tab in the flow manager's properties:

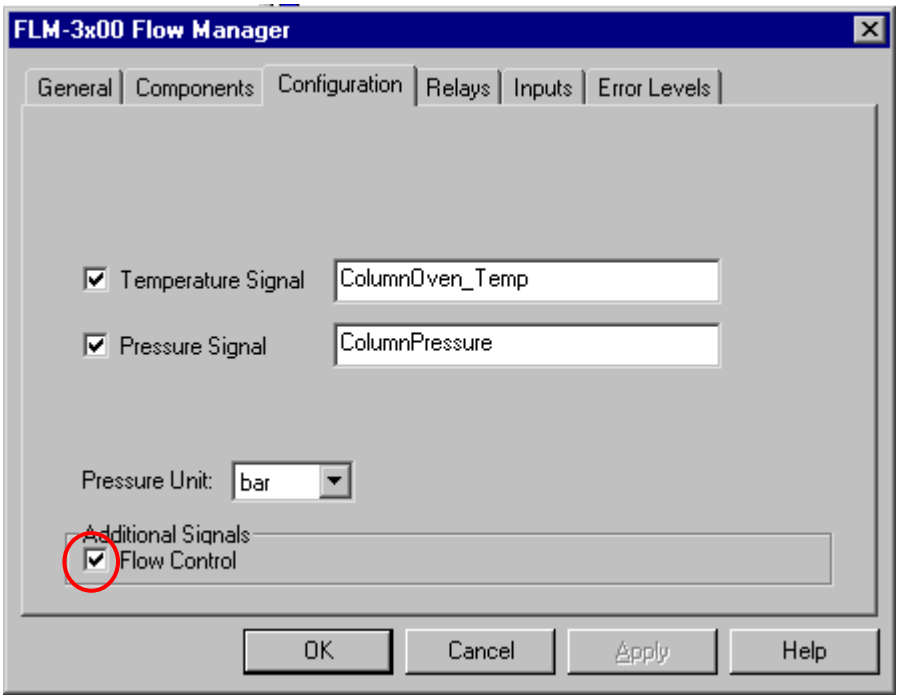


Fig. 1: Select the Flow Control check box in the Server Configuration

3. Save the configuration and close the Chromeleon Server Configuration Program. Insert the CD in your CD drive. Double-click the "FCV Flushing and Test Programs.cmb" file.
4. The **Restore** dialog box opens. Under "Destination", enter the path for the timebase in which the FLM is installed.

5. The test and flushing programs are installed in Chromeleon. Before you run a program, open it and connect it to the timebase via the **Control** menu. Save the modified program.

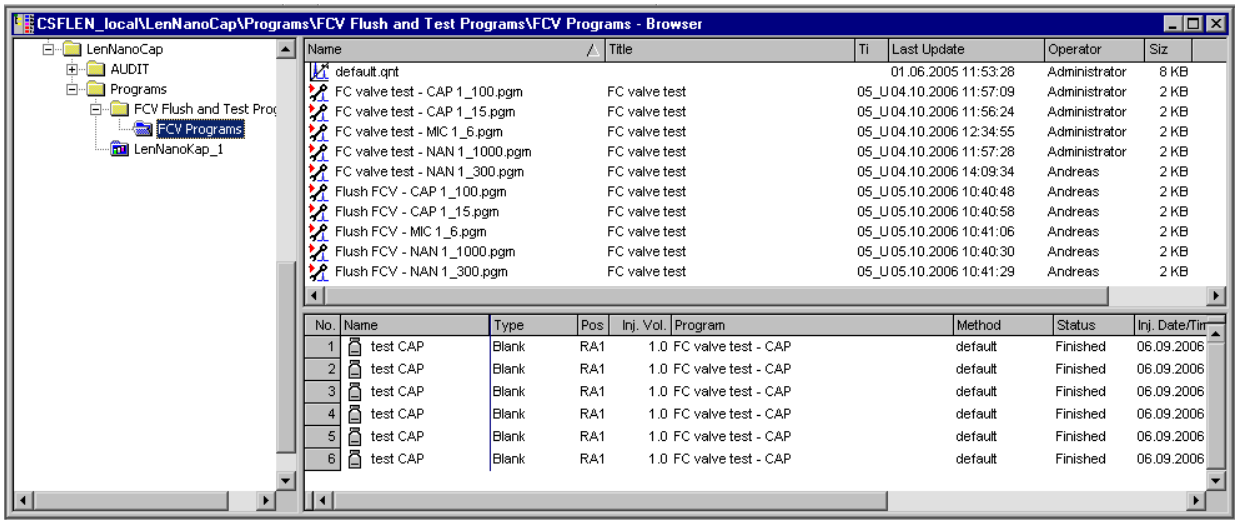


Fig. 2: Installation of the program files in Chromeleon

⚠ **Tips:** If you have selected a different name for a device than the standard name in the driver configuration, or are working with a special system configuration (such as a Dual Gradient System), the respective program must be adapted to the configuration.

For general information about restoring files in Chromeleon and about program files, refer to the Chromeleon Online Help.

2 Flow Control Valve Test

Introduction

The following test procedure is designed to provide information about the condition of the flow control valve (FCV). The test verifies if the FCV builds up sufficient back pressure to operate properly or if it requires maintenance. The test is carried out with water + 0.05% TFA.

Important: Dionex recommends that the test be performed only if a flow control valve related error message is displayed (e.g. 'Flow Control Valve Failure!') and the entire flow path has been checked for leakage and blockage. The components to be checked include the column path as well as the micro pump connections. This test should not be run on a routine basis to monitor system performance.

Tip: If you are using Chromeleon version 6.80 Service Pack 2 or higher, an integrated diagnostic test is available to facilitate testing of the flow control valve. The test also includes evaluation of the results. To select the test, click **Control -> Diagnostics**. For more information about running the test using the software, refer to the Chromeleon online Help.

Test Sequence

The test run starts with a flow control valve initialization command which brings the valve into a defined position. The stepper position will run from 4160 steps down to 0 steps (which corresponds to opened position of the valve), to flush it at a higher flow rate.

In the next step, the flow rate of the micro pump is set to approximately 100 µL/min. The exact flow rate is defined by the split ratio of the currently installed splitter, for example, if a Nano flow splitter cartridge with a split ratio of 1:1007 is installed the master flow rate will be

$$0.100\ \mu L/min * 1007 = 100.7\ \mu L/min.$$

While the micro pump is pumping at that flow rate, the **InitFlowControlSelfTest** command is executed. This command closes the valve continuously until the maximum pressure (set by **ColumnPressure.Signal.UpperLimit**) or the end position of the stepper motor of the valve has been reached. Once this trigger condition is reached, the valve is switched back to 'Off' mode and opens automatically. To ensure that the desired flow rates are reached within an appropriate time during testing, the **Micropump.MaximumFlowRampUp** and **Micropump.MaximumFlowRampDown** parameters are set to 'infinite'. They will be reset to default values after finishing the test.

