



thermoscientific

Vanquish

Column Compartments VC-C10, VH-C10

Operating Manual

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ThermoFisher
SCIENTIFIC

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Original Operating Manual

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1 Using this Manual

This chapter provides information about this manual, the conventions used throughout the manual, and the reference documentation that is available in addition to this manual.

1.1 About this Manual

This manual describes the functional features and operating principle of your Vanquish™ device and provides instructions for installation, set up, start up, shut down, operation, maintenance and troubleshooting.

The layout of this manual is designed to provide quick reference to the sections of interest to the user. To obtain a full understanding of your device, read this manual thoroughly.

This manual also contains safety messages, precautionary statements, and special notices that can prevent personal injury, damage to the device, or loss of data when followed properly.

Note the following:

- The device configuration may vary; therefore, not all descriptions necessarily apply to your particular device.
- If some detail applies to only one model or variant, the model or variant is identified by name.
- Illustrations in this manual are provided for basic understanding. They can vary from the actual model of the device or component. However, this does not influence the descriptions. No claims can be derived from the illustrations in this manual.

1.2 Conventions

This section describes the conventions that are used throughout this manual.

1.2.1 Safety Messages

The safety messages and precautionary statements in this manual appear as follows:

- Safety messages or precautionary statements that apply to the entire manual and all procedures in this manual are grouped in the Safety chapter.
- Safety messages or precautionary statements that apply to an entire section or to multiple procedures in a section appear at the beginning of the section to which they apply.
- Safety messages that apply to only a particular section or procedure appear in the section or procedure to which they apply. They appear different from the main flow of text.

Safety messages are often preceded by an alert symbol and/or alert word. The alert word appears in uppercase letters and in bold type.

Make sure that you understand and follow all safety messages presented in this manual.

1.2.2 Special Notices and Informational Notes

Special notices and informational notes in this manual appear different from the main flow of text. They appear in boxes and a note label identifies them. The label text appears in uppercase letters and in bold type.

NOTICE

Highlights information necessary to prevent damage to the device or invalid test results.

TIP Highlights information of general interest or helpful information that can make a task easier or optimize the performance of the device.

1.2.3 Typographical Conventions

These typographical conventions apply to the descriptions in this manual:

Data Input and Output

- The following appears in **bold** type:
 - ◆ Input that you enter by the keyboard or that you select with the mouse
 - ◆ Buttons that you click on the screen
 - ◆ Commands that you enter by the keyboard
 - ◆ Names of, for example, dialog boxes, properties, and parameters
- For brevity, long expressions and paths appear in the condensed form, for example: Click **Start > All Programs > Thermo Chromeleon 7 > Services Manager > Start Instrument Controller**.

References and Messages

- References to additional documentation appear *italicized*.
- Messages that appear on the screen are identified by quotation marks.

Viewpoint

If not otherwise stated, the expressions *left* and *right* in this manual always refer to the viewpoint of a person that is facing the device from the front.

Particularly Important Words

Particularly important words in the main flow of text appear *italicized*.

Electronic Manual Version (PDF)

The electronic version (PDF) of the manual contains numerous links that you can click to go to other locations within the manual. These include:

- Table of contents entries
- Index entries
- Cross-references (in blue text), for example, to sections and figures

1.3 Reference Documentation

In addition to this operating manual, other documentation is available for reference.

Hardware Documentation

Additional hardware documentation includes the following:

- *Operating manuals* for the other modules of the Vanquish system
A printed version of the manual is shipped with the device.
- *Vanquish System Operating Manual*
A printed version of the manual is shipped with the Vanquish system base and solvent rack.
- *Instrument Installation Qualification Operating Instructions*

TIP Electronic versions of these manuals are available as PDF (Portable Document Format) files. To open and read the PDF files, Adobe™ Reader™ or Adobe™ Acrobat™ is required.

Software Documentation

Additional software documentation includes the following:

- *Chromeleon™ Help and documents*
The *Chromeleon Help* provides extensive information and comprehensive reference material for all aspects of the software.

In addition, the following documentation is available (availability depends on the software version):

- *Installation Guide*
For basic information about device installation and configuration, refer to the *Installation Guide*.
- *Instrument Configuration Manager Help*
For specific information about a certain device, refer to the *Instrument Configuration Manager Help*. In Chromeleon 7, devices are called modules.
- *Quick Start Guide*
For information about the main elements of the user interface and step-by-step guidance through the most important workflows, refer to the *Quick Start Guide*.
- *Reference Card*
For a concise overview of the most important workflows, refer to the *Reference Card*.

TIP The *Chromeleon Help* and documents are included in the software shipment.

Third-Party Documentation

Refer also to the user documentation provided by the manufacturers of third-party components and materials, for example, Safety Data Sheets (SDSs).

2 Safety

This chapter provides general and specific safety information and informs about the intended use of the device.

2.1 Safety Symbols and Signal Words

2.1.1 Safety Symbols and Signal Words in This Manual

This manual contains safety messages to prevent injury of the persons using the device.

The safety symbols and signal words in this manual include the following:



Always be aware of the safety information. Do not proceed until you have fully understood the information and consider the consequences of what you are doing.



CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.



WARNING

Indicates a hazardous situation that, if not avoided, could result in serious injury.

2.1.2 Observing this Manual

Observe the following:




- Before installing or operating the device, read this manual carefully to be familiar with the device and this manual. The manual contains important information with regard to user safety as well as use and care of the device.
- Always keep the manual near the device for quick reference.
- Save this manual and pass it on to any subsequent user.



Read, understand, and comply with all safety messages and precautionary statements presented in this manual.

2.1.3 Safety Symbols on the Device

The table lists the safety symbols that appear on the device or on labels affixed to the device. Follow the safety notices in this manual to prevent the risk of operator injury or damage to the device.

Symbol	Description
	Indicates a potential hazard. Refer to this manual to avoid the risk of personal injury and/or to prevent damage to the device.
— ○	Power supply is on Power supply is off
	Indicates alternating current.
	Indicates that the surface becomes hot during operation. Do not touch these surfaces while they are heated up.

2.1.4 Rating Plate

The rating plate is present on the device near the electrical connections. The rating plate indicates the serial number, part number, module name, revision number (if any), line and fuse rating, and the manufacturer's address.

2.2 Intended Use

The device is intended to be part of the Vanquish system.

The intended use of the Vanquish system is to analyze mixtures of compounds in sample solutions.

The device is for use by qualified personnel and in laboratory environment only.

The device and Vanquish system are intended to be used as General Laboratory Equipment (GLE).

They are not intended for use in diagnostic procedures.

Laboratory Practice

Thermo Fisher Scientific recommends that the laboratory in which the Vanquish system is used follow best practices for LC analyses. This includes among others:

- Using appropriate standards
- Regularly running calibration
- Establishing shelf life limits and following them for all consumables used with the system
- Running the system according to the laboratory's verified and validated 'lab developed test' protocol

2.3 Safety Precautions

2.3.1 General Safety Information

All users must observe the general safety information presented in this section and all specific safety messages and precautionary statements elsewhere in this manual during all phases of installation, operation, troubleshooting, maintenance, shutdown, and transport of the device.



If the device is used in a manner not specified by Thermo Fisher Scientific, the protection provided by the device could be impaired. Observe the following:

- Operate the device only within its technical specifications.
- Use only the replacement parts and additional components, options, and peripherals specifically authorized and qualified for the device by Thermo Fisher Scientific.
- Perform only the procedures that are described in this operating manual and in supporting documents for the device. Follow all instructions step by step and use the tools recommended for the procedure.
- Open the enclosure of the device and other components only if specifically instructed to do so in this manual.
- Thermo Fisher Scientific cannot be held liable for any damage, material or otherwise, resulting from inappropriate or improper use of the device. If there is any question regarding appropriate usage, contact Thermo Fisher Scientific before proceeding.

Safety Standard

This device is a Safety Class I instrument (provided with terminal for protective grounding). The device has been manufactured and tested according to international safety standards.

2.3.2 Qualification of the Personnel

Observe the information below on the proper qualification of the personnel installing and/or operating the device.



Installation

Only skilled personnel are permitted to install the device and to establish the electrical connections according to the appropriate regulations.

- Thermo Fisher Scientific recommends always having service personnel certified by Thermo Fisher Scientific perform the installation (for brevity, referred to as Thermo Fisher Scientific service engineer).
- If a person other than a Thermo Fisher Scientific service engineer installs and sets up the module, the installer is responsible for ensuring the safety of the module and system.



General Operation

The device is designed to be operated only by trained and qualified personnel in a laboratory environment.

All users must know the hazards presented by the device and the substances they are using. All users should observe the related Safety Data Sheets (SDSs).

2.3.3 Personal Protective Equipment

Wear personal protective equipment and follow good laboratory practice to protect you from hazardous substances. The appropriate equipment depends on the hazard. For advice on the hazards and the equipment required for the substances you are using, refer to the material handling and safety data sheet provided by the vendor.



An eyewash facility and a sink should be available nearby. If any substance contacts your skin or eyes, wash the affected area and seek medical attention.

Protective Clothing

To protect you from chemical splashes, harmful liquids, or other contamination, put on appropriate protective clothing, such as a lab coat.

Protective Eyewear

To prevent liquids from striking your eyes, put on appropriate protective eyewear, such as safety glasses with side shields. If there is a risk of splashing liquids, put on goggles.

Gloves

To protect you from harmful liquids and avoid personal injury during maintenance or service, put on appropriate protective gloves.

2.3.4 Electrical Safety Precautions



WARNING—Electric Shock or Damage to the Device

High voltages are present inside the device that could cause an electric shock or damage to the device.

- Do not make any changes to the electrical or grounding connections.
- If you suspect any kind of electrical damage, disconnect the power cord and contact Thermo Fisher Scientific Technical Support for assistance.
- Do not open the housing or remove protective panels unless specifically instructed to do so in this manual.
- Do not place liquid reservoirs directly upon the device. Liquid might leak into the device and get into contact with electronic components causing a short circuit. Instead, place liquid reservoirs in the solvent rack that is available for the Vanquish system.

2.3.5 General Residual Hazards

Pay attention to the following general residual hazards when working with the device:



WARNING—Hazardous Substances

Solvents, mobile phases, samples, and reagents might contain toxic, carcinogenic, mutagenic, infectious, or otherwise harmful substances. The handling of these substances can pose health and safety risks.

- Be sure that you know the properties of all substances that you are using. Avoid exposure to harmful substances. If you have any doubt about a substance, handle the substance as if it is potentially harmful.
- Wear personal protective equipment as required by the hazard and follow good laboratory practice.
- Reduce the volume of substances to the minimum volume required for sample analysis.
- Do not operate the device in a potentially flammable environment.
- Avoid accumulation of harmful substances. Make sure that the installation site is well ventilated.
- Dispose of hazardous waste in an environmentally safe manner that is consistent with local regulations. Follow a regulated, approved waste disposal program.



WARNING—Biohazard

Biohazardous material, for example microorganisms, cell cultures, tissues, body fluids, and other biological agents can transmit infectious diseases. To avoid infections with these agents:

- Assume that all biological substances are at least potentially infectious.
- Wear personal protective equipment as required by the hazard and follow good laboratory practice.
- Dispose of biohazardous waste in an environmentally safe manner that is consistent with local regulations. Follow a regulated, approved waste disposal program.

**WARNING—Self-Ignition of Solvents**

Solvents with a self-ignition temperature below 150 °C might ignite when in contact with a hot surface (for example, due to leakage in the chromatography system).

Avoid the use of these solvents.

**WARNING—Hazardous Vapors**

Mobile phases and samples might contain volatile or flammable solvents. The handling of these substances can pose health and safety risks.

- Avoid accumulation of these substances. Make sure that the installation site is well ventilated.
- Avoid open flames and sparks.
- Do not operate the device in the presence of flammable gases or fumes.

**CAUTION—Escape of Hazardous Substances from PEEK Capillaries**

In the Vanquish system, capillaries made of PEEK may be used. Swelling or attack by acids can cause PEEK capillaries to start leaking or to burst. Certain chemicals, for example, trichloromethane (CHCl₃), dimethyl sulfoxide (DMSO), or tetrahydrofuran (THF) can cause PEEK to swell. Concentrated acids, such as sulfuric acid and nitric acid, or a mixture of hexane, ethyl acetate, and methanol, can attack PEEK.

- Swelling or attack is not a problem with brief flushing procedures.
- For more information, refer to the technical literature on the chemical resistance of PEEK.

**CAUTION—Allergic Reaction**

Some capillaries in the Vanquish system are made of MP35N™, a nickel/cobalt-based alloy. Individuals with sensitivity to nickel/cobalt may show an allergic reaction from skin contact.



CAUTION—Sparking due to Electrostatic Discharge

Liquid flowing through capillaries can generate static electricity. This effect is particularly present with insulating capillaries and non-conductive solvents (for example, pure acetonitrile). Discharge of electrostatic energy might lead to sparking, which could constitute a fire hazard.

Prevent the generation of static electricity near the chromatography system.

2.3.6 In Case of Emergency



WARNING—Safety Hazard

In case of emergency, disconnect the device from the power line.

2.4 Solvent and Additive Information

2.4.1 General Compatibility

To protect optimal functionality of the Vanquish system, observe these recommendations on the use of solvents and additives:

- The system must be used with reversed-phase (RP) compatible solvents and additives only.
- Use only solvents and additives that are compatible with all parts in the flow path.

TIP In a Vanquish Core system, normal-phase (NP) compatible solvents and additives may be used if the VC-pumps and the VC-autosamplers are modified with the components from the Normal-Phase (NP) kit. Refer to the *Operating Manuals* for the pumps and autosamplers.

NOTICE

If the system flow path includes a Vanquish charged aerosol detector, observe the specific solvent and additive information for this detector. Refer to the *Operating Manual* for the Vanquish charged aerosol detector.

2.4.2 Allowed pH Ranges

Allowed pH ranges (standard system configuration):

System (Standard Configuration)	Allowed pH ranges	Remarks
Vanquish Core	1-13	<ul style="list-style-type: none"> • <i>pH values of 2 or less</i>: The application time should be as short as possible. Flush the system thoroughly after these applications. • <i>pH values higher than 9.5 with optical detectors</i>: Avoid using mobile phases with a pH value higher than 9.5 together with optical detectors. This can impair the functionality and optical performance of the detector flow cell. • <i>pH values higher than 12</i>: May affect electrochemical detection. Before using highly alkaline solvents for flushing the system, disconnect the detector from the system. • <i>Mobile phases containing ammonium hydroxide</i>: In rare cases, a shortened lifetime of reversed-phase (UHMW-PE) piston seals has been observed with high pH, ammonium hydroxide containing mobile phases and prolonged exposure.
Vanquish Horizon Vanquish Flex	2-12	

2.4.3 Allowed Concentrations

Allowed concentrations (standard system configuration):

System (Standard Configuration)	Chloride	Buffer	Remarks
Vanquish Core	0.1 mol/L or less	1 mol/L or less	<ul style="list-style-type: none"> • <i>High chloride concentration</i>: The application time should be as short as possible. Flush the system thoroughly after these applications. • <i>Mobile phases containing ammonium hydroxide</i>: In rare cases, a shortened lifetime of reversed-phase (UHMW-PE) piston seals has been observed with high pH, ammonium hydroxide containing mobile phases and prolonged exposure.
Vanquish Horizon Vanquish Flex	1 mol/L or less	-	

2.4.4 Further Information

- For details about the materials that are used in the analytical flow path of the device, see the *Specifications* chapter in this manual. For information about the materials that are used in the flow path of the other modules in the Vanquish system, refer to the *Specifications* chapter in the *Operating Manual* for the modules.
- Follow any specific recommendations presented in other sections of this manual. Refer also to the *operating manuals* for all modules in the Vanquish system. They may provide additional guidelines and information.
- Observe the general guidelines and recommendations on the use of solvents and additives in the chromatography system. Refer to *Use of Solvents and Additives* in the *Vanquish System Operating Manual*.