To perform the flow control valve test:

1. Disconnect the capillary that is connected to the outlet of the flow splitter (e.g. the tubing to the WPS-3000 Microautosampler), and then plug the outlet firmly using the blind plug.

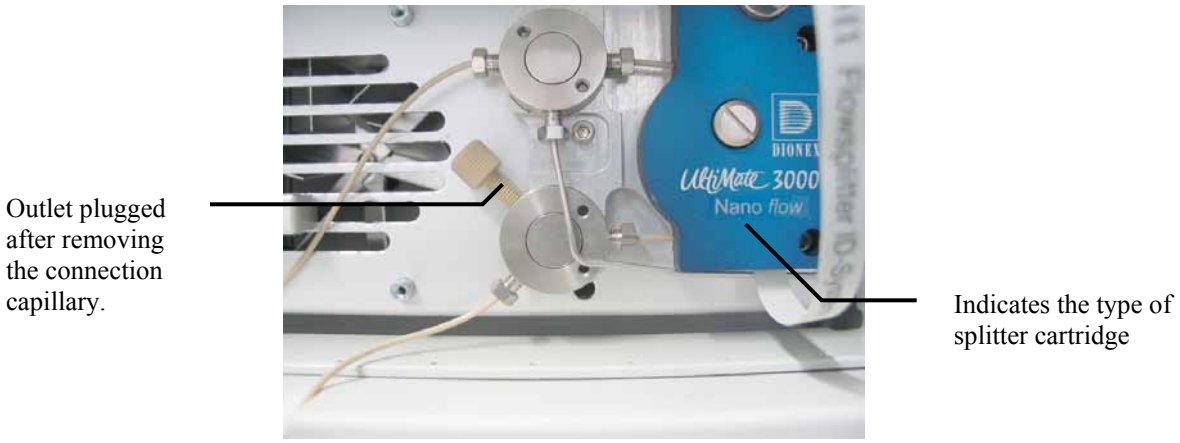


Fig. 3: Pressure Test of the Flow Control Valve

2. Fill solvent bottle A of the micro pump with water + 0.05% TFA and purge the pump.
3. Select a Chromeleon test program from the CD included in the kit (for installation instructions, see section 1.4, page 3). The splitter cartridge (→ Fig. 3) and the split ratio define which program is required. Refer to TABLE 1 to select the appropriate test program for your system configuration. A program example is also presented in the Appendix (→ page 23):

Splitter Cartridge Type	Split Ratio	Program Name
Nano flow	1:1000	FC Valve Test - NAN 1_1000
Nano flow	1:300	FC Valve Test - NAN 1_300
Cap flow	1:100	FC Valve Test - CAP 1_100
Cap flow	1:16	FC Valve Test - CAP 1_16
Micro flow	1:6	FC Valve Test - MIC 1_6

TABLE 1: Choosing the Test Program

4. The program executes the **InitFlowControlSelfTest** command at a step rate of 100 steps. In addition, it stores the master pressure (**MicroPump_MasterPressure**), the column pressure (**ColumnPressure**) and the stepper motor position (**ColumnOven_FC_stepper**).

   Tip: Do not change the maximum pressure settings or the step rate. This may lead to improper results.

5. Run the program.

Test Result interpretation:

Compare your results with the results presented in Fig. 4. The flow control valve is in a perfect condition (blue trace) if the following criteria are met:

- The delay time is shorter than 2 minutes (at a **StepRate** of 100)

  and

- The pressure builds constantly (linear ramp, no drops or jumps).

  and

- The maximum pressure (350 bar) is reached before the stepper motor has reached its end position, which refers to 4160 steps (in our example it stopped at around 3400 steps for pressure trace 1)

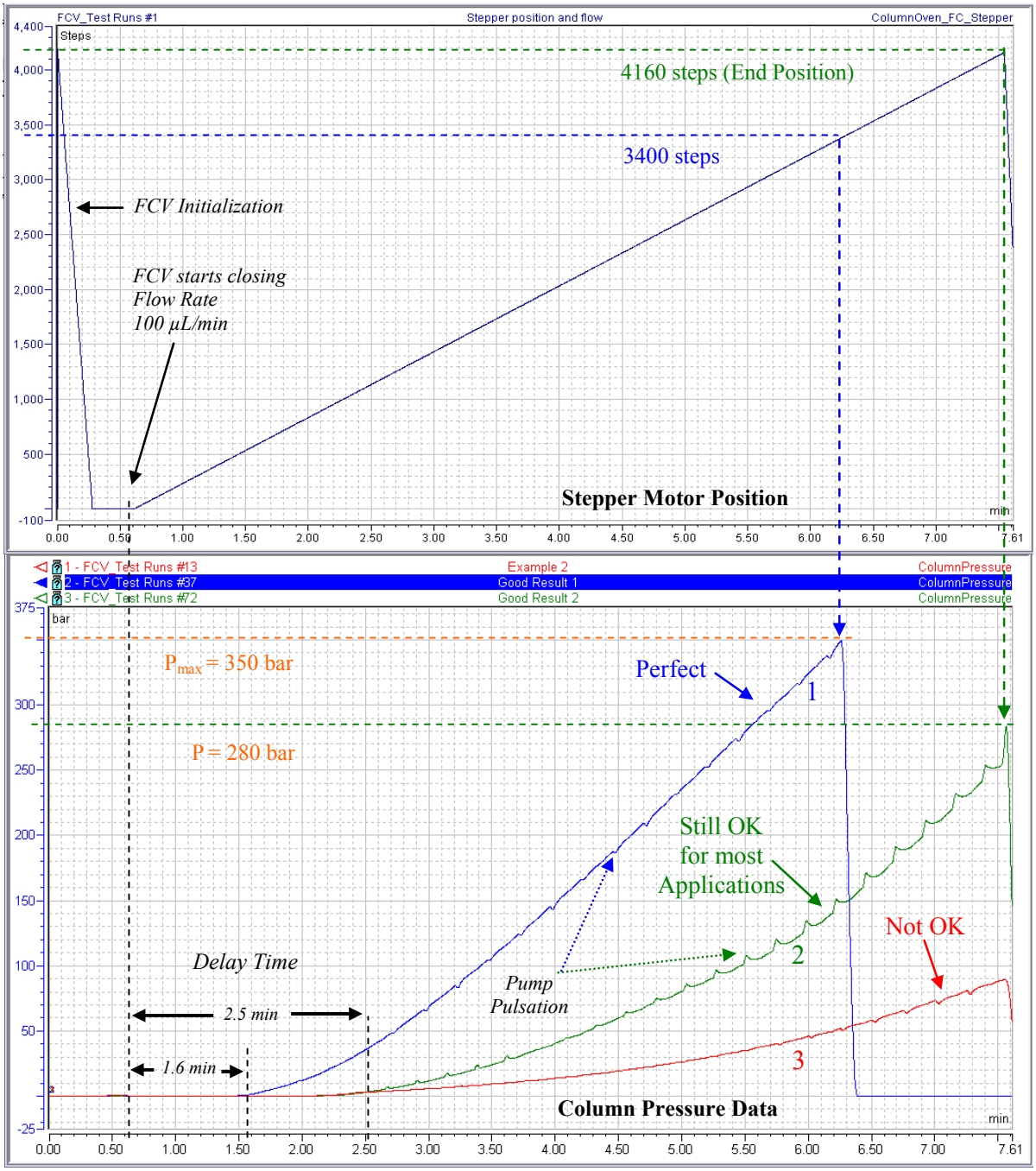


Fig. 4: Flow Control Valve Test – Stepper Motor Position and Pressure Traces

If one or more of the above criteria are not fulfilled, the flow control valve will still work ok for your application if the 'Minimal Required FCV Pressure as presented in TABLE 2 is reached before the stepper motor has reached its end position (4160 steps).

If the flow control fails to build up sufficient pressure during operation of the system, an error message (e.g. Flow Control Valve failure) is issued. So there is no need to clean or replace the flow control valve before such error messages occur.

Column Type [I.D. x L, packing material]	**Part Number**	**Typical Back Pressure** [@ Column Flow Rate/Temperature]	**Minimal Required FCV Pressure**
75 µm x 15 cm, C18	160321	115– 130 bar [0.3 µL/min / 25 ºC]	230 bar
100 µm x 5 cm, monolith	162348	140 – 180 bar [1.0 µL/min / 60 ºC]	280 bar
200 µm x 5 cm, monolith	161409	160 – 200 bar [2.5 µL/min / 60 ºC]	300 bar
300 µm x 15 cm, C18	160295	90 – 120 bar [4.0 µL/min / 25 ºC]	220 bar
1.0 mm x 15 cm, C18	160282	90 – 120 bar [2.5 µL/min / 25 ºC]	220 bar

Note: Solvent is water with 0.05 % TFA. The back pressure may vary from column to column.

TABLE 2: Minimal Required FCV Back Pressure

6. If the flow control valve works ok, remove the plug and connect the splitter outlet.

If the specifications are not met, you can repeat the test. If the result still does not meet the specifications after a maximum of 5 runs, clean the flow control valve as described in section 3.

Tip: The ripple which may be observed is caused by the pump's residual pulsation. It is not a matter of concern for this test.

Fig. 4 presents sample data of the test from three different flow control valves. In addition, the corresponding stepper motor position is presented.

- The flow control valve in profile '1' shows a very good response. After a short delay, the pressure increases constantly until the pressure limit is reached. The stepper motor did not reach its end position (4160 steps).
- The flow control valve in profile '2' generates 280 bar at 4160 steps. This is sufficient back pressure to operate a standard 75 µm, 15 cm, C18 Nano column properly.
- The flow control valve in profile '3' hardly generates back pressure. The stepper motor reaches its end position (4160 steps) and the maximum pressure limit is not reached.

Typical Scenarios of a failing Flow Control Valve

Fig. 5 presents typical data from flow control valves that are not working properly because of dirt. Cleaning of the valve (→ section 3) may most likely restore the valve.

- Fig. 5 A – Stepper motor position (as reference).
- Fig. 5 B – Too much delay, pressure builds up too late and too slow.
- Fig. 5 C – Pressure increases too slowly, pressure spike in the end of the test run.