2.5 Compliance Information

Thermo Fisher Scientific performs complete testing and evaluation of its products to ensure full compliance with applicable domestic and international regulations. When the device is delivered to you, it meets all pertinent electromagnetic compatibility (EMC) and safety standards as described in this manual.

Changes that you make to the device may void compliance with one or more of these EMC and safety standards. Changes to the device include replacing a part or adding components, options, or peripherals not specifically authorized and qualified for the product by Thermo Fisher Scientific. To ensure continued compliance with EMC and safety standards, replacement parts and additional components, options, and peripherals must be ordered from Thermo Fisher Scientific or one of its authorized representatives.

The device has been shipped from the manufacturing site in a safe condition.

See also

 [Compliance Information](#) (▶ page 142)

3 Device Overview

This chapter introduces you to the device and the main components.

3.1 Column Compartment Features

The device includes the following main features:

- Column thermostating in a temperature range from +5 °C to 85 °C (VC-C10) or +5 °C to 120 °C (VH-C10)
- Column cooling by a maximum of 18 °C from the ambient temperature, with the lower temperature limit being +5 °C
- Support of still air and forced air thermostating modes
- Column chamber providing room for two columns, with pre-heater and pre-column as required by the application
Maximum possible length of the entire assembly: 387 mm
- Column identification for Good Laboratory Practice (GLP) compliant documentation of the column type and major column properties
- As an option, the column compartment can also hold:
 - ◆ Column switching valves to quickly change between different columns
 - ◆ Passive pre-heater for thermostating of the eluent before it enters the column
 - ◆ Active pre-heater with proper temperature control for warming up the eluent to a settable temperature before it enters the column
- Post-column cooler (VH-C10 only)
To cool down the eluate before it flows into the detector

For specifications, see [Performance Specifications](#) (▶ [page 132](#)).

3.2 Operating Principle

The fundamental requirement for a column compartment for liquid chromatography applications is the ability to maintain the preset temperature as precisely as possible. However, for obtaining good measurement results, temperature stability is more important than the absolute precision of the setting. The advanced electronic circuitry of the column compartment enables the column compartment to maintain the temperature with a precision of ± 0.1 °C.

The thermo-optimized design of the column compartment reduces the time required to equilibrate the temperature between the column and the eluent.

Thermoelectric elements heat up or cool down the components in the column chamber. An active or a passive pre-heater can be installed to adapt the eluent to the column temperature, before the eluent enters the column. This avoids temperature gradients in the first part of the column and a loss of separation performance.

VH-C10 only:

In addition, a post-column cooler can be installed to cool down the eluate before it flows into the detector. Post-column cooling minimizes the detector noise and optimizes the detection results.

Thermostating Modes

The column compartment supports the following thermostating modes for column thermostating:

- Still air mode
 - ◆ In still air mode, the column warms up over the total length of the column.
 - ◆ The temperature in the interior of the column is the same as in the outer areas.
 - ◆ The eluent and sample travel through the interior of the column with the same speed as they travel through the outer areas (no flow concentration).

In still air mode there is less fronting and tailing of peaks.

- Forced air mode
 - ◆ In forced air mode, the column surface is held at the preset temperature over the total length of the column.
 - ◆ The temperature in the interior of the column is higher than in the outer areas.
 - ◆ The eluent and sample travel faster through the interior of the column than they travel through the outer areas (flow concentration).
- These factors lead to broader peaks and may impair the separation performance.

The pictures show the thermal distribution inside the column for the two modes:

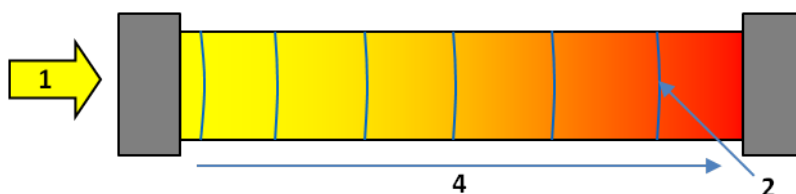


Figure 1: Thermal conditions inside the column in still air mode

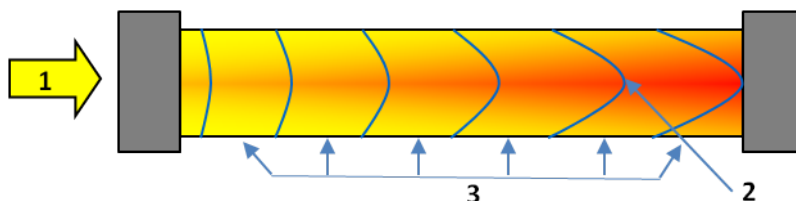


Figure 2: Thermal conditions inside the column in forced air mode

No.	Description
1	Direction of flow through the column
2	Flow profile
3	Same temperature on the column surface
4	Temperature increase on the column in the direction of flow

The eluent travelling through the column generates friction in the column, with the flow rate determining the amount of friction. Friction leads to self-heating of the column. This effect is particularly pronounced with the high flow rates in UHPLC applications because the higher the flow rate is the more friction is generated and the more the column heats up.

3.3 Interior Components

The user-accessible components of the column compartment are located behind the front door:

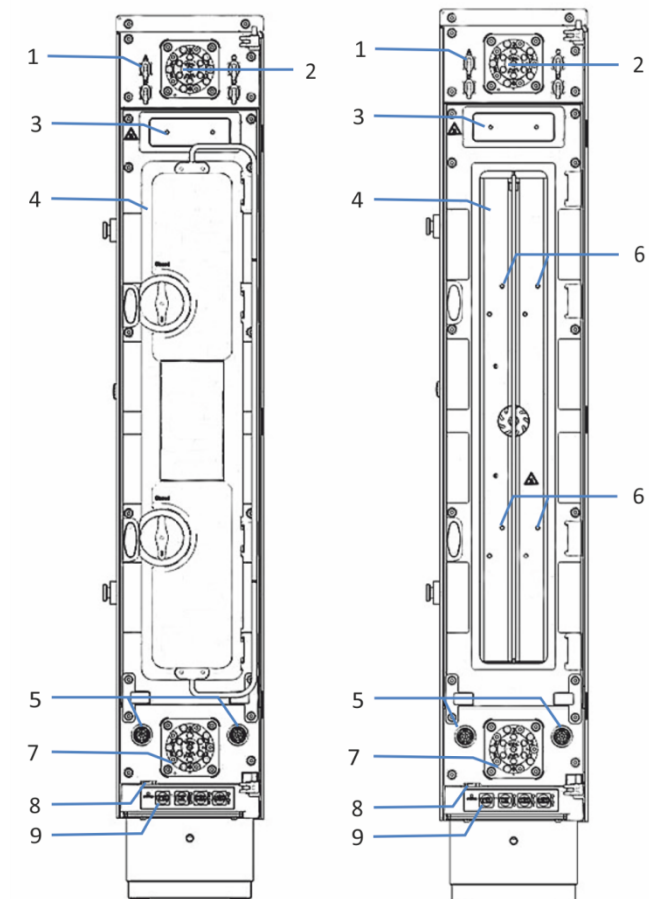


Figure 3: Interior view (left: with chamber cover; right: without chamber cover)

No.	Description
1	Connection ports for column ID tags
2	Upper column switching valve (if installed)
3	VH-C10 only: Post-column cooler (if installed)
4	Column chamber (with and without chamber cover)
5	Connection ports for active pre-heater
6	Passive pre-heater mounting positions
7	Lower column switching valve (if installed)
8	Leak tray with sensor for liquid leaks
9	Keypad with four buttons for device control

3.4 Leak Detection

Leaks are a potential safety issue.

The leak sensor inside the device monitors the device for liquid leaks from the flow connections. The liquid is collected in the leak tray and guided to the drain port. From the drain port, the liquid is discharged to waste through the drain system of the Vanquish system.

When the leak sensor detects leakage, the status indicators change to red and beeping starts to alert you. Follow the instructions in this manual to find and eliminate the source for the leakage.

3.5 Column Identification (Column ID)

The column identification (column ID) system allows you to store column-specific information on a column ID tag. While the column is installed in the column chamber and column identification is active, the column information is updated continuously and can be reviewed by the user from the chromatography software.

For a GLP-compliant overview of the column status, the following information is available:

- **Primary column properties**
Primary column properties allow reliable identification of the column. Primary column properties include, for example, the product ID, batch number, serial number, and date of manufacture.
- **Secondary column properties**
Secondary column properties provide additional information, for example, the manufacturer, packing material, particle size, minimum and maximum temperature allowed, or minimum and maximum pressure allowed.
- **Operational column properties**
Operational column properties provide information about the column lifecycle, including, for example, the total number of injections performed on the column, date of the first injection, and date of the most recent injection. The Chromeleon software determines and updates the operational information upon each injection. Operational column properties are read-only.

3.6 Operation

The device is designed to be operated from a computer configured with the Chromeleon Chromatography Data System (CDS). The Chromeleon software provides complete instrument control, data acquisition, and data management.

For a basic description of instrument control and automated sample analysis with the Chromeleon software, refer to the *Vanquish System Operating Manual*. Details on control and operation of the device are available in the *Chromeleon Help*.

TIP The device can be operated also with other data systems, such as Thermo Scientific™ Xcalibur™. In this case, installation of additional software is required in addition to the data system software. For details, contact the Thermo Fisher Scientific sales organization.

4 Unpacking

This chapter provides information for unpacking the device and informs you about the scope of delivery.

4.1 Unpacking the Device

Damaged Packaging, Defective on Arrival

Inspect the shipping container for signs of external damage and, after unpacking, inspect the device for any signs of mechanical damage that might have occurred during shipment.

If you suspect that the device may have been damaged during shipment, immediately notify the incoming carrier and Thermo Fisher Scientific about the damage. Shipping insurance will compensate for the damage only if reported immediately.

Unpacking

NOTICE

To lift or move the device, grasp the device by the sides. Do not move or lift the device by the front door. This will damage the door or the device.

TIP Save the shipping container and all packing material. These items will be needed if the device is shipped or moved to a new location.

Tools required

Screwdriver, Torx™ T20

Follow these steps

1. Place the shipping container on the floor and open it.
2. Remove the ship kit from the shipping container.
3. Grasp the device by the sides.
4. Slowly and carefully, lift the device out of the shipping container.
5. Place the device on a stable surface, on its left side panel, with the bottom side of the device facing toward you.
6. *If applicable*
Remove any additional packing material. Leave any protective films attached to the surfaces of the device until it is properly positioned in the system stack.
7. Locate the 2 feet and the 4 screws in the ship kit.
The foot with the drain port is the front foot of the device.

TIP The front foot can be fixed with the drain port facing toward the front side or rear side.

8. With the screwdriver (Torx T20), tighten the 2 screws, to mount the front foot.

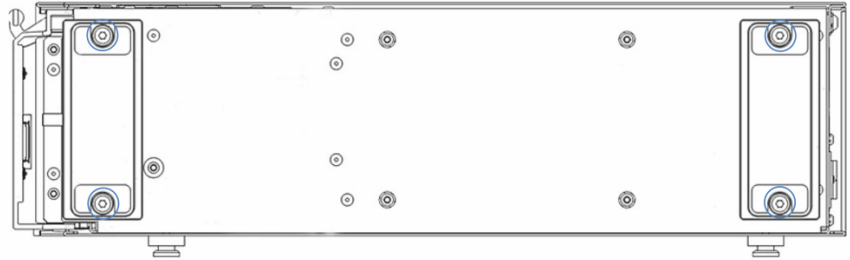


Figure 4: Mounting the feet

9. With the screwdriver (Torx T20), tighten the 2 screws, to mount the rear foot.
10. Grasp the upper and lower side of the device and lift it into vertical position.
11. Transport the device to the installation site, if it is not already there.
12. Some surfaces including the door of the device are covered by a protective film during shipment. Remove the protective foils from all surfaces as applicable.



CAUTION—Tip-Over

This column compartment can tip over.

To avoid personal injury or damage to the device, always attach the column compartment to the Vanquish system housing. For instructions, see [Attaching the Column Compartment to the System](#) (► page 47).

4.2 Scope of Delivery

The following items are included in the delivery:

- Column compartment
- Ship Kit
- Operating manual
- Power cord

For information on contents of the ship kit or reordering parts, see [Accessories, Consumables and Replacement Parts](#) (▶ page 135).

5 Installation

This chapter specifies the requirements for the installation site and describes how to set up, install, and configure the device in the Vanquish system and in the chromatography software.

5.1 Safety Guidelines for Installation

Pay attention to the following safety guidelines:



Observe all warning messages and precautionary statements presented in [Safety Precautions](#) (▶ page 19).



CAUTION—Tip-Over

This column compartment can tip over.

To avoid personal injury or damage to the device, always attach the column compartment to the Vanquish system housing. For instructions, see [Attaching the Column Compartment to the System](#) (▶ page 47).



CAUTION—Electric Shock or Damage to the Device

After the power to the device is turned off, the device is still energized as long as the power cord is connected. Repair work on the device while the device is connected to power could lead to personal injury.

- Always unplug the power cord before starting repair work inside the device.
- If you were instructed to remove any housing covers or panels, do not connect the power cord to the device while the cover or panels are removed.

NOTICE

To lift or move the device, grasp the device by the sides. Do not move or lift the device by the front door. This will damage the door or the device.

5.2 Installing the Device

The Vanquish system is installed and set up by a Thermo Fisher Scientific service engineer, including all modules and options or parts shipped with them. The service engineer checks that the installation is correct and that the Vanquish system and modules operate as specified. The engineer also demonstrates the basic operation and main features.

If personnel other than a Thermo Fisher Scientific service engineer installs the device, follow the steps below.

NOTICE

The device is part of the Vanquish system. Therefore, follow the order for installing the system modules as described in the *Vanquish System Operating Manual*.

1. Pay attention to the safety guidelines and observe all site requirements. See [Safety Guidelines for Installation](#) (▶ page 42) and [Site Requirements](#) (▶ page 45).
2. Set up the device hardware. See [Setting Up the Hardware](#) (▶ page 53).
3. Set up the flow connections. See [Setting Up the Flow Connections](#) (▶ page 66).
4. Turn on the device. See [Turning On the Device](#) (▶ page 77).

TIP

Before turning on the power to a Vanquish system module for the first time, verify that the chromatography software is installed on the data system computer. When the power is turned on, the required USB drivers are automatically found and the Windows™ operating system can detect the device.

5. Set up the device in the software. See [Setting Up the Device in the Software](#) (▶ page 78).

6. *Recommended:*
Perform Instrument Installation Qualification.

In the Chromeleon software, a wizard is available to guide you through the qualification process. On the **Chromeleon 7 Console**: Click **Tools > Instrument Qualification > Installation Qualification**.