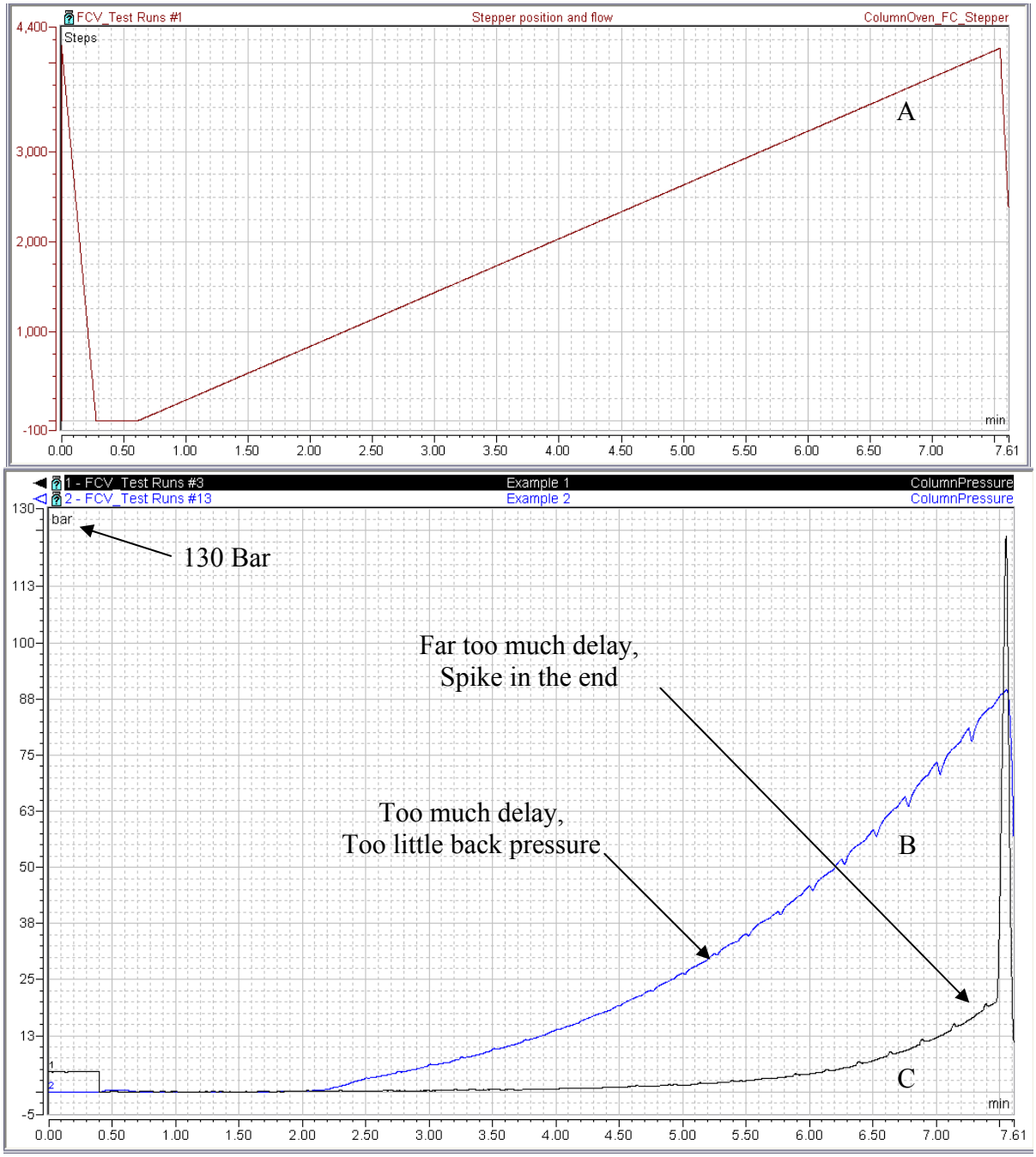


Fig. 5: Test Results of different Flow Control Valves with dirt

Fig. 6 shows typical data from flow control valves that are not working properly because of a mechanical failure. Cleaning the valve (→ section 3) will probably not recover the flow control valve and the valve will most likely need to be replaced. In this case, contact Dionex Service.

- Fig. 6 A – Stepper motor position (as reference).
- Fig. 6 B – Pressure spike in the beginning. May indicate a damaged membrane.
- Fig. 6 C – Pressure 'jump' in the middle. May indicate dirt, air or an internal leakage.
- Fig. 6 D – Pressure remains almost constant. Usually indicates a broken valve seat.

Tips: The pressure data presented in example C can also be caused by air in the flow control valve. To remove the air, repeat the test.

The pressure data presented in example D can also be caused by a leak (e.g. purge screw, connections between pump and FLM or splitter and FCV).

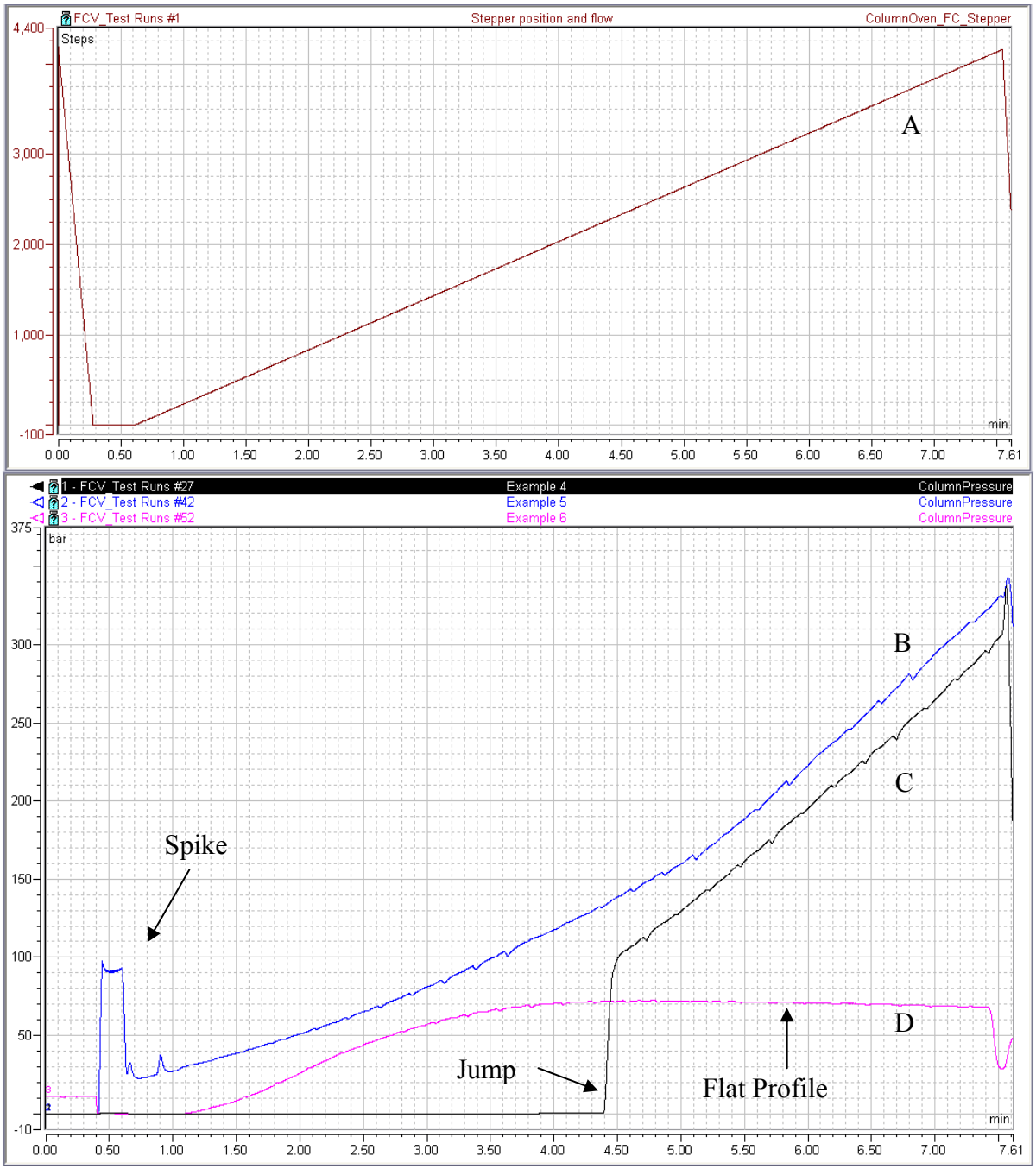


Fig. 6: Test Results of different Flow Control Valves with mechanical failures

3 Cleaning the FCV

Tip: Before you start cleaning the flow control valve, perform the FCV test as described in section 2 to find out whether cleaning will help resolving the problem.

3.1 Overview

Cleaning the FCV involves the steps below:

1. Disconnecting the column from the flow splitter. This prevents the column from being damaged during the FCV test.
2. Testing the FCV. This test measures and records the pressure build-up. It helps you to find out whether the problem can be solved by cleaning the valve or not.
3. Flushing the FCV.
4. Removing the FCV. The flow manager is designed in such a way that the FCV can easily be removed without having to remove the flow manager from the HPLC system.
5. Cleaning the FCV. Use the available Maintenance Kit that contains the required cleaning materials.
6. Re-installing the FCV.
7. Testing the FCV. The test ensures that the cleaning was successful.
8. Re-establishing the connections and system start-up.

Warning: Highly flammable isopropyl alcohol is used for cleaning the FCV. Observe the safety regulations for isopropyl alcohol!

3.2 Disconnecting the Column

1. Stop the pump flow and wait until the flow is zero.
2. Open the door of the FLM.
3. Remove the capillary at the splitter connector (connector no. 4 in the Figure in the "Connecting the Capillaries to the Column Switching Valve" section of the FLM *Operating Instructions*) and close the outlet firmly with the blind nut that is included in the FCV Maintenance Kit.

3.3 Testing the FCV

Test the FCV as described in section 2 on page 5 to find out whether the FCV is working properly, or whether it can be cleaned or must be replaced.

3.4 Flushing the FCV

Warning: If you have been using toxic solvents or solvents harmful to health, purge the flow manager with an appropriate solvent before starting maintenance work to avoid injuries caused by residual solvents.

Fill solvent bottle A of the micro pump with water + 0.05% TFA, if not yet done, to flush the flow control valve. Run the flushing program for your application from the CD included in the kit (for installation instructions, see section 1.4, page3). The splitter cartridge (→ Fig. 3, page 6) and the split ratio define which program is required (→ Table 3). A program example is also presented in the Appendix (→ page 23).

Splitter Cartridge Type	Split Ratio	Program Name
Nano flow	1:1000	Flush FCV - NAN 1_1000
Nano flow	1:300	Flush FCV - NAN 1_300
Cap flow	1:100	Flush FCV - CAP 1_100
Cap flow	1:16	Flush FCV - CAP 1_16
Micro flow	1:6	Flush FCV - MIC 1_6

Table 3: Selecting a test program

3.5 Removing the FCV

The FCV must be brought to zero position before it can be removed. This is done automatically during the flush program described in the previous section. If you do not run the flush program, you can manually bring the FCV to zero position. To do so, go to the **Commands** (F8) dialog box in Chromeleon and, under **FlowSplitter_1**, set the **FSControlMode** property to **Off**. Wait for 10 seconds until the FCV has reached zero position, then turn off the instrument and disconnect the power cord.

Caution: Before you turn off the instrument, verify that the FCV is in zero position to prevent it from being damaged.

The Flow-Control Valve (FCV) is installed in the rear of the flow manager's enclosure (on the right) and can be easily dismounted after the right side panel was removed without having to remove the flow manager from the HPLC system.

Warning: Before you open the instrument, make sure that the power cord is disconnected from its source! Danger of fatal electric shocks!

1. At the rear panel, loosen the screw that holds the right side panel (Fig. 7) and pull the side panel slightly to the side and then towards the back (Fig. 8).

Fig. 7: Loosen the screw for the right side panel

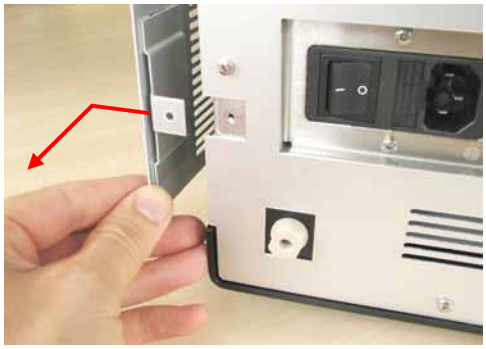


Fig. 8: Remove the side panel

2. Disconnect both FCV connectors from the green FCV board (Fig. 9).
3. Check whether your flow manager is equipped with a prefilter (Fig. 10) or not (Fig. 9). Continue with either step a or b.

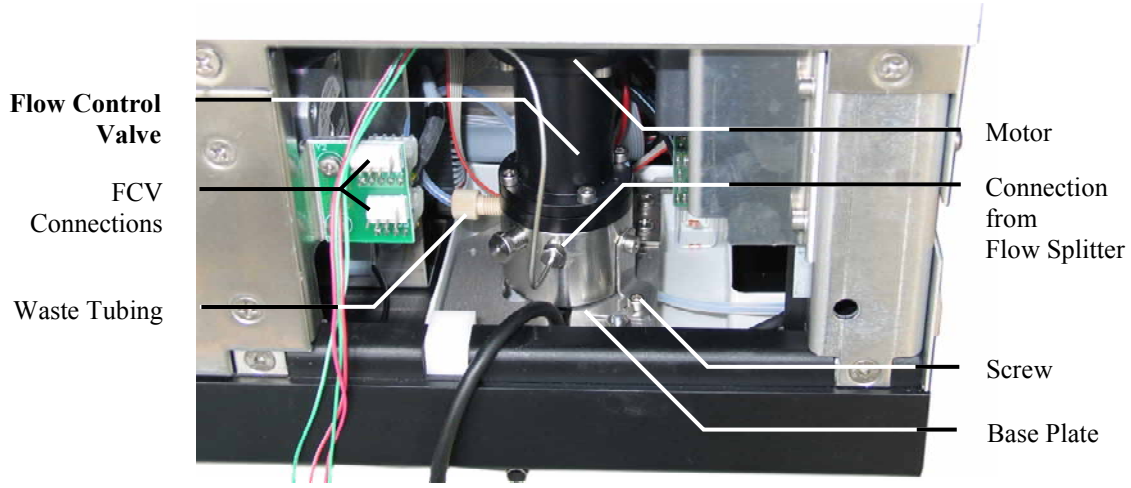


Fig. 9: Right side panel removed (no prefilter)

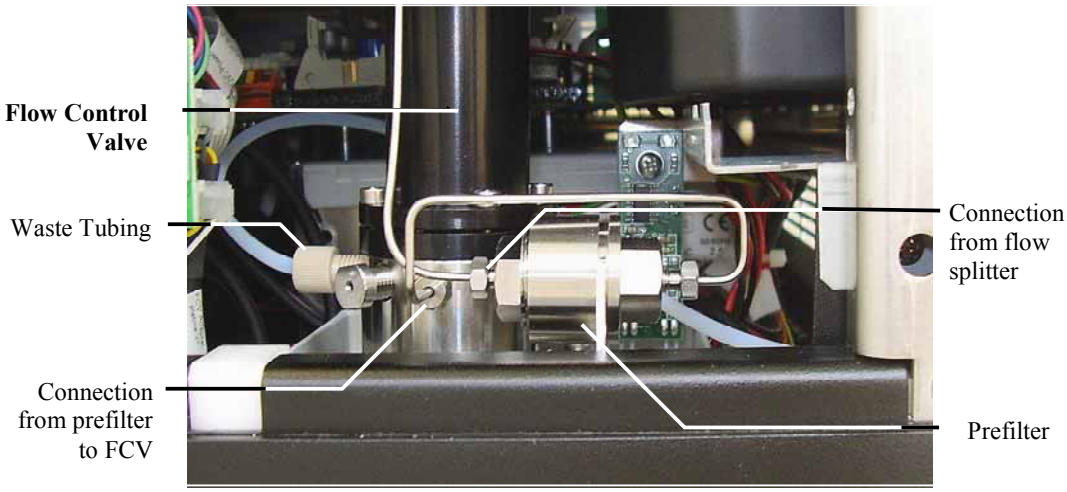


Fig. 10: Right side panel removed (with prefilter installed)

a) *Prefilter installed:* Use the wrench (size ¼“) for high-pressure fitting screws to unscrew the connection between the flow splitter and the prefilter, while steadying the prefilter nut with a 13 mm wrench (Fig. 11). Then unscrew the connection between the prefilter and the FCV high-pressure connection, using the ¼“ wrench again (Fig. 12). Put the prefilter aside in a clean place.