Follow the instructions in the *Instruments Installation Qualification Operating Instructions*. The manual provides information about the required materials and detailed instructions.

NOTICE

If the device is operated with another data system, refer to the documentation for the software that you are using and/or perform the qualification manually. The *Instruments Installation Qualification Operating Instructions* provide information about the parameters to be adapted and the required settings.

7. *Recommended:* Perform Operational Qualification.
The qualification kit includes all materials required for the qualification and detailed instructions.

Moving the Device after Installation

If you have to move the device after it has been set up and installed in the Vanquish system, prepare the device for transport and move it to the new location. Follow the instructions in [Transporting or Shipping the Device](#) (▶ page 119).

5.3 Site Requirements

The operating environment is important to ensure optimal performance of the device. This section provides important requirements for the installation site. Note the following:

- Operate the device only under appropriate laboratory conditions.
- The device is intended to be part of the Vanquish system. Observe the site requirements for the Vanquish system as stated in the *Vanquish System Operating Manual*.
- For specifications, see [Specifications](#) (▶ page 131) and the *Specifications* sections in the *Operating Manuals* for the other modules in the Vanquish system.
- For general residual hazards, see [General Residual Hazards](#) (▶ page 22).

5.3.1 Power Considerations

The power supply of the device has wide-ranging capability, accepting any line voltage in the range specified for the device.



CAUTION—Electric Shock or Damage to the Device

Connecting the device to a line voltage higher or lower than specified could result in personal injury or damage to the device.

Connect the device to the specified line voltage only.

5.3.2 Power Cord

The power cords are designed to match the wall socket requirements of the country in which they are used. The end of the power cords that plugs into the power socket on the device is identical for all power cords. The end of the power cords that plugs into the wall socket is different.

**WARNING—Electric Shock or Damage to the Device**

- Never use a power cord other than the power cords provided by Thermo Fisher Scientific for the device.
- Only use a power cord that is designed for the country in which you use the device.
- Do not use extension cords.
- Never plug the power cord to a power socket that is shared with other equipment (for example, multiple sockets).
- Operate the device only from a power outlet that has a protective ground connection.
- In case of emergency, it must be possible to reach the power cord easily at any time to disconnect the device from the power line.

**WARNING—Electric Shock or Damage to a Product**

Misuse of the power cords could cause personal injury or damage the instrument. Use the power cords provided by Thermo Fisher Scientific only for the purpose for which they are intended. Do not use them for any other purpose, for example, for connecting other instruments.

5.3.3 Condensation

NOTICE—Condensation in the device can damage the electronics.

- When using, shipping, or storing the device, avoid or minimize conditions that can lead to a build-up of condensation in the device. For example, avoid significant or fast changes in environmental conditions.
- If you suspect that condensation is present, allow the device to warm up to room temperature. This may take several hours. Wait until the condensation is gone completely before connecting the device to the power line.

5.4 Attaching the Column Compartment to the System

TIP Before you attach the column compartment to the system, connect the waste line to the system drain port. For instructions, refer to the *Vanquish System Operating Manual*.

Parts required

- 4 T-slot nuts
- 2 crosspieces
- 4 screws
- 4 spacers

Tools required

Screwdriver, Torx T20

Follow these steps

1. Align the screw holes of the two T-slot nuts, the spacers and the crosspiece.

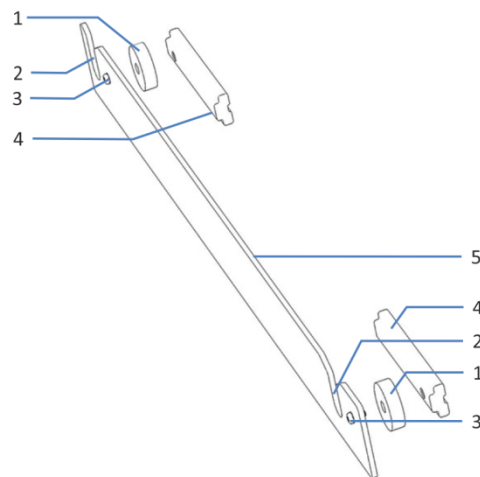


Figure 5: Mounting bar

No.	Description
1	Spacer
2	Groove
3	Screw
4	T-slot nut
5	Crosspiece

2. With the screws, fix the T-slot nuts and the spacers onto the crosspiece.
The T-slot nuts must face each other, as shown above.
3. Slide the T-slot nuts of the mounting bar in the rail on the system housing and push until stop.
The grooves on the mounting bars must face upwards. Make sure, that the orientation of the crosspiece is as indicated on the picture.
4. Tighten the screws on the mounting bars.

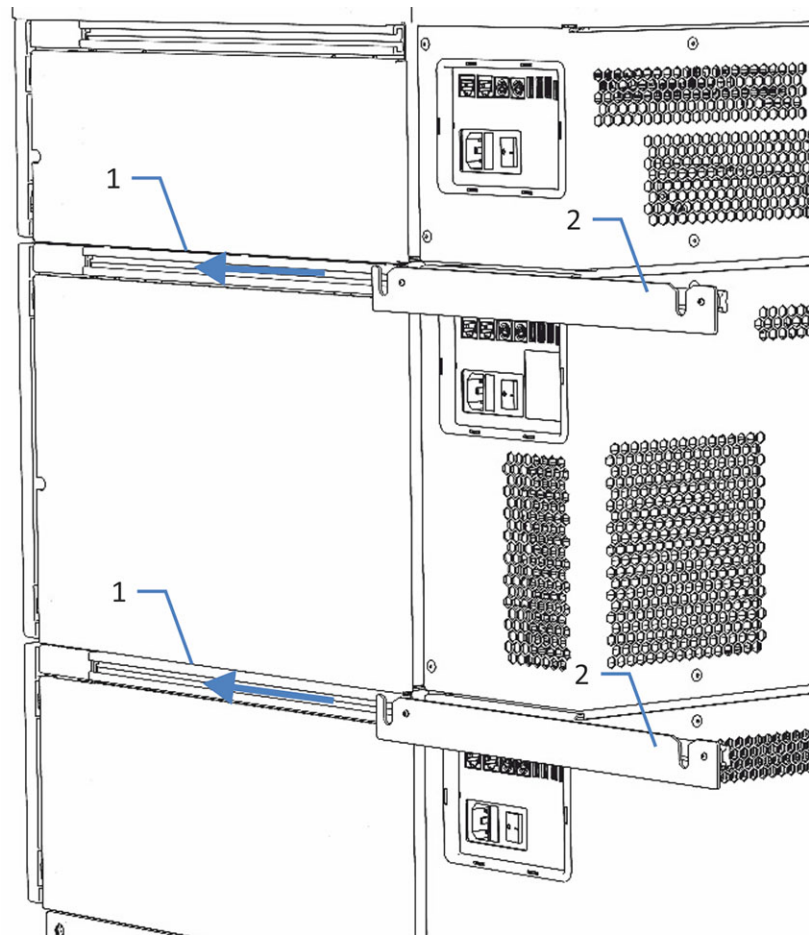


Figure 6: Installing the mounting bars on the system housing

No.	Description
1	Rail
2	Mounting bar

5. Lift the column compartment into vertical position.
6. To insert the holding knobs in the grooves on the mounting bar, grasp the column compartment by its sides and slightly lift the column compartment up.

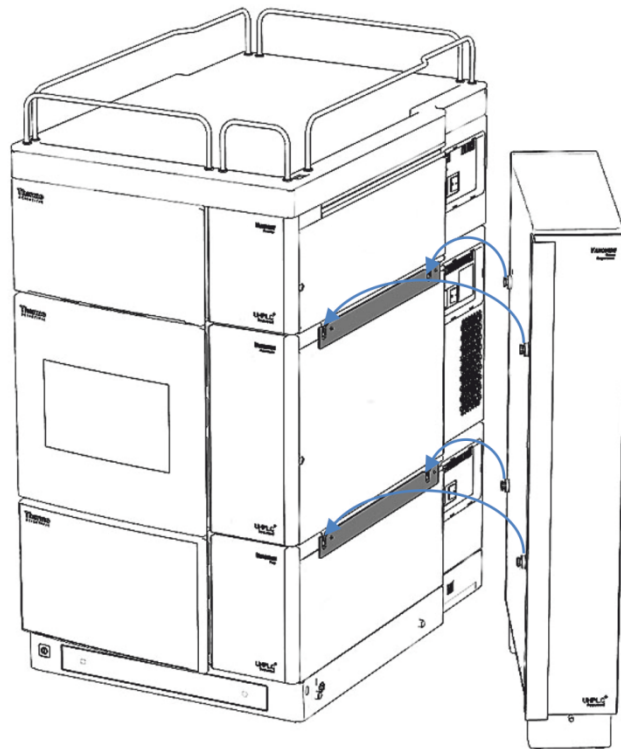


Figure 7: Attaching the column compartment to the system stack

5.5 Accessing the Interior Components

To access the interior components in the column compartment, open the column compartment door and the column chamber cover.

Opening and Closing the Column Compartment Door

1. To open the door, slightly pull on the door.
2. To close the door, push against the door.

Opening the Column Chamber



CAUTION—Hot Surfaces

Surfaces inside the device may become hot during operation. Touching hot parts might cause burns.

- Do not touch the inner side of the column chamber cover. When opening the column chamber cover, only grasp it by its holder.
- Allow hot surfaces to cool down before starting replacement or maintenance procedures.

1. Open the column compartment door.
2. Turn both rotating locks 180 °counterclockwise until they lock in vertical position.
A click confirms that the rotating locks are in the correct position to open the column chamber.

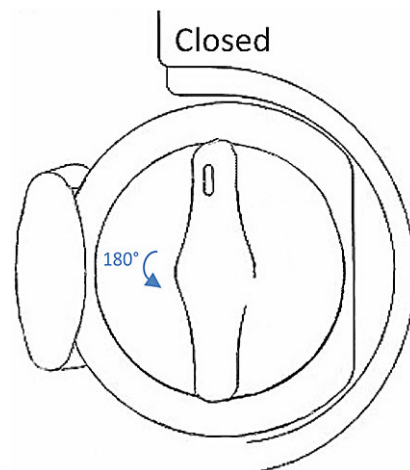


Figure 8: Unlocking the column chamber cover

3. Grasp the column chamber cover by its holder.

4. Slightly pull the column chamber cover towards you and push it to the right with the inner side of the cover pointing towards the inner side of the door.

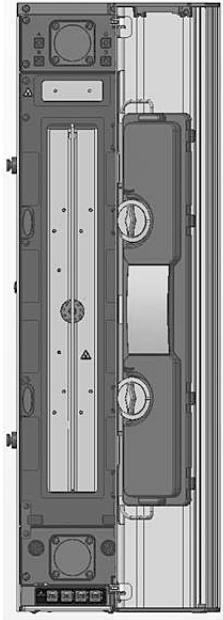


Figure 9: Opening the column chamber cover

Closing the Column Chamber

1. Grasp the column chamber cover by its holder.
2. Slightly pull the column chamber cover towards you and push it to the left with the inner side of the cover pointing towards the column chamber.

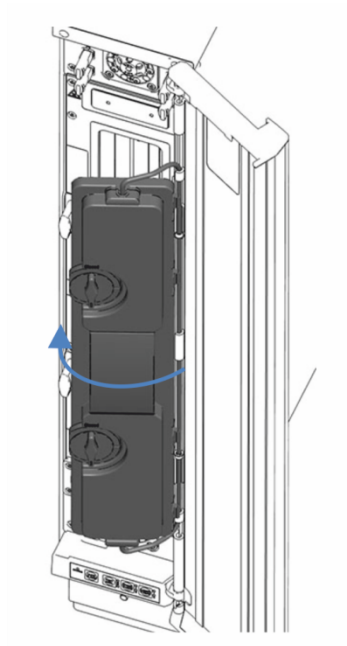


Figure 10: Closing the column chamber cover

3. Before closing the column chamber, properly position the 4 hinges of the column chamber cover to hinge the column chamber cover.

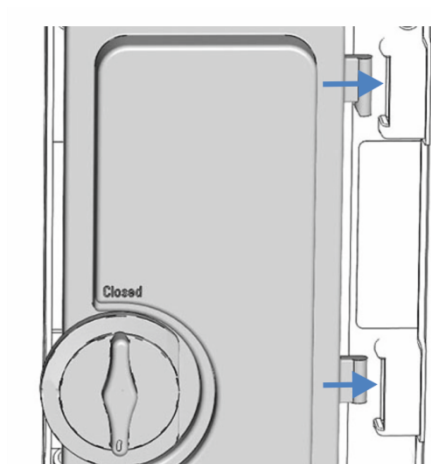


Figure 11: Column chamber cover hinges

4. Turn both rotating locks 180° clockwise until they reach vertical position and lock in.
Observe the labeling above the rotating locks and make sure that both rotating locks are set to Closed.

TIP Always operate the column compartment with the column chamber cover and the column compartment door closed, otherwise you cannot start the analysis.

5.6 Setting Up the Hardware

This section describes how to set up the hardware and provides information about the device connectors and cables.

5.6.1 System Arrangement

The device is part of the Vanquish system. The system modules are typically arranged in a system stack, with the arrangement depending on the system configuration.

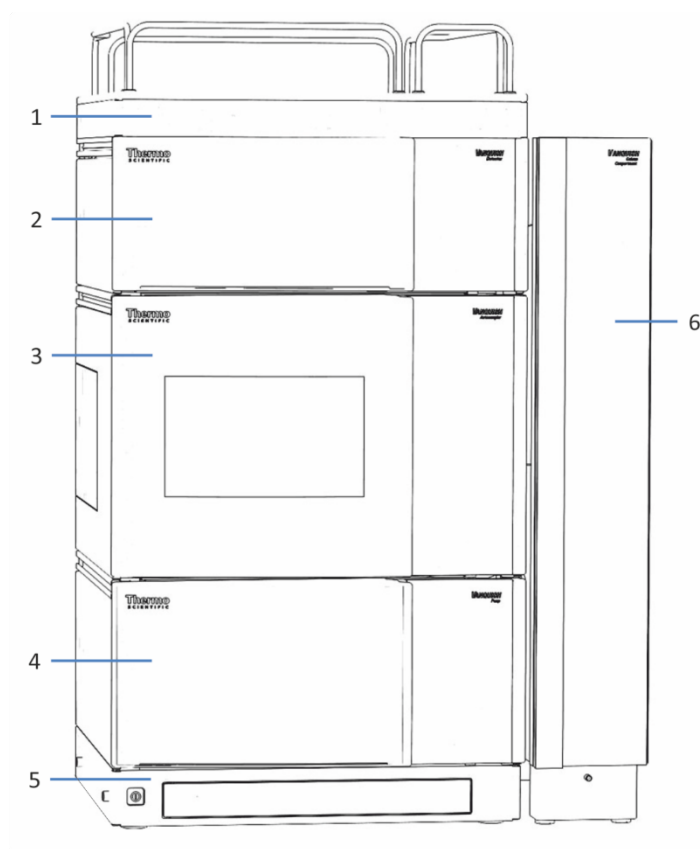


Figure 12: Vanquish system, standard configuration (example)

No.	Description
1	Solvent Rack
2	Detector
3	Autosampler
4	Pump
5	System Base
6	Column Compartment

In the standard configuration, the Vanquish system includes one column compartment, installed to the right side of the system.

For instructions on how to set up the system stack, refer to the *Vanquish System Operating Manual*.

TIP An extended or left-side configuration of the column compartment is also available. Observe the following notes:

- The extended configuration on the right side can include up to three column compartments. For the extended configuration of the column compartment, up to two conversion kits are required.
- The column compartment can also be installed to the left side of the Vanquish system stack. For the left-side installation, one column compartment requires one conversion kit. Each additional column compartment on the left side requires an additional conversion kit. If a Vanquish Charger is used with the Vanquish system, the column compartment must be attached to the right side of the system.
- For ordering information, contact your local Thermo Fisher Scientific sales organization.



Installation by Service Engineer only

Only service personnel certified by Thermo Fisher Scientific are permitted to install the extended configuration with up to three column compartments or to perform the left-side installation of the column compartment.

5.6.2 Connecting the Device

Device Connectors

The following connectors are provided on the device:

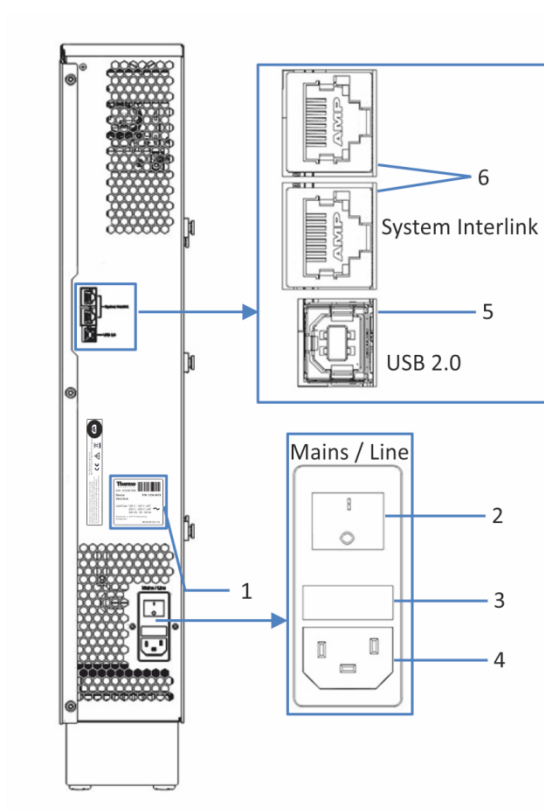


Figure 13: Connectors

No.	Description
1	Rating plate, indicating the serial number, part number, module name, revision number (if any), line and fuse rating, and the manufacturer's address
2	Main power switch (on/off control)
3	Fuse holder
4	Power-inlet connector
5	USB (Universal Serial Bus) port ("B" type connector) Allows connection to other modules in the Vanquish system or the computer on which the data management system is installed, such as the Chromeleon software
6	System Interlink port Allows power on/off control for the device from the Vanquish system base and device communication

TIP Thermo Fisher Scientific recommends using the USB ports only as described above. If the USB ports are used for any other purpose, Thermo Fisher Scientific cannot ensure proper functionality.

Follow these steps

NOTICE

- Never use defective communication cables. If you suspect that a cable is defective, replace the cable.
- To ensure trouble-free operation, use only the cables provided by Thermo Fisher Scientific for connecting the device.

1. Place the device in the system as required by the system configuration. For details, refer to the *Vanquish System Operating Manual*.
2. Connect the required interface cables to the device. For information about how to connect the device to other modules in the Vanquish system or to the chromatography data system computer, refer to the *Vanquish System Operating Manual*.
3. Connect the power cord (see [Connecting the Power Cord](#) (▶ page 56)).

5.6.3 Connecting the Power Cord

NOTICE

Condensation in a device can damage the electronics.

- Before connecting the devices to the power line, be sure that no condensation is present in the devices.
- If you suspect that condensation is present, allow the device to warm up to room temperature slowly. Wait until the condensation is completely gone before proceeding.

1. Verify that the power switch on the device is set to OFF.
2. Connect the power cord to the power inlet connector on the device.
3. Connect the free end of the power cord to an appropriate power source.

5.6.4 Guiding Liquids to Waste

Parts required

- Drain tubing
- L-piece
- Waste container as required
- Tubing cutter (optional)

Follow these steps

1. Connect the drain tubing to the L-piece.
2. Connect the L-piece to the drain port.
The drain port is located on the bottom front of the device, below the front door.

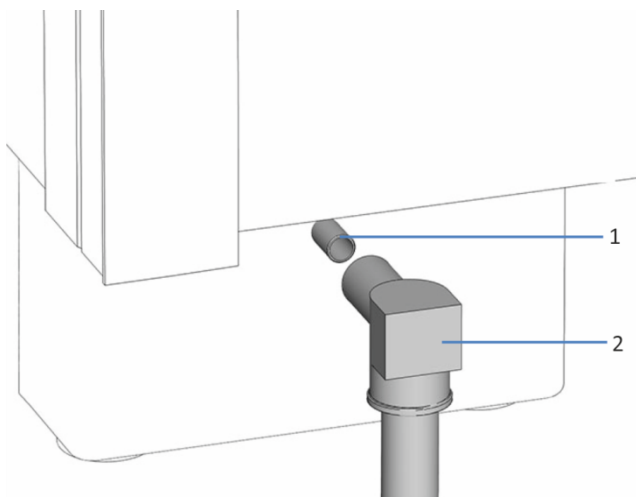


Figure 14: Connecting drain tubing

No.	Description
1	Drain port
2	L-piece

3. Place the free end of the drain tubing into an appropriate waste container.
If you should ever have to cut tubing to length, use a tubing cutter. Make sure that the cut is at a right angle to the length of the tubing and that the end is free of nicks or burrs.

NOTICE

To maintain a positive siphon, position the waste container below the level of the column compartment. Otherwise, liquid may flow back into the interior and cause damage to the device.

For information about how the liquid is discharged to waste through the Vanquish drain system, refer to the *Vanquish System Operating Manual*.

5.6.5 Installing the Post-Column Cooler (VH-C10 only)

To reduce the temperature of the liquid leaving the column, install a post-column cooler. Post-column cooling minimizes the detector noise and optimizes the detection results.

NOTICE

With Vanquish systems including a detector with LightPipe™ flow cell, always use post-column cooling to reduce the temperature of the liquid leaving the column to values below 50 °C. Higher temperatures will damage the flow cell.

Parts required

- Post-column cooler
- 2 thumb screws

Follow these steps

1. Open the column compartment door.
2. Attach the post-column cooler to the mounting plate above the column chamber.
The post-column cooler can be installed either side, depending on the location of the detector:
 - ◆ If the detector is located left of the column compartment, the capillary fixed on the side of the post-column cooler should point to the left.
 - ◆ If the detector is located right of the column compartment, the capillary of the post-column cooler should point to the right.
 - ◆ You can turn the post-column cooler upside down: If the hot column eluate comes from the upper column switching valve, the capillary should point upwards. If the hot eluate comes from the column, the capillary should point downwards.

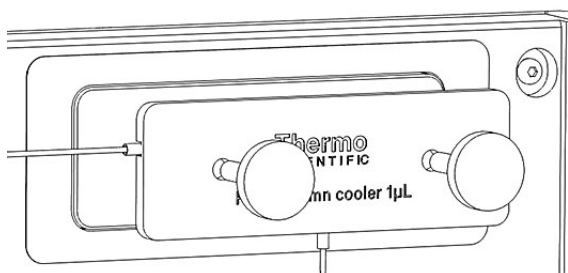


Figure 15: Mounting a post-column cooler

3. To fix the post-column cooler to the mounting plate, tighten the 2 thumb screws.
4. Configure the post-column cooler in Chromeleon:
In the Instrument Configuration Manager dialog box for the column compartment, enable the post-column cooler.

TIP When removing the post-column cooler, disable the post-column cooler in the Instrument Configuration Manager dialog box for the column compartment.

5.6.6 Installing the Passive Pre-heater

Parts required

- Passive pre-heater
- 2 screws
- 2 washers

Tools required

Screwdriver, Torx T10

Follow these steps

1. Place the passive pre-heater in the desired position.
Inside the column chamber, four different positions are available.

TIP The passive pre-heater can be mounted in any of the four positions that are shown below. It can be orientated as required, with the outlet capillary pointing downwards or upwards, depending on the column inlet position.

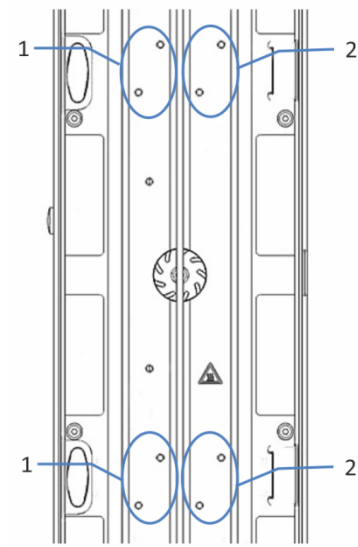


Figure 16: Mounting positions for passive pre-heater

No.	Description
1	Passive pre-heater positions in left column slot
2	Passive pre-heater positions in right column slot

- Align the screw holes of the passive pre-heater with the screw holes on the pre-heater mounting position.
- With the screwdriver (Torx T10), tighten the two screws and washers to mount the passive pre-heater inside the column chamber.

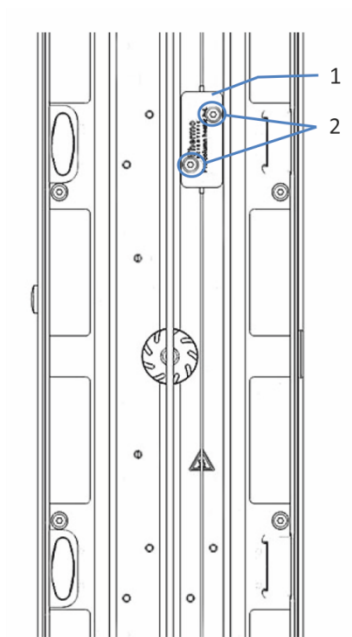


Figure 17: Mounting the passive pre-heater

No.	Description
1	Passive pre-heater (installed)
2	Passive pre-heater washers and screws

4. Connect the outlet capillary of the passive pre-heater to the column inlet.
5. Connect the inlet capillary of the passive pre-heater to the autosampler or a column switching valve.

TIP The passive pre-heater is not controlled by the Chromeleon software. Therefore, it is not required to set up the passive pre-heater in Chromeleon. The passive pre-heater can be used to adapt the eluent to the column temperature, before the eluent enters the column.

5.6.7 Installing the Column Switching Valve

For quickly changing between columns, the column compartment can hold one or two column switching valves. The valves can be installed at the positions shown in [Interior Components](#) (▶ page 33).

Parts required

Column switching valve

Tools required

Screwdriver, Torx T10

Preparations

1. Turn off the power to the device.
2. Disconnect the device from the power line.
3. Loosen the dummy plugs that cover the valve ports.

Follow these steps

1. Open the column compartment door.
2. Remove the switching valve cover:
 - a) With the screwdriver (Torx T10), loosen the 4 screws on the switching valve cover.

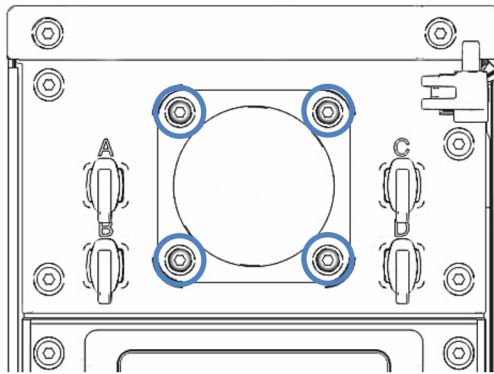


Figure 18: Switching valve cover screws

- b) Remove the switching valve cover and gasket.

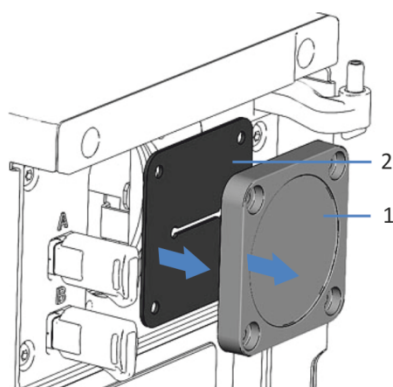


Figure 19: Removing the switching valve cover and gasket

No.	Description
1	Cover
2	Gasket

- c) Carefully detach the cable for the column switching valve from the rear of the switching valve gasket.
3. Check the orientation of the cable. The alignment pin in the middle of the connector on the cable should point downward.
4. Connect the cable to the valve drive that is located on the rear of the column switching valve.
5. Push the cable into the housing.
6. Push the column switching valve into the housing.

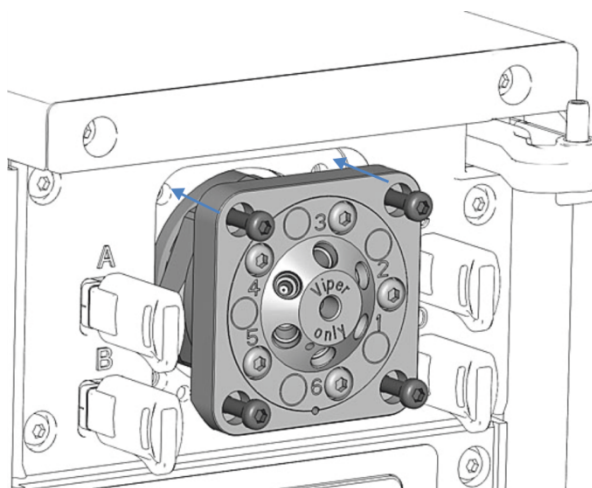


Figure 20: Installing a column switching valve

7. Tighten the 4 screws of the column switching valve.

8. Configure the column switching valve in Chromeleon:
 - a) In the Instrument Configuration Manager dialog box, select the position (**Upper Valve, Lower Valve**).
 - b) Select the valve model.

5.6.8 Installing Column Identification (Column ID)

Column identification (column ID) is used to create a column lifecycle (column history). The column compartment supports column identification for four columns simultaneously.

Parts required

- Column ID tag
- Rivet

Follow these steps

1. Open the column compartment door.
2. Attach the ribbon to the column:
 - a) Wrap the ribbon around the column.
 - b) Pass the shank of the rivet through a hole, and press down to unite the two parts.

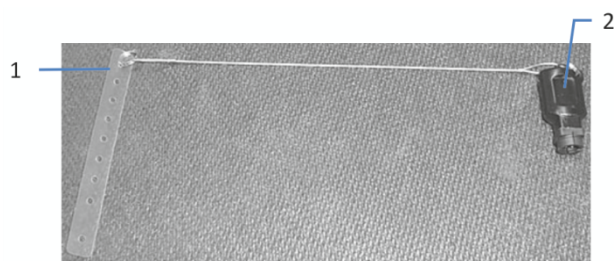


Figure 21: Column ID tag with ribbon

No.	Description
1	Ribbon
2	Column ID tag

3. Connect the column ID tag to the related column ID port. Four column ID ports are available and located next to the upper column switching valve.