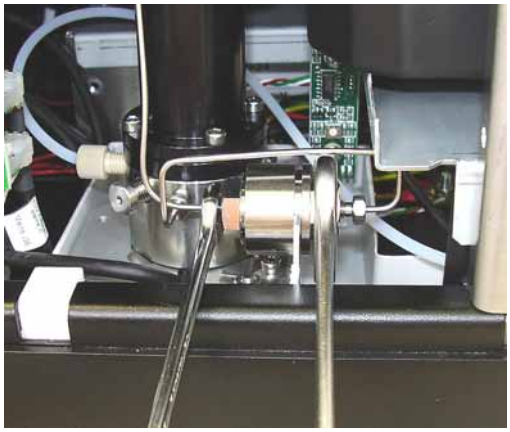


Fig. 11: Unscrew the prefilter connector

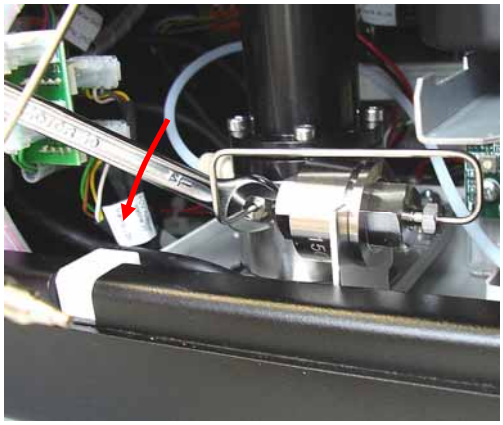


Fig. 12: Unscrew the FCV high-pressure connector

b) <u>No</u> *prefilter installed:* Use the wrench (size ¼“) for high-pressure fitting screws to unscrew the connection between the flow splitter and the FCV high-pressure connection (Fig. 13).

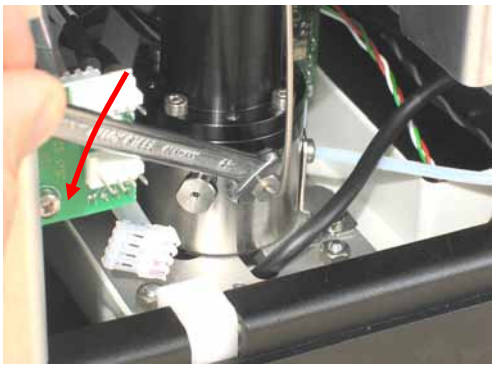


Fig. 13: Unscrew the FCV high-pressure connector (no prefilter)

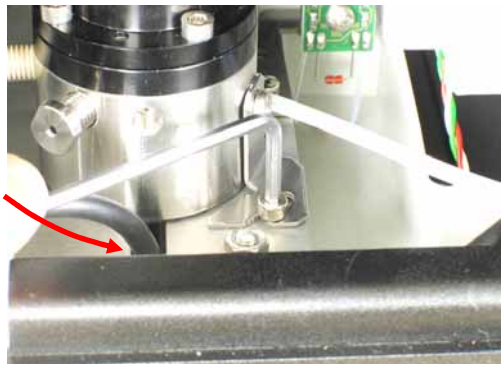


Fig. 14: Loosen the fixing screw

4. Use the Allen screw to loosen the FCV fixing screw by two revolutions to release the locking plate (Fig. 14).

5. Hold the FCV at the drive (top) and turn it by approx. 45° counterclockwise (Fig. 15) to the position where the bayonet catch at the FCV's lower side is released.

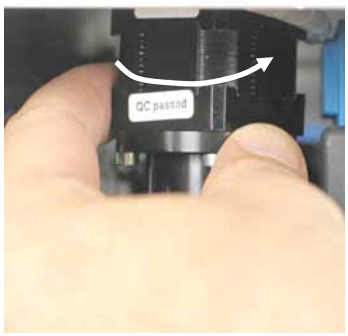


Fig. 15: Release the FCV

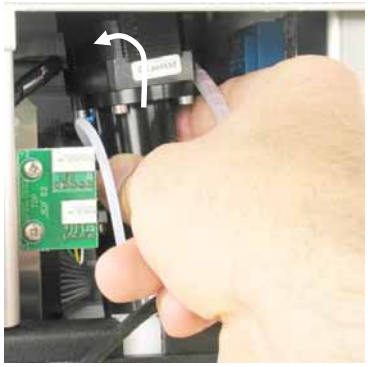


Fig. 16: Lift the FCV and tilt it

Fig. 17: Remove the FCV

6. Lift the FCV a little and tilt it towards the back with the drive showing into the inside of the flow manager (Fig. 16). Remove it from the enclosure with the bottom part ahead (Fig. 17).
7. Unscrew the low-pressure connection (Fig. 18).

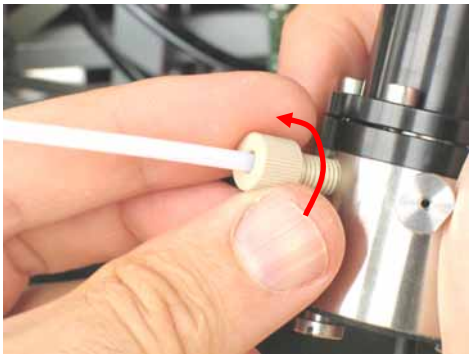


Fig. 18 Unscrew the low-pressure connection

Fig. 19: Remove the solvent

8. To remove the remaining solvent from the FCV, draw air into the syringe that is contained in the Maintenance Kit. Hold the FCV with the low-pressure connection over a collect vessel and quickly press air with the syringe through the high-pressure connection into the FCV (Fig. 19).

3.6 Disassembling and Cleaning the FCV

3.6.1 Disassembling the FCV

⚠ **Caution:** The ball located in the center of the drive is held in position only by a short tube, see Fig. 21. Make sure not to lose these parts! Do not touch the ball, tube and membrane.

1. Use the Allen screw to remove the four hex socket head screws of the FCV's fluidic block (not on the drive) (Fig. 20). Demount the fluidic block from the drive (Fig. 21).

Fig. 20: Remove the screws on the FCV fluidic block

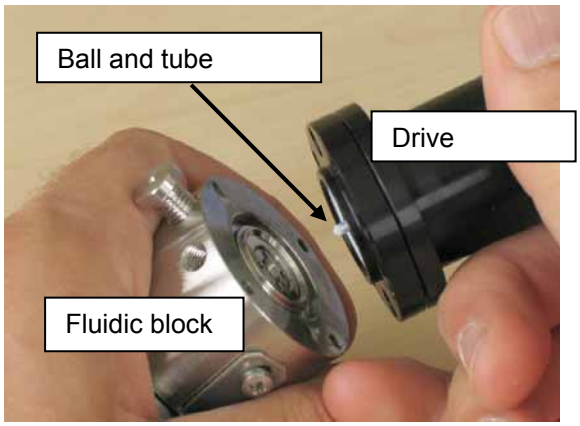


Fig. 21: Separate the fluidic block and the drive

3.6.2 Cleaning the Fluidic Block

STOP **Warning:** Observe the safety regulations for isopropyl alcohol! Wear goggles to avoid contact with eyes. It is recommeded to wear protective gloves.

⚠ **Caution:** Do not use cleaning swabs other than the pointed lint-free swabs contained in the FCV Maintenance Kit. Cleaning tools such as conventional cotton swabs or similar products are not suitable.

1. Remove the remaining solvent from the fluidic block:
   - Place the fluidic block open side down on a beaker.
   - Draw air into the syringe that is contained in the Maintenance Kit.
   - Quickly press the air from the syringe through the high-pressure connection.
   - Refill the syringe and press more air through the low-pressure connection.

Fig. 22: Remove solvent from the fluidic block

Perform the steps below immediately after each other to prevent the isopropyl alcohol that is used for cleaning from drying up too quickly.

2. Fill the syringe with clean isopropyl alcohol and use it to wet the tip of the cleaning swab contained in the Maintenance Kit (Fig. 23).

Fig. 23: Wet the swab with clean isopropyl alcohol

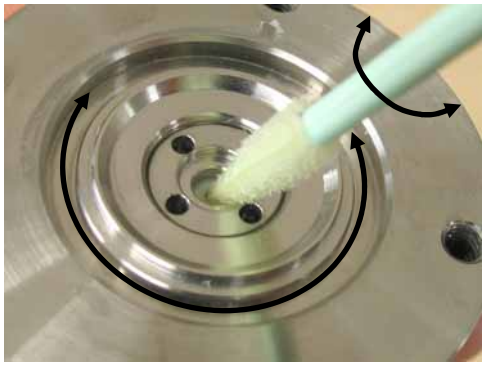


Fig. 24: Clean the white ceramic seat

3. Place the tip of the swab in the hole in the middle of the fluidic block where the white ceramic seat is visible and clean it thoroughly by rotating the swab and moving it around the hole (Fig. 24).
4. Wash the valve seat vicinity using isopropyl alcohol (Fig. 25). Wash the hole in the valve seat: Use the syringe to quickly inject about 5 ml of isopropyl alcohol through the high-pressure connection (Fig. 26).

Fig. 25: Wash the valve seat vicinity

Fig. 26: Wash the hole

5. Use the compressed air to blow the remaining liquid from the valve seat vicinity (Fig. 27). This removes not only the isopropyl alcohol, but also any dirt particles. Then blow the hole of the ceramic seat (Fig. 28) by blowing compressed air into the FCV's high-pressure connection.

Warning: When the compressed air is blown through the FCV, the isopropyl alcohol inside the valve shoots out of the hole in the ceramic seat. Therefore, be careful to hold the opening away from you.

Fig. 27: Blow the liquid off the valve seat vicinity

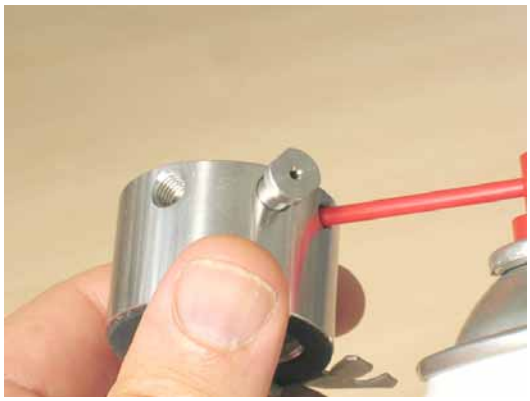


Fig. 28: Blow air through the hole

The cleaning of the fluidic block is now complete. Place the block onto an **absolutely clean** surface to ensure that no more particles, e.g., dust, can cause pollution.

3.6.3 Cleaning the Drive

Warning: Observe the safety regulations for isopropyl alcohol! Wear goggles to avoid contact with eyes. It is recommeded to wear protective gloves.

Caution: The membrane of the drive is very sensitive to deformation. Do not touch the membrane and do not apply any force to the ball or ball seat!

Caution: Do not use tissues other than the cleaning tissue contained in the FCV Maintenance Kit!

1. Wet the membrane with isopropyl alcohol to remove any dirt particles that may have accumulated (Fig. 29).
2. Use the compressed air to remove the isopropyl alcohol and dirt particles (Fig. 30). Do not touch the ball.

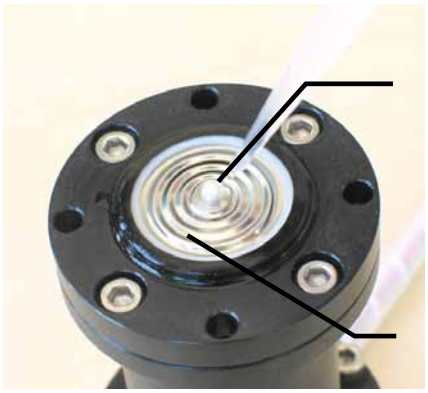


Fig. 29: Wet membrane with isopropyl alcohol

Fig. 30: Blow the liquid off the membrane

3. Wet a corner of the tissue with isopropyl alcohol (Fig. 31).

Fig. 31: We tissue with isopropyl alcohol

Fig. 32: Clean the ball

Fig. 33: Blow liquid off

4. Wipe the ball gently but thoroughly in circular movements (Fig. 32). Be careful not to apply any force on the ball. Ensure that after the cleaning, the ball and tube are in their proper center position. Use the wet tissue to move the ball into the correct position if necessary.

⚠ **Caution:** Do not apply any strong force to the ball, as this might deform the membrane!

5. Immediately afterward, before the isopropyl alcohol has evaporated, blow the remaining liquid off the ball (Fig. 33). If necessary, wet the ball again with isopropyl alcohol before you do so.

The FCV should be assembled immediately afterward to avoid pollution, e.g. by dust in the air.