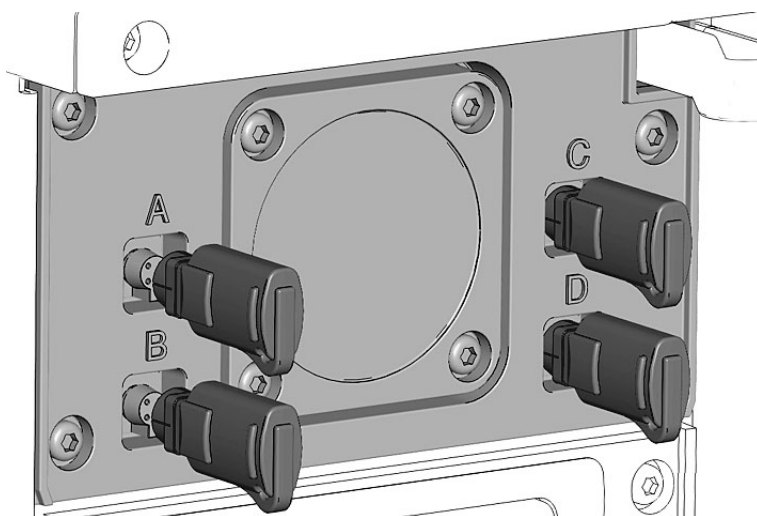


Figure 22: Connecting the Column ID tag to the Column ID port

Enable column identification in Chromeleon

To enable column identification in the Instrument Configuration Manager:

1. During initial set up of the column compartment, on the **General** page for the column compartment, select the **Use Column ID system** check box.
2. On the **Columns** page, activate the respective column ID tags.

5.7 Setting Up the Flow Connections

This section describes how to set up the flow connections to and from the device and additional flow connections, if required.

5.7.1 General Information and Guidelines

When setting up flow connections, follow these rules and recommendations:



Flow connections can be filled with hazardous substances. Observe the warning messages and precautionary statements presented in [Safety Precautions](#) (▶ page 19).

- Dirty components can contaminate the chromatography system. Contamination leads to poor performance of the modules and entire system or can even cause damage to the modules and system. Therefore:
 - ◆ Always wear appropriate gloves.
 - ◆ Place the components only on a clean, lint-free surface.
 - ◆ Keep your tools clean.
 - ◆ Use only lint-free cloth for cleaning.
- For installation instructions and guidelines and for handling recommendations, see [Connecting Fittings, Capillaries, and Tubing](#) (▶ page 67).

NOTICE

When you install devices or components to the system, always flush them to waste before connecting them in the system flow path. To flush the Vanquish modules, follow the instructions in the *Vanquish System Operating Manual*.

Follow these steps

To set up the flow connections and complete the installation of the column compartment, follow these steps:

1. Connect and place the columns and pre-heater (see [Connecting and Placing the Active Pre-heater](#) (▶ page 71)).
2. Connect the components to the column switching valve (see [Connecting the Components to a Column Switching Valve](#) (▶ page 74)).

5.7.2 Connecting Fittings, Capillaries, and Tubing

This section provides information about how to connect and handle capillaries, fittings, and tubing.

5.7.2.1 General Guidelines

When connecting capillaries and tubing, follow these general recommendations:

- Use only the capillaries and tubing (for example, solvent lines or waste tubing) that are shipped with the product or additional or spare capillaries and tubing as recommended by Thermo Fisher Scientific.
- The connectors must be free from contaminants. Even minute particles may cause damage to the system or lead to invalid test results.
- Do not install capillaries or tubes that are stressed, nicked, kinked, or otherwise damaged.
- Install capillaries and fittings only at the positions for which they are intended.

5.7.2.2 Connecting Viper Capillaries

This section describes how to connect Viper™ capillaries. All Viper flow connections in the Vanquish system are designed to be finger-tight.

To connect Viper capillaries with knurls, follow these steps:

NOTICE

- Tighten or loosen Viper capillaries *only* with your fingers. Do not use tools other than the knurl that comes with the capillary.
- To avoid damage to the capillary or connection, tighten and loosen the Viper capillaries *only* when the system pressure is down to zero.

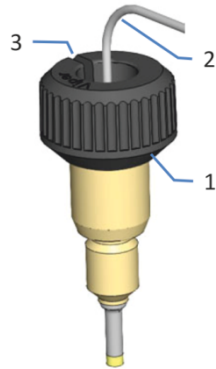


Figure 23: Viper fitting with knurl

No.	Description
1	Knurl
2	Capillary
3	Slot

1. Insert the Viper capillary into the connection port.
2. Tighten the connection by the knurl.

TIP Note the slot in the knurl. For narrow connections, you can easily remove the knurls from neighboring capillaries through this slot and attach them again later.

3. Check whether the connection leaks. If leakage exists, follow the steps further down.

Resolving Leakage of Viper Fittings with Knurls

1. Tighten the connection a little more.
2. If leakage continues, remove the capillary.
3. Clean the capillary ends carefully by using a lint-free tissue wetted with isopropanol.
4. Reinstall the capillary.
5. If the connection continues to leak, install a new Viper capillary.

5.7.3 Connecting and Placing the Column

Inside the column chamber, a central wall separates the left column position from the right one. Use a column holder to fix the columns on the central wall inside the column chamber.

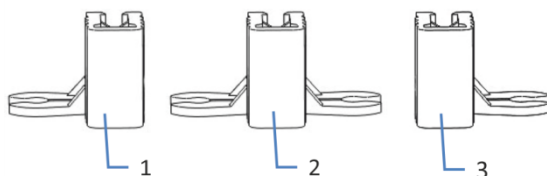


Figure 24: Column holders

No.	Description
1	Column holder for left-side positioning of the column
2	Column holder for placing two columns at the same height
3	Column holder for right-side positioning of the column

Follow these steps

1. Connect the capillaries to the column inlet and column outlet.

NOTICE

To avoid any leakage, check that all fittings are properly connected to the column inlet and outlet, when installing or exchanging capillaries.

2. Attach the column holder to the column fitting.

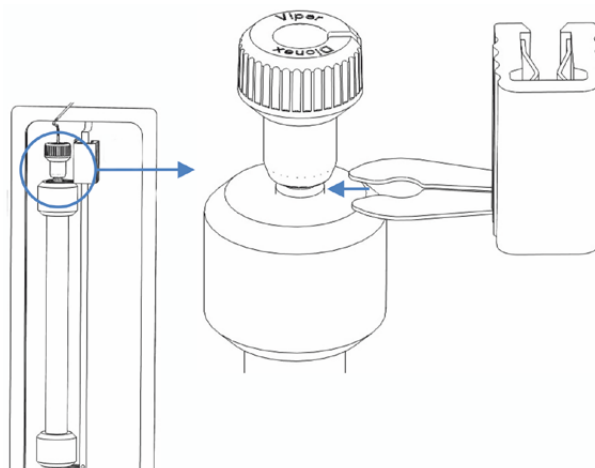


Figure 25: Attaching column holder to column fitting

3. Fix the column holder on the central wall inside the column chamber.
The column holder can be fixed at any position on the central wall.

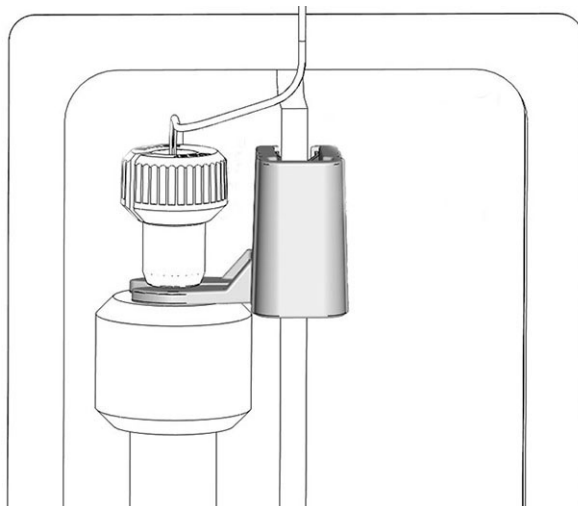


Figure 26: Positioning the column inside the column chamber

NOTICE

To avoid any damage to the central wall, do not slide the holders along the wall. If you need to change their position, pull off the holder and fix it again at the desired position.

4. Route the capillaries through the capillary guide. The capillary guide is located above the column chamber.

5.7.4 Connecting and Placing the Active Pre-heater

This section describes how to connect and place the active pre-heater in the column compartment.

Parts required

- Column holder
- Active pre-heater
- Viper inline filter (optional)

Preparations

NOTICE

The active pre-heater is filled with isopropanol when the column compartment is shipped from the manufacturing site. If of insufficient quality, isopropanol may damage the column.

- Flush the components filled with isopropanol to waste, using solvents that are miscible with isopropanol. If they are not, use an appropriate solvent of similar polarity.
- Install a Viper union in the flow path that replaces the column for the flushing procedure.

Follow these steps

TIP Use a Viper inline filter between the active pre-heater and the column to prevent un-dissolved particles from getting into the column.

1. Connect the Viper inline filter to the column.
2. Connect the active pre-heater to the Viper inline filter.
3. Attach the column holder to the active pre-heater fitting.
4. Fix the column holder on the central wall inside the column chamber.

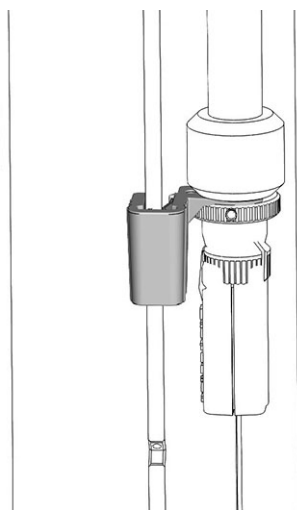


Figure 27: Positioning pre-heater and column inside the column chamber

5. Before you connect the pre-heater cable to the pre-heater connection port for the first time, check that the pre-heater is enabled in the Instrument Configuration Manager dialog box for the column compartment.
Once the pre-heater is enabled in the Chromeleon software, the software detects automatically when the pre-heater is connected.

6. Connect the pre-heater cable to the pre-heater connection port. The pre-heater connection ports are located next to the lower column switching valve.

TIP Use the left connection port for a pre-heater installed in the left column slot, and the right connection port for a pre-heater installed in the right column slot.

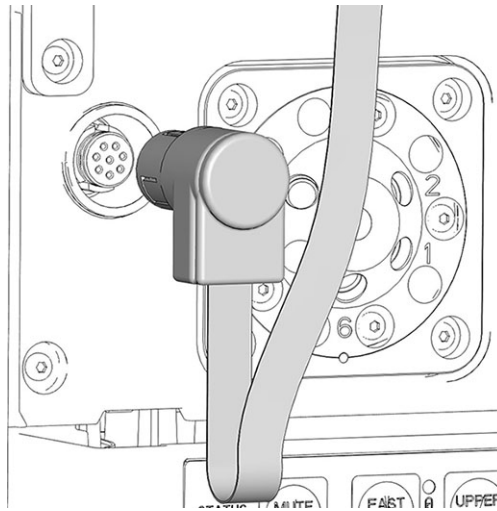


Figure 28: Pre-heater connection port

7. Route the pre-heater cable through the pre-heater cable guide. Each pre-heater cable and cable guide is located above the pre-heater port. If the pre-heater cable is too long, loop the cable in the guide.

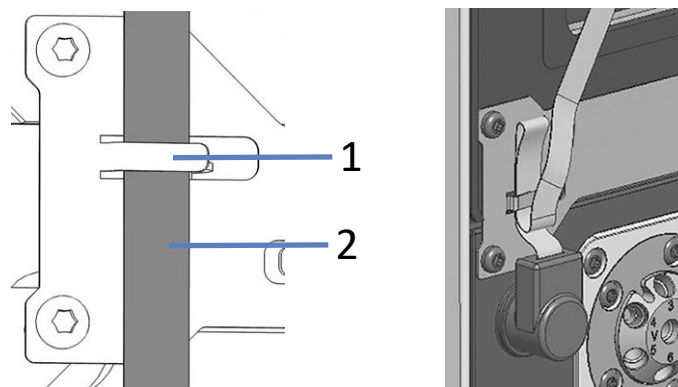


Figure 29: Pre-heater cable and cable guide; on the right: cable looped in guide

No.	Description
1	Pre-heater cable
2	Cable guide

5.7.5 Connecting the Components to a Column Switching Valve

Several column switching valve types are available for the column compartment. For ordering information, see [Optional Accessories](#) (► [page 138](#)). The column switching valves are shipped with detailed information about possible fluidic setups.

The installation of a column switching valve is described in [Installing the Column Switching Valve](#) (► [page 62](#)).

This section provides an example for the fluidic setup of a 2-position, 6-port column switching valve in the Vanquish column compartment.

Parts required

- Column switching valve
- Viper capillaries, as required by the application
- Post-column cooler (optional)
- Active pre-heater (optional) or passive pre-heater (optional)
- Viper plugs

NOTICE

Liquid may spill from open valve ports. The leak sensor of the column compartment detects any liquid and indicates a leak with an error message and an alarm sound.

To avoid spilling, always close unoccupied valve ports with Viper plugs.

5.7.5.1 Fluidic Setup for the Use of One Column Switching Valve

The figure shows the recommended fluidic setup for the use of one column switching valve.

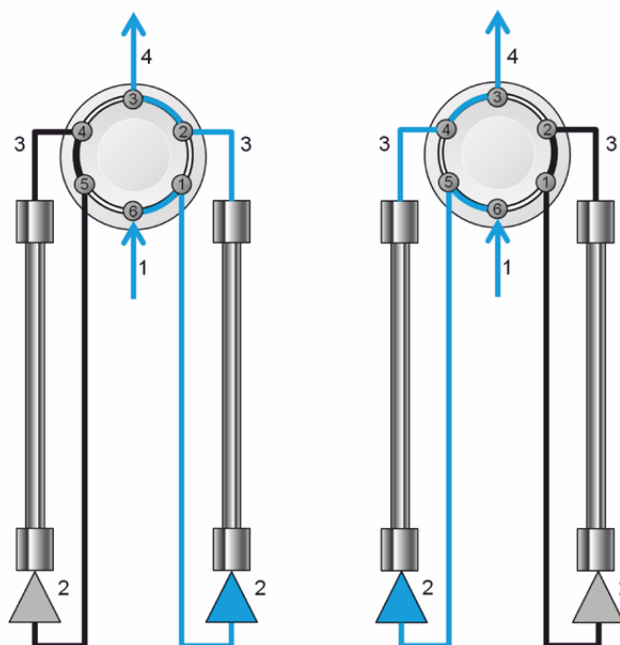


Figure 30: Example: Connections on a 2-p, 6-p column switching valve, upper valve setup, left: position 6-1, right: position 1-2

Follow these steps

1. Connect the Viper capillary from the pump or autosampler to port 6 of the column switching valve.
2. Depending on the column position, connect an active or passive pre-heater to port 1 or 5 of the column switching valve and connect it to the column inlet.
3. Connect a Viper capillary to port 2 or 4 of the column switching valve and connect it to the column outlet.
4. Connect a post-column cooler or a Viper capillary to port 3 of the column switching valve and connect it to flow cell inlet of the detector.

5.7.5.2 Fluidic Setup for the Use of Two Column Switching Valves

The figure shows the recommended fluidic setup for the use of two column switching valves.

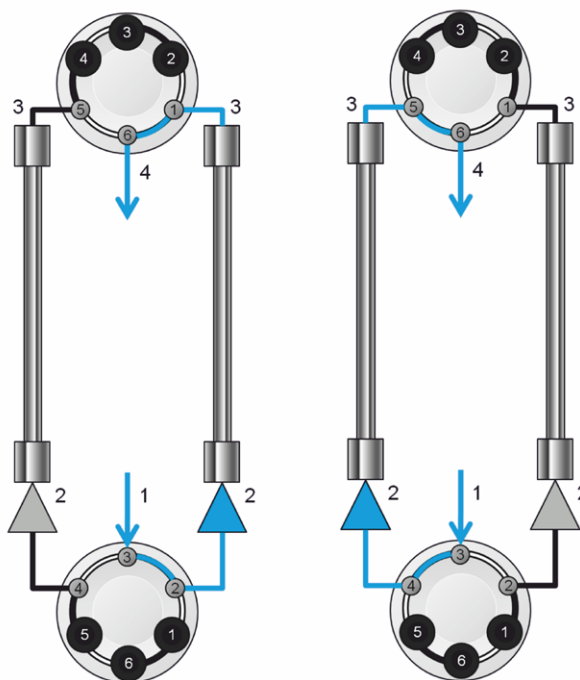


Figure 31: Example: Setting up two column switching valves in the system fluidics, left: position 6-1, right: position 1-2

Follow these steps

1. Connect the Viper capillary from the pump or autosampler to port 3 of the bottom column switching valve.
2. Depending on the column position, connect an active or passive pre-heater to port 2 or 4 of the bottom column switching valve and connect it to the column inlet.
3. Connect a Viper capillary to port 1 or 5 of the top column switching valve and connect it to the column outlet.
4. Connect a post-column cooler or a Viper capillary to port 6 of the top column switching valve and connect it to flow cell inlet of the detector.

5.8 Turning On the Device

TIP

Before turning on the power to a Vanquish system module for the first time, verify that the chromatography software is installed on the data system computer. When the power is turned on, the required USB drivers are automatically found and the Windows™ operating system can detect the device.

To turn on the power to the device, follow these steps:

1. Check that the power button on the front left of the Vanquish system base (system power button) is pressed in. If the power button stands out, press the power button to turn on the power on the system base.
2. Turn on the device with its main power switch.

Turn the device off with the main power switch, when instructed to do so, for example, during maintenance. Pressing the system power button will not be sufficient to turn off the power to the device completely.

See also

 [Power On/Off Control \(▶ page 85\)](#)

5.9 Setting Up the Device in the Software

This manual assumes that the chromatography software is already installed on the data system computer and a valid license is available.

For more information about setting up the Vanquish system in the software, refer to the *Vanquish System Operating Manual*.

The Help for the software that you are using provides detailed information about the settings on each property page.

6 Operation

This chapter describes the elements for device control, provides information for routine operation and for shutdown.

6.1 Introduction to this Chapter

The information in this chapter assumes that the initial setup of the device has already been completed. If this is not the case, refer to the instructions in [Installation](#) (▶ page 41).

For a basic description of instrument control and automated sample analysis with the Chromeleon software, refer to the *Vanquish System Operating Manual*. Details on control and operation of the device are available in the *Chromeleon Help*.

Software descriptions in this manual refer to Chromeleon 7. Terminology may be different to that of other software versions.

6.2 Safety Guidelines for Operation

When operating the device, pay attention to the following safety guidelines:



Observe all warning messages and precautionary statements presented in [Safety Precautions](#) (▶ page 19).



CAUTION—Hot Surfaces

Surfaces inside the device may become hot during operation. Touching hot parts might cause burns.

- Allow hot surfaces to cool down before you touch them.
- To cool down hot surfaces inside the column compartment quickly, press FAST COOL on the keypad. For details, see [Keypad](#) (▶ page 82).

NOTICE

Pay attention also to the following guidelines:

- When operating the chromatography system, always set the lower pressure limit for the pump. This prevents damage resulting from leakage or from running the pump dry.
- If there is evidence of leakage in the device, turn off the pump flow and remedy the situation immediately.

6.3 Control Elements

The device is designed to be operated mainly from a computer running with the chromatography software.

In addition, the following elements are available on the device:

- **Keypad**
The keypad buttons allow you to perform certain functions directly from the device.
- **Status indicators**
The LEDs (Light Emitting Diodes) on the status indicator LED bar on the front side of the device and the **STATUS** LED on the keypad provide a quick visual check of the operational status of the device.

6.3.1 Keypad

The keypad inside the device allows you to perform certain functions directly from the device. When you press a button, a short beep confirms that the function is performed.

When the device is connected in the Chromeleon software, some functions may not be available from the keypad (see further down in this section).

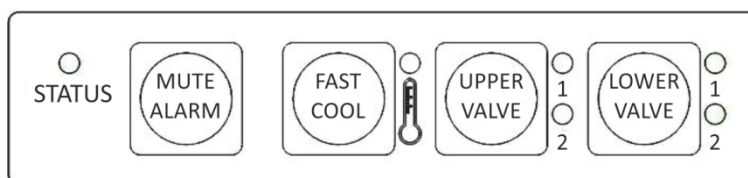


Figure 32: Keypad

STATUS

The **STATUS** LED provides a quick visual check of the operational status of the device.

When the door is closed, the LED bar on the front side indicates the operational status.

For status details, see [Status Indicators](#) (▶ page 84).

MUTE ALARM

Beeping alerts you when the device detects a problem, for example, leakage. To turn off the beep for the current alarm, press this button. Eliminate the source for the alarm within 10 minutes. Otherwise, beeping starts again. If the device detects a different problem, beeping alerts you again immediately.

FAST COOL

Pressing this button cools down hot surfaces in the column compartment quickly, for example, to allow fast and safe access to the components for replacement or maintenance procedures. For details, see [Important Operating Parameters](#) (▶ page 88).

The button LED is red while cooling is in progress. When the cool down temperature has been reached, the LED is green, indicating that you can safely access the components.

To cancel the Fast Cool mode, press the button again. The button LED is off and the components are heated up to the latest setpoint temperature. The Fast Cool mode can also be cancelled via the Chromeleon software.

UPPER VALVE , LOWER VALVE

Pressing these buttons switches the (upper or lower) column switching valve (if installed).

With 2-position 6-port valves, the LEDs next to the button indicate the current valve position. The upper LED is green when the valve is in position 1. The lower LED is green when the valve is in position 2. The LEDs are off during valve switching.

When the device is connected in the Chromeleon software

The button functionality is as follows when the device is connected in the Chromeleon software:

- No injection or sequence is running:
All functions are available from the keypad.
- An injection or sequence is running:
The **MUTE ALARM** function remains available from the keypad, allowing you to turn off the beep for the current alarm.

6.3.2 Status Indicators

The status LED bar on the front side of the device and the **STATUS LED** on the inside keypad provide information about the device status.

LED Bar

The LED bar provides the information when the device is closed. When the device is connected in the Chromeleon software, the LED bar may provide less information.

LED Bar	Description
Off (dark)	The power to the device is turned off.
Dimmed	The door of the device is open.
Yellow, flashing slowly	The power to the device is turned on, but the device is not connected in the Chromeleon software.
Yellow	The device is connected in the Chromeleon software.
Green, flashing	The device is equilibrating.
Green	The device is equilibrated.
Blue	An injection or sequence is running, including data acquisition.
Red	A problem or error has occurred. For the related message, check the Chromeleon Audit Trail. For remedial action, see Troubleshooting (▶ page 123).

STATUS LED

The **STATUS LED** on the keypad inside the device provides the following information:

STATUS LED	Description
Off (dark)	The power to the device is turned off.
Green	The device is functioning properly.
Red	A problem or error has occurred. For the related message, check the Chromeleon Audit Trail. For remedial action, see Troubleshooting (▶ page 123).

6.4 Power On/Off Control

The power switch on the device is the main switch for power on/off control. The main power switch is turned on during initial installation of the device.

For easier handling, you can use the power button on the front left of the Vanquish system base (system power button) for power on/off.

Observe the following:

- All modules in the Vanquish system that are connected to the system base via system interlink cables are turned on or off simultaneously when the system power button is pressed.
- When the power is on, the system power button is pressed in. When the power is off, the system power button stands out.
- If the main power switch on a device is off, you cannot turn on the device with the system power button.
- To turn off a device completely, you *have to* turn it off with the main power switch on the device. Pressing the system power button will not be sufficient to turn off the power to the device completely.

6.5 Preparing the Device for Operation

This section gives information on any additional steps that are required to prepare the device for operation and sample analysis.

Before Operating the Device for the First Time

Prepare the device for the first-time operation, observing the following:

NOTICE

Flush the system flow path thoroughly before operating the device for the first time:

- When you install devices or components to the system, always flush them to waste before connecting them in the system flow path. To flush the Vanquish modules, follow the instructions in the *Vanquish System Operating Manual*.
- Some components of the device are filled with isopropanol when the device is shipped from the manufacturing site. When operating the device for the first time, use solvents that are miscible with isopropanol. If they are not, use an appropriate intermediate solvent.

Before Starting Sample Analysis

Before starting an analysis:

- Check the liquid level in the solvent reservoirs. Verify that the amount of solvent is sufficient for the analysis.
- Verify that the doors of all modules in the Vanquish system are closed.
- Make sure that the chromatography system is properly equilibrated (see further down).

System Equilibration

System equilibration should include the following operations:

- Purging the pump (*all* channels, including those not used for the application)
- Flushing the entire chromatography system with the starting solvent to rinse out any solvent from a previous analysis run

- Warming up (or cooling down) all temperature-controlled devices in the system to the starting temperature. Temperature-controlled devices can be, for example
 - ◆ Column compartment and post-column cooler
 - ◆ Sample compartment thermostating in the autosampler
 - ◆ Flow cell in a fluorescence detector
 - ◆ Evaporation tube in a charged aerosol detector
- Turning on the lamp (or lamps) in the UV/VIS detector
- Monitoring the pump pressure and pressure ripple and checking that the pressure is stable and the ripple within reasonable limits for the application
- Monitoring the detector signal and checking whether the detector signal is stable so that the drift and signal noise are within reasonable limits for the application
- Performing an autozero of the detector baseline

TIP The Chromeleon software supports procedures for automatically starting a chromatography system in the software (**Smart Startup**). The startup procedure includes the operations for system equilibration. For details, refer to the *Chromeleon Help*.

6.6 Important Operating Parameters

The parameters described in this section should be considered for routine operation of the device. You can usually access them from the Chromeleon user interface.

If a parameter listed below is not available in the Chromeleon software, consider updating the firmware and Chromeleon version.

For more information, refer to *Chromeleon Help and documents*.

TIP The Instrument Method Wizard provides different parameter view modes. Depending on the parameters to be set, you can select the desired view mode (for example, **Easy** or **Advanced**).

Parameter	Description
Column ID	<p>The column identification (column ID) system allows you to store column-specific information on a column ID tag. For a complete list of column properties and for more information about the column identification system, see Column Identification (Column ID) (▶ page 35) or refer to the <i>Chromeleon Help</i>.</p> <p>To activate column identification in Chromeleon, see Installing Column Identification (Column ID) (▶ page 64).</p>
Column Selection	<p>For a column compartment with one or two column switching valves, column selection is performed in Chromeleon. The number of column switching valves, the valve model, and the application determine which commands and properties are used.</p>
Equilibration Time	<p>Equilibration Time can be set for the column compartment, the post-column cooler (VH-C10 only) and the active pre-heaters (if installed).</p> <p>For details, see Ready Temp Delta and Equilibration Time (▶ page 90) or refer to the <i>Chromeleon Help</i>.</p>
Fast Cool	<p>The Fast Cool mode is disabled as a standard. To cool down hot surfaces in the column compartment quickly, turn on the Fast Cool mode in Chromeleon or press the FAST COOL button on the keypad, see Keypad (▶ page 82).</p> <p>To cancel the Fast Cool mode in Chromeleon:</p> <ul style="list-style-type: none"> • Set a new nominal temperature for the post-column cooler, the active pre-heater or the column compartment. The respective component is heated up to the new setpoint temperature. Note that temperature control remains turned off for the components, for which no new nominal temperature is set. • Set temperature control to ON for the post-column cooler, the active pre-heater or the column compartment. Note that temperature control remains turned off for the components, for which temperature control is not enabled.

Parameter	Description
Leak Sensor Settings	The leak sensor is enabled as a standard.
Ready Temp Delta	<p>Ready Temp Delta can be set for the column compartment, the post-column cooler (VH-C10 only) and the active pre-heaters (if installed).</p> <p>For details, see Ready Temp Delta and Equilibration Time (▶ page 90) or refer to the <i>Chromeleon Help</i>.</p>
Column Thermostatting	<p>In the Command window, select the column compartment, named CC by default and set TempCtrl to ON, to turn on column thermostatting.</p> <p>To change the thermostatting temperature, enter a value for the Temperature.Nominal.</p>
Post-Column Cooler Thermostatting (VH-C10 only)	<p>In the Command window, select the post-column cooler, named PCC by default and set TempCtrl to ON, to turn on post-column cooler thermostatting.</p> <p>To change the thermostatting temperature for the post-column cooler, enter a value for the Temperature.Nominal.</p>
Active Pre-Heater Thermostatting (if installed)	<p>In the Command window, select the active pre-heaters, named PrehtLeft and PrehtRight by default and set TempCtrl to ON, to turn on active pre-heater thermostatting.</p> <p>To change the thermostatting temperature for the active pre-heater, enter a value for the Temperature.Nominal.</p>
Thermostatting Modes	<p>The still air mode is selected as a standard.</p> <p>If required, change the setting and select the forced air mode. For further information about the thermostatting modes, see Operating Principle (▶ page 31).</p>
Temperature Signals	<p>In the Instrument Configuration Manager dialog box of the column compartment the temperature check boxes are selected as a standard, when the column compartment is set up in Chromeleon. The Chromeleon software uses this setting to generate the channels for recording the temperature signals.</p> <p>If a problem occurs, the temperature signals can provide helpful information to identify and eliminate the source for the problem. Therefore, always record the temperature signals.</p>

6.7 Ready Temp Delta and Equilibration Time

The **Ready** property indicates whether the column compartment is ready for operation. When the column compartment is in the status **NotReady**, you cannot start the analysis. Keep in mind that the settings for **Ready Temp Delta** and **Equilibration Time** influence the time that the column compartment needs to enter the **Ready** state.

By default, the Chromeleon software pre-defines the **Equilibration Time**. If required, this setting can be adjusted.

Ready Temp Delta

Ready Temp Delta indicates for how many degrees the current temperature may be above or below the temperature setpoint. If the current temperature deviates from the temperature setpoint by more degrees than the value entered here, the column compartment enters the **NotReady** state and is not ready for operation.

Example: Temperature setpoint: 45 °C, **Ready Temp Delta**: 1 °C

The column compartment is ready for operation when the current temperature is between 44 °C and 46 °C. If the current temperature is outside this range, the column compartment enters the **NotReady** state.

Equilibration Time

Indicates for how long the preferred temperature must be in the range specified by the temperature setpoint and the setting for **Ready Temp Delta** before the column compartment is ready for operation and the analysis can be started.