3.6.4 Assembling the FCV

1. Reassemble drive and fluidic block. To do so, guide the two parts with your fingers as shown in Fig. 34 to avoid a lateral misalignment. Now turn both parts in opposite directions to align the holes in both parts with each other (Fig. 35). (It does not matter where the motor connection lines are located.)

Fig. 34: Reassemble drive and fluidic block

Fig. 35: Align the holes

2. Replace the four hexagon socket head screws and tighten them until they touch the drive flange (Fig. 36). Then screw down the four screws crosswise one by one (Fig. 37), i.e., two opposing screws until they begin to tighten. Then repeat the same for the other two screws. Now tighten all screws in the same order bit by bit until they are equally and firmly tightened.

Fig. 36: Replace the screws

Fig. 37: Tighten the screws

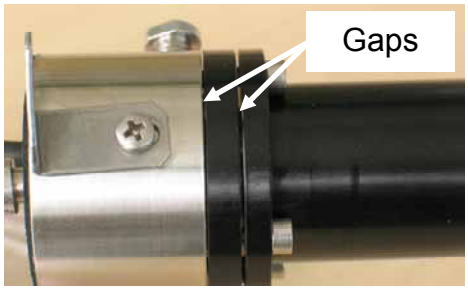


Fig. 38: Gaps between the parts

⚠ **Caution:** Do not over-tighten the screws! It is normal that a small gap remains between the fluidic block and the drive and another wider gap between the two black parts of the drive (Fig. 38). If the valve was mounted correctly, the gap width is the same around the valve.

3.7 Reinstalling the FCV

Reinstall the FCV in reverse order. Note the following:

- Do not do not pinch cables or tubings under the FCV.
- Make sure the FCV is firmly seated in the base plate and the fixing screw is tightened.
- The wider pressure sensor connector is connected to the upper position on the green board. There should be no offset between the two connectors.
- Do not guide the motor connector cable through the leak tray below the FCV base plate.
- Make sure to reinstall the prefilter (if available).

Test the FCV (see section 2) before you reinstall the flow manager's side panel.

3.8 Testing the FCV

Test the FCV as described in section 2 on page 5 and check the FCV for leaks.

Repeat the cleaning process if necessary.
If the test was successful, mount the side panel and reconnect the column to the flow splitter.

Appendix

CHROMELEON® Program Examples

Flow Control Valve Flushing for a Nano Configuration, 1:1000 Splitter

```
;=====================================================================
; Flow Control Valve Flushing NAN 1_1000
; ---------------------------------------------------------------------
; Column: Blind plug
; Eluent A: Water + 0.05% TFA (HPLC grade or better)
; HPLC-System:
; Pump: DGP/LPG3x00 (low pressure gradient)
; Flow Control: FLM-3x00, NAN splitter 1:1000 installed
;=====================================================================


; FLM Settings
            FlowSplitter_1.FSControlMode = Off
            ColumnPressure.Signal.LowerLimit =    0 [bar]
            ColumnPressure.signal.UpperLimit =    350 [bar]

; Pump Settings
            MasterPressure.LowerLimit =           0 [bar]
            MasterPressure.UpperLimit =           500 [bar]
            MicroPump.%A.Equate =                 "%A"
            MicroPump.%B.Equate =                 "%B"
            MicroPump.%C.Equate =                 "%C"
            MicroPump.MaximumFlowRampUp =         infinite
            micropump.MaximumFlowRampDown =       infinite

; Signals
            MicroPump_MasterPressure.Step =       0.20 [s]
            MicroPump_MasterPressure.Average =    Off
            ColumnPressure.Step =                 0.20 [s]
            ColumnPressure.Average =              Off


 0.000      MicroPump_MasterPressure.AcqOn
            ColumnPressure.AcqOn
            ColumnOven_FC_Stepper.AcqOn
            FlowSplitter_1.FSValveInit
            FlowSplitter_1.FSControlMode =        Off

0.100       MicroPump.Flow =                      0.500 [µl/min]
            MicroPump.%B =                        0.0 [%]
            MicroPump.%C =                        0.0 [%]

5.000       MicroPump.Flow =                      0.500 [µl/min]

5.100       MicroPump_MasterPressure.AcqOff
            ColumnPressure.AcqOff
            ColumnOven_FC_Stepper.AcqOff

            MicroPump.Flow =                      0.000 [µl/min]

            FlowSplitter_1.FSControlMode =        Off


            End
```

Flow Control Valve Test for a Nano Configuration, 1:1000 Splitter

```
;=====================================================================
; Flow Control Valve Test NAN 1_1000
; ---------------------------------------------------------------------
; Column: Blind plug
; Eluent A: Water + 0.05% TFA (HPLC grade or better)
; HPLC-System:
; Pump: DGP/LPG3x00 (low pressure gradient)
; Flow Control: FLM3x00, Nano flow splitter 1:1000 installed
;=====================================================================


; FLM Settings
            FlowSplitter_1.FSControlMode = Off
            ColumnPressure.Signal.LowerLimit =     0 [bar]
            ColumnPressure.signal.UpperLimit =     350 [bar]

; Pump Settings
            MasterPressure.LowerLimit =            0 [bar]
            MasterPressure.UpperLimit =            500 [bar]
            MicroPump.%A.Equate =                  "%A"
            MicroPump.%B.Equate =                  "%B"
            MicroPump.%C.Equate =                  "%C"
            MicroPump.MaximumFlowRampUp =          infinite
            micropump.MaximumFlowRampDown =        infinite

; Signals
            MicroPump_MasterPressure.Step =        0.20 [s]
            MicroPump_MasterPressure.Average =     Off
            ColumnPressure.Step =                  0.20 [s]
            ColumnPressure.Average =               Off


 0.000      MicroPump_MasterPressure.AcqOn
            ColumnPressure.AcqOn
            ColumnOven_FC_Stepper.AcqOn
            FlowSplitter_1.FSValveInit
            FlowSplitter_1.FSControlMode =         Off

0.400
            MicroPump.Flow =                       0.300 [µl/min]
            MicroPump.%B =                         0.0 [%]
            MicroPump.%C =                         0.0 [%]

0.600       MicroPump.Flow =                       0.100 [µl/min]

0.610       MicroPump.Flow =                       0.100 [µl/min]
            InitFlowControlSelfTest StepRate=100

7.600       MicroPump.Flow =                       0.100 [µl/min]

7.610       MicroPump.Flow =                       0.000 [µl/min]

8.000       MicroPump_MasterPressure.AcqOff
            ColumnPressure.AcqOff
            ColumnOven_FC_Stepper.AcqOff

            MicroPump.MaximumFlowRampUp =          0.300 [µl/min²]
            micropump.MaximumFlowRampDown =        0.300 [µl/min²]


            End
```