Example: Temperature setpoint: 45 °C, **Ready Temp Delta**: 1 °C, **Equilibration Time**: 0.5 min

The column compartment is ready for operation when the current temperature is between 44 °C and 46 °C and has remained in this range for 0.5 minutes.

Observe the following:

- The smaller the value is for **Ready Temp Delta** and the higher the value is for **Equilibration Time**, the longer it takes until the column compartment is ready for operation and the data acquisition and/or the analysis can be started.
- Environmental conditions, such as draft or air conditioning, may also extend the waiting period or even prevent the column compartment from entering the **Ready** state.

6.8 Optimizing the Performance of the Device

This section provides information for best performance of the device and gives hints on what you can do to optimize the performance further.

6.8.1 General Guidelines

To optimize the column compartment performance, consider the following general guidelines:

- Use short connection capillaries.
- Monitor the usage of specific column compartment components, for example, column switching valves that are subject to wear and stress and schedule appropriate maintenance intervals (see [Predictive Performance](#) (▶ page 102)).
- Always close the column chamber cover and the column compartment door during operation.
- Observe the general guidelines and recommendations on the use of solvents and additives in the chromatography system. Refer to *Use of Solvents and Additives* in the *Vanquish System Operating Manual*.

6.8.2 Active Pre-Heating

To bring the eluent to a settable temperature before the analysis, an active pre-heater can be installed. For information about how to install an active pre-heater, see [Connecting and Placing the Active Pre-heater](#) (▶ page 71).

6.9 Shutting Down the Device

If the device will not be operated for some time, follow the instructions in this section to shut down the device.

TIP The Chromeleon software provides procedures for automatically preparing the chromatography system for shutdown. The procedures include, for example, operations for reducing the flow rate, reducing the temperature in temperature-controlled devices, and turning off the detector lamps. For information about **Smart Shutdown** and **Smart Standby**, refer to the *Chromeleon Help*.

6.9.1 Short-Term Shutdown (Interruption of Operation)

To interrupt operation of the device for a short period (short-term shutdown), for example, overnight, observe these guidelines for the Vanquish system modules, as required by your system arrangement:

- For your Vanquish detector, note the following:

Detector Type	Description
Charged aerosol detector	Check that sufficient gas is available to continue gas flowing through the detector. This is to prevent any build-up of residue from solvents or analytes. Gas must be flowing when pump flow is delivered to the detector.
UV/VIS detectors	The lamp(s) in the detector can remain turned on. <i>Variable wavelength detector and VH-D10 diode array detector only:</i> The shutter can be moved to a closed position for protection of the flow cell.
Fluorescence detector	Turn off temperature control for the flow cell.

- Apply a flow of 0.05 mL/min and have the pump deliver an appropriate solvent.
Check the lower pressure limit for the pump and adapt the value if necessary. If the pressure falls below the lower limit, the pump stops the flow.
- Set the injection valve in the autosampler to the Inject position.
- Make sure that the temperature of the column does not exceed 40 °C.
- When resuming operation, let the flow equilibrate and verify that the operating parameters for the other system modules are set as required before proceeding.

6.9.2 Long-Term Shutdown

To interrupt operation for a longer period, follow the instructions below.

TIP Shutting down the device affects the operation of the system. When shutting down the device, also observe the shutting down instructions for the other Vanquish system modules and take appropriate action (refer to the *Operating Manuals* for the modules).

1. Remove the column.
2. Flush the system with an appropriate solvent (minimum HPLC-grade). Observe the following:

TIP With a Vanquish Core system that has been modified for using normal-phase compatible solvents and additives, see the information about the flushing liquid in the *Considerations with Normal-Phase Compatible Solvents and Additives* section in *Operating Manual* for the pump.

Situation after Shutdown	If no additive is used	If an additive is used
Device remains in the laboratory after shutdown	Flush the system, for example with methanol. 100% acetonitrile should not be used.	Flush the system with several volumes of methanol and water (50:50) (for example, 1.0 mL/min for 10 minutes with the standard system) to prevent salt buildup in the fluidics. If the solvents in the device are not miscible with water, use an appropriate intermediate solvent.
Device shall be transported or shipped after shutdown	Flush the system with isopropanol.	Flush the system first with several volumes of methanol and water (50:50) (for example, 1.0 mL/min for 10 minutes with the standard system) to prevent salt buildup in the fluidics. If the solvents in the device are not miscible with water, use an appropriate intermediate solvent. Afterward, flush the system with isopropanol.

3. Turn off the pump flow. Wait until the system pressure is down to zero before you continue the shutdown of the device.

4. The step depends as follows:

Situation	Steps
Device and all other system modules remain in the system stack and are to be turned off	Turn off the system with the system power button on the system base.
Device shall be transported or shipped after shutdown	If one of the modules shall be removed from the system stack, turn off <i>all</i> system modules with their main power switch. Pressing the system power button will not be sufficient to turn off the power to the devices completely. Follow the instructions in Transporting or Shipping the Device (▶ page 119).

6.9.3 Restart after Long-Term Shutdown

To restart the device after a long-term shutdown, follow these steps:

1. Turn on the device. Observe the following:

Situation	Action
If the device remained in the system stack and all system modules were turned off.	Turn on the system with the system power button on the system base.
If the device is restarted after transport.	Turn on the device with the main power switch.

2. Prepare and restart the other modules in the Vanquish system, following the instructions in the *Operating Manuals* for the modules. Pay special attention to the *Preparing the Module for Operation* section.

3. Before starting an analysis, let the device equilibrate and be sure that it is ready for operation. See [Preparing the Device for Operation](#) (▶ page 86).

7 Maintenance and Service

This chapter describes the routine maintenance and the service procedures that the user may perform.

7.1 Introduction to Maintenance and Service

This chapter describes the routine maintenance and service and repair procedures that the user may perform.



Additional maintenance or service procedures must be performed only by service personnel certified by Thermo Fisher Scientific (for brevity, referred to as Thermo Fisher Scientific service personnel).

The device is designed for easy maintenance and service. The user-serviceable parts of the device can be accessed from the front. If not stated otherwise, the maintenance procedures do not require that you remove the device from the system.

The maintenance procedures do not require that you remove the door. However, it is possible to remove a door if this should ever be required for a specific reason or procedure. If you need to remove a door, follow the related steps in [Replacing the Device Door](#) (► page 115).

7.2 Safety Guidelines for Maintenance and Service

When performing maintenance or service procedures, pay attention to the following safety guidelines:



Observe all warning messages and precautionary statements presented in [Safety Precautions](#) (▶ page 19).



WARNING—High Voltage

High voltages are present inside the device that could cause an electric shock.

Do not open the housing or remove protective panels unless specifically instructed to do so in this manual.



WARNING—Escape of Hazardous Substances from Flow Connections

Flow and capillary connections can be filled with substances that can pose health risks. Solvent can spray when capillaries burst, slip out of their fittings, or are not properly tightened or when capillary connections are otherwise open.

- Wear appropriate protective equipment and follow good laboratory practice.
- Before starting maintenance or repair procedures, flush out harmful substances with an appropriate solvent.



WARNING—Tilting Liquid Reservoirs

Liquids in the reservoirs on the solvent rack might contain harmful substances. Spilling of these substances can pose health and safety risks.

To prevent the reservoirs from tilting, be careful not to pull on the liquid lines when performing maintenance.



CAUTION—Spraying Solvent

Solvents can spray when under high pressure.

- Stop the pump flow prior to opening the flow path.
- Wait until the system pressure is down to zero.
- When opening the flow path, wear appropriate protective equipment.

**CAUTION—Hot Surfaces**

Surfaces inside the device may become hot during operation. Touching hot parts might cause burns.

- Do not touch the inner side of the column chamber cover. When opening the column chamber cover, only grasp it by its holder.
- Allow hot surfaces to cool down before starting replacement or maintenance procedures.

**CAUTION—Hydrostatic Pressure**

Solvent may spill when you open the flow path. This is due to hydrostatic pressure in the system when the solvent reservoirs are located above the pump outlet. Before you loosen a connection in the flow path:

- Turn off the pump flow and wait until the system pressure is down to zero.
- Unscrew the caps of the solvent reservoirs and remove the solvent lines together with the caps from the reservoirs.
- Empty the solvent lines. Refer to the *Operating Manual* for the pump.
- Retighten the reservoir caps.

**CAUTION—Electric Shock or Damage to the Device**

After the power to the device is turned off, the device is still energized as long as the power cord is connected. Repair work on the device while the device is connected to power could lead to personal injury.

- Always unplug the power cord before starting repair work inside the device.
- If you were instructed to remove any housing covers or panels, do not connect the power cord to the device while the cover or panels are removed.

7.3 General Rules for Maintenance and Service

For successful maintenance and service procedures, follow these rules and recommendations:

- Before starting maintenance or service procedures, shut down the device when instructed to do so.
- Use only the replacement parts specifically authorized and qualified for the device by Thermo Fisher Scientific.
- Follow all instructions step by step and use the tools recommended for the procedure.
- Before opening the flow path to replace capillaries in the system, turn off the pump flow and wait until the system pressure is down to zero.
- Dirty components can contaminate the chromatography system. Contamination leads to poor performance of the modules and entire system or can even cause damage to the modules and system. Therefore:
 - ◆ Always wear appropriate gloves.
 - ◆ Place the components only on a clean, lint-free surface.
 - ◆ Keep your tools clean.
 - ◆ Use only lint-free cloth for cleaning.
- If you need to return the device for depot repair, follow the instructions in [Transporting or Shipping the Device](#) (▶ page 119).

Using Fast Cool mode for maintenance procedures

To cool down hot surfaces inside the column compartment quickly, use the Fast Cool mode:

- Press the **FAST COOL** button on the keypad. When the LED next to the button is green, you can access the column compartment.
- Cancel the Fast Cool mode when the procedure has been completed by pressing the **FAST COOL** button again. The Fast Cool mode can also be cancelled via the Chromeleon software (see [Important Operating Parameters](#) (▶ page 88)).

7.4 Routine and Preventive Maintenance

Optimum device performance, maximum uptime of the device, and accurate results can be obtained only if the device is in good condition and properly maintained.

7.4.1 Maintenance Plan

Perform the maintenance procedures in the table on a regular basis. The frequency given in the table is a suggestion. The optimum frequency for maintenance depends on several factors, such as the types and amounts of samples and solvents used with the device.

Frequency	What you should do...
Daily	<ul style="list-style-type: none"> Inspect the flow connections for signs of leakage or blockage. Tighten leaking connections. When you use buffers or salt solutions, flush the device thoroughly after use with an appropriate solvent that does not contain buffers or salts.
Regularly	<ul style="list-style-type: none"> Inspect the flow connections for damage, such as cracks, nicks, cuts, or blockage. Drain tubing is connected to the drain port on the bottom front of the device, below the front door. Verify that the tubing is unclogged and routed below the drain port. Empty the waste container as needed. Check that all warning labels are still present on the device and clearly legible. If they are not, contact Thermo Fisher Scientific for replacement.
Annually	Have Thermo Fisher Scientific service personnel perform preventive maintenance once a year.

TIP The Chromeleon software supports functions for estimating the lifetime of consumables (see [Predictive Performance](#) (► page 102)).

7.4.2 Cleaning or Decontaminating the Device

Cleaning and decontamination must be performed by qualified personnel wearing suitable personal protective equipment. Always observe national and local regulations.

NOTICE

Wipe up all liquids spilled onto the system immediately. If surfaces are exposed for longer periods, these liquids can cause damage.

Decontamination

Decontamination is required, for example, when leakage or spillage has occurred, or before service or transport of the device. Use a suitable cleaning detergent or disinfectant to ensure that the treatment renders the device safe to handle.

Parts required

- Suitable cleaning detergent (or disinfectant)
- Purified water
- Lint-free cloths or wipes



CAUTION—Explosive Gas Mixtures from Alcoholic Cleaning Detergents

Alcohol-containing cleaning detergents may form flammable and explosive gas mixtures when exposed to air.

- Use such cleaning detergents only when required and only in adequately ventilated rooms.
- Avoid open flames or exposure to excessive heat during the cleaning process.
- Wipe the cleaned components thoroughly dry after cleaning. Do not operate the device before it is completely dry.

NOTICE

Observe the following:

- Only use cleaning detergents that will not damage the surfaces of the system.
- Never use sharp tools or brushes for cleaning any surfaces.
- Do not use sprays for cleaning.
- Prevent cleaning detergent from entering the flow path.
- Do not use excessively wetted cloth or wipes for cleaning. Prevent any liquids from entering the functional components of the device. Liquids can cause a short circuit when getting in contact with the electronic components.

Preparations

1. Turn off the power to the device and disconnect the power cord from the power source.

Follow these steps

1. Wipe the surfaces clean with a clean, dry, soft, lint-free cloth or wipe. If necessary, slightly dampen the cloth or wipe with a solution of lukewarm water and a suitable cleaning detergent.
2. Allow the cleaning detergent to react as recommended by the manufacturer.
3. Wipe the cleaned surfaces with purified water to ensure that all cleaning detergent residues have been removed.
4. Wipe the surfaces dry using a soft, lint-free cloth or wipe.

7.4.3 Predictive Performance

The Chromeleon software supports functions for monitoring and recording service and qualification information about the device.

Monitoring service and qualification intervals

On special service and qualification panels, you can define intervals for service procedures or qualification procedures. These functions, which are called Predictive Performance, allow you to schedule these procedures based on the actual operating and usage conditions of the device. In addition, you can set limits to alert you before and when the service or qualification is due.

Color-coded bars provide visual feedback, allowing you to easily check and monitor the status. If a warning limit was set, a message in the Chromeleon Audit Trail alerts you when the action is due.

Service and qualification counters can be reset to zero after the required action was performed. To keep the Predictive Performance information up-to-date, consider resetting the counter when a service, or qualification procedure has been performed.

For more information, refer to the *Chromeleon Help*.

7.5 Column Switching Valve

The column compartment can hold one or two column switching valves. To ensure optimum operation of the column switching valve, observe the following guidelines:

- Operating, storing, or shipping the valve below 0 °C with water in the fluid passages may cause failure of the sealing surfaces.
- Install only Viper fitting connections to connect the capillaries to the valve.
- Clean the valve by flushing all lines with an appropriate solvent. The nature of the solvent to be used depends on the samples and the mobile phases that are used.

7.5.1 Inspecting the Column Switching Valve for Leakage

When

If liquid droplets appear on one or more drain holes, this may indicate valve leakage.

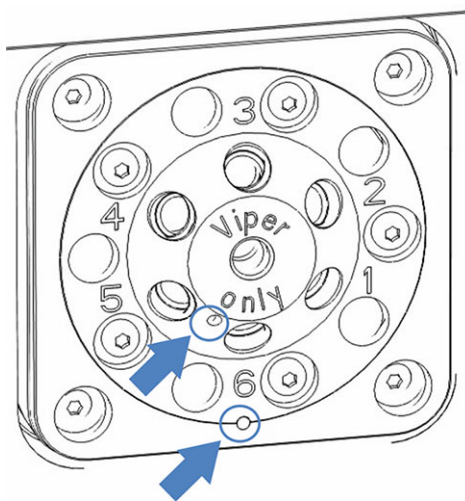


Figure 33: Drain holes on column switching valve

Follow these steps

1. As leakage usually occurs at a connection, visually inspect all connections in the flow path.
2. Remove the capillaries and install them again. Make sure to tighten all connections in the flow path properly.
3. If liquid droplets still appear at one or more drain holes, replace the column switching valve. See [Replacing the Column Switching Valve](#) (▶ page 104).

7.5.2 Replacing the Column Switching Valve

When

If column switching valve is leaking

Parts required

- Column switching valve as required by the application
- 4 screws

Tools required

- Screwdriver, Torx T10

Preparations



WARNING—Escape of Hazardous Substances from Flow Connections

Flow and capillary connections can be filled with substances that can pose health risks. Solvent can spray when capillaries burst, slip out of their fittings, or are not properly tightened or when capillary connections are otherwise open.

- Wear appropriate protective equipment and follow good laboratory practice.
- Before starting maintenance or repair procedures, flush out harmful substances with an appropriate solvent.

1. Turn off the pump flow.
2. Disconnect all liquid lines connected to the column switching valve.
3. Disable the valve in the Instrument Configuration Manager dialog box.
4. Turn off the power to the column compartment. If the power is on, the switching valve can be damaged during replacement.

Follow these steps

1. Loosen the 4 screws on the column switching valve.
2. Keep the screws for installation of the replacement column switching valve.

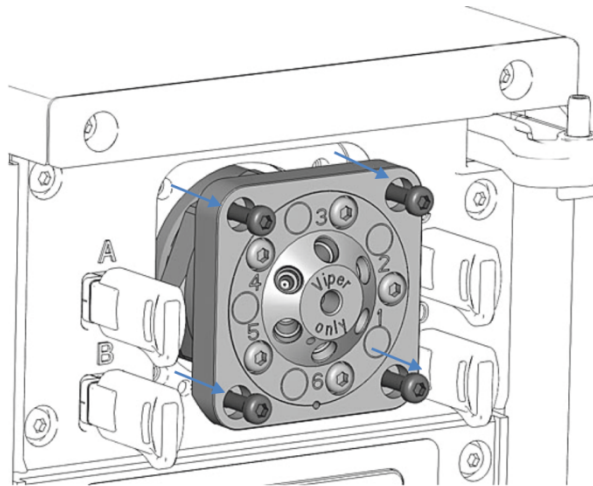


Figure 34: Removing the column switching valve

3. Carefully pull the column switching valve out of the housing.
4. Disconnect the cable from the valve drive on the rear of the column switching valve.
5. *If no column switching valve is to be installed to the column compartment afterward*
Install the column switching valve cover to the column switching valve opening on the column compartment:
 - a) Attach the cable to the rear of the column switching valve gasket.
 - b) Position the gasket and the switching valve cover onto the column switching valve opening.
 - c) With a screwdriver (Torx T10), tighten the four screws on the column switching valve cover.
6. Loosen the dummy plugs that cover the valve ports.
7. Check the orientation of the cable. The alignment pin in the middle of the connector on the cable should point downward.
8. Connect the cable to the valve drive of the new column switching valve.
9. Push the cable of the column switching valve into the housing.
10. Carefully push the column switching valve into the housing.

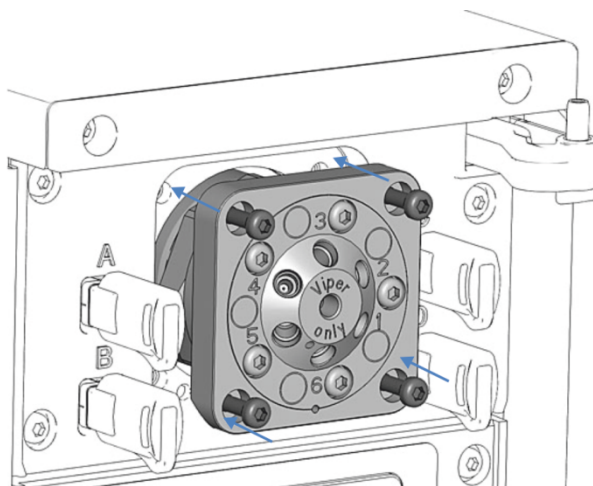


Figure 35: Installing the column switching valve

11. With a screwdriver (Torx T10), tighten the 4 screws on the column switching valve.
12. Connect the fluidic lines as required by the application. For instructions, see [Connecting the Components to a Column Switching Valve](#) (► page 74).
13. Turn on the power to the column compartment.
14. Configure the column switching valve in Chromeleon:
 - a) In the Instrument Configuration Manager dialog box, select the position (**Upper Valve, Lower Valve**).
 - b) Select the valve model.
15. Switch the valve into the different positions and test the flow connections.

7.5.3 Replacing the Column Switching Valve Cover

Parts required

- Column switching valve cover
- 4 screws from valve cover removal

Tools required

Screwdriver, Torx T10

Follow these steps

1. With the screwdriver (Torx T10), loosen the four screws on the switching valve cover.

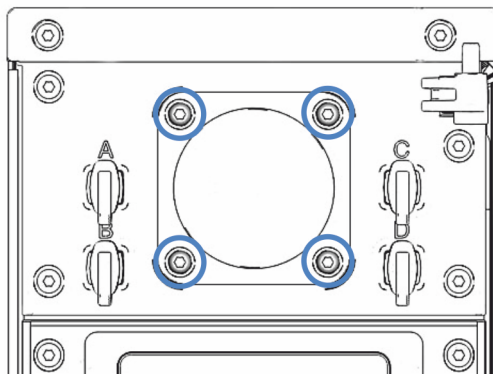


Figure 36: Switching valve cover screws

2. Remove the screws.
Keep the screws for installation of the replacement column switching valve cover.
3. Remove the switching valve cover and gasket.

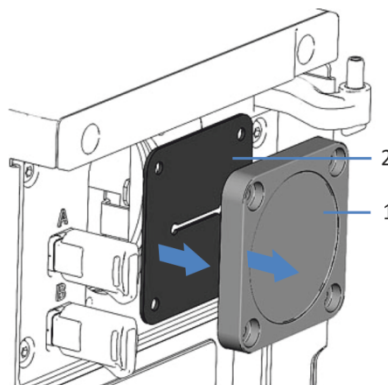


Figure 37: Removing the switching valve cover and gasket

No.	Description
1	Cover
2	Gasket

4. Detach the cable from the rear of the column switching valve gasket.
5. Attach the cable to the rear of the new column switching valve gasket/cover.
6. Place the column switching valve cover onto the valve position.
7. With a screwdriver (Torx T10), tighten the four screws on the column switching valve cover.

7.6 Replacing the Post-Column Cooler (VH-C10 only)

When

If post-column cooler is defective

Parts required

- Post-column cooler
- 2 screws

Preparations



CAUTION—Hot Surfaces

Surfaces inside the device may become hot during operation. Touching hot parts might cause burns.

- Allow the post-column cooler to cool down before starting the service procedure.
- Do not touch the inner side of the column chamber cover. When opening the column chamber cover, only grasp it by its holder.
- Allow hot surfaces to cool down before starting replacement or maintenance procedures.

TIP To cool down the post-column cooler quickly, press the **FAST COOL** button on the keypad. Wait until the button LED is green.

Follow these steps

1. Open the column compartment door.
2. Disconnect the post-column cooler capillaries from the detector and the column switching valve or the column.
3. Loosen the two screws on the post-column cooler.

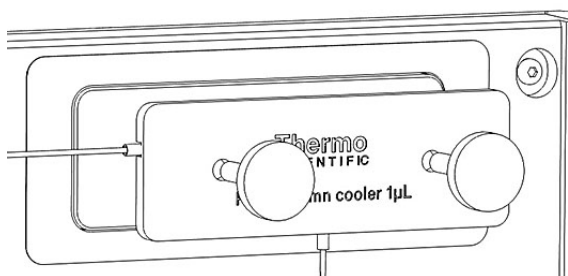


Figure 38: Removing post-column cooler screws

4. Detach the post-column cooler from the mounting plate.
5. To mount the new post-column cooler, follow the instructions in [Installing the Post-Column Cooler \(VH-C10 only\)](#) (▶ page 58).

TIP When the procedure is complete, cancel the Fast Cool mode by pressing the **FAST COOL** button again.

7.7 Replacing the Pre-heater

This section describes how to replace a pre-heater in the column compartment. Depending on the configuration of the column compartment, different types of pre-heaters are available.

- Active pre-heater, see [Replacing the Active Pre-Heater](#) (▶ page 110).
- Passive pre-heater, see [Replacing the Passive Pre-Heater](#) (▶ page 112).

7.7.1 Replacing the Active Pre-Heater

When

If active pre-heater is defective

Parts required

Active pre-heater

Preparations



CAUTION—Hot surfaces

The column compartment and pre-heater may be hot. Touching hot parts might cause burns. Allow the column compartment and the pre-heater to cool down before starting the service procedure.

Follow these steps

1. Detach the column holder from the active pre-heater fitting.
2. Disconnect the active pre-heater from the column.

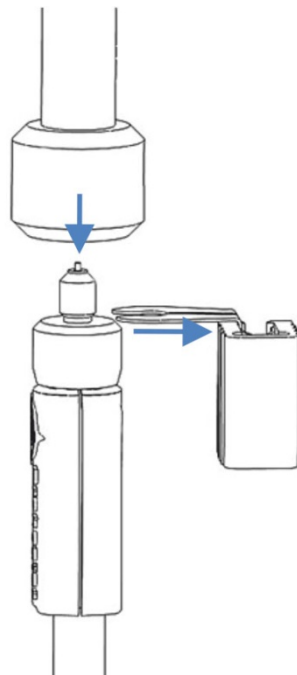


Figure 39: Disconnecting the active pre-heater from the column

3. Disconnect the pre-heater cable from the pre-heater port that is located next to the lower switching valve.

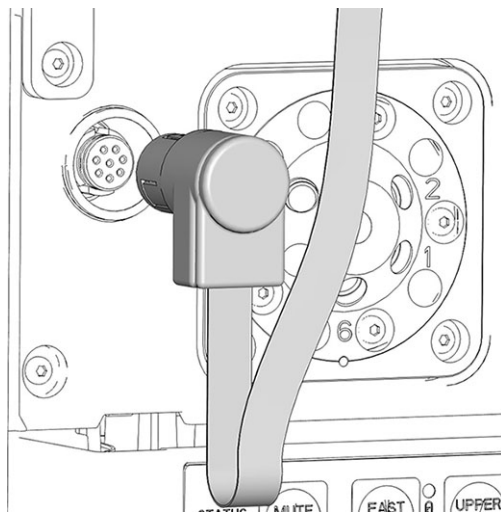


Figure 40: Pre-heater connection port

4. Remove the pre-heater cable from the pre-heater cable clip that is located above the pre-heater connection port.
5. Replace the defective pre-heater.
6. Connect the new pre-heater to the column. For instructions, see [Connecting and Placing the Active Pre-heater](#) (▶ page 71).

7.7.2 Replacing the Passive Pre-Heater

Parts required

- Passive pre-heater
- 2 Screws
- 2 washers

Tools required

Screwdriver Torx T10

Preparations



CAUTION—Hot surfaces

The column compartment and pre-heater may be hot. Touching hot parts might cause burns. Allow the column compartment and the pre-heater to cool down before starting the service procedure.

Follow these steps

1. Disconnect the outlet capillary of the passive pre-heater from the column inlet.
2. Disconnect the inlet capillary of the passive pre-heater from the autosampler or a column switching valve.
3. With the screwdriver Torx T10, loosen the two screws and washers on the passive pre-heater and remove the passive pre-heater.
4. Mount the new passive pre-heater in the column chamber. See [Installing the Passive Pre-heater](#) (▶ page 59).

7.8 Replacing the Main Power Fuses

When

Blown fuses

Parts required

Fuses (2 fuses, 4 AT, 250 V AC, slow-blow, 5 x 20 mm) from Fuses Kit

Tools required

Slotted screwdriver, any size between 3.3 mm and 5.5 mm is appropriate

Preparations



WARNING—Electric Shock

High voltages are present inside the device that could cause an electric shock or damage to the device.

- Turn off the device with its main power switch. Disconnect the power cord from both the power source and the device.
- Use only the fuses of the type and current rating specified for the device by Thermo Fisher Scientific.
- Do not use repaired fuses and do not short-circuit the fuse holders.

Follow these steps

The fuse holder is located next to the main power switch.

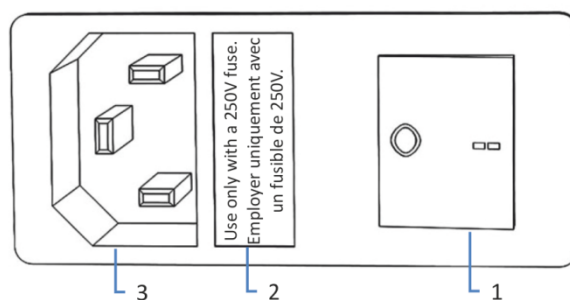


Figure 41: Fuse holder

No.	Description
1	Main power switch (on/off control)
2	Fuse holder
3	Power-inlet connector

1. Use the screwdriver to remove the fuse holder.
2. Replace the two fuses with new fuses of the specified type and current rating. Always replace *both* fuses.
3. Reinstall the fuse holder.
4. Reconnect the power cord to the power source and to the device.
5. Turn on the device with the main power switch.

7.9 Replacing the Device Door

When

If column compartment door is defective

Parts required

Column compartment door

Preparations

Open the column chamber cover. See [Accessing the Interior Components](#) (▶ page 50).

Follow these steps

1. Open the door to an angle of 90°, a position in which the two hinges on the housing are in the grooves on the door.
2. To release the door, push it upward.
3. Slightly tilt the door to the outside, away from the housing, and remove the door.

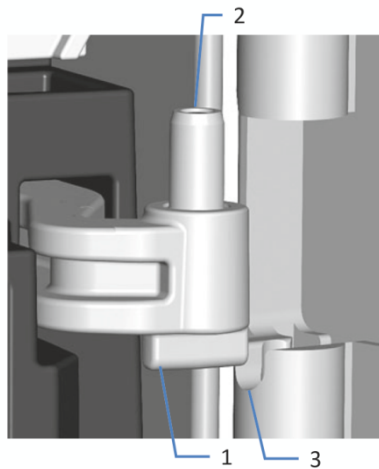


Figure 42: Hinging the door

No.	Description
1	Hinge on the housing
2	Groove on the door
3	Pin

4. To install the door, align the grooves on the door with the hinges on the housing.
5. Insert the lower hinge and pin in the groove on the door.

6. Slightly push up the door to insert the upper hinge and pin.
7. Push the door downward to lock it in place.
You can close the door only when it is properly installed.

7.10 Updating the Device Firmware

When

Updating the device firmware might be required, for example, when a new firmware version is released that adds functionality or solves problems of a previous version.

Items required

Firmware version/Chromeleon version as appropriate

TIP When a new firmware version is released, the new version will be included in the next available Chromeleon version. The new firmware will *not* be transferred automatically to the device when you install the Chromeleon version.

Preparations

1. Read the release notes provided with the firmware and/or Chromeleon version.
2. Connect the device in the Chromeleon software.
3. Stop all operations on the Instrument that includes the device.
4. Wait until the Instrument is idle.

Follow these steps

1. Start the Instrument Configuration Manager program.
2. Perform a firmware update from the **General** tab page in the configuration dialog box for the device. For details, refer to the *Chromeleon Help*.
The firmware update may take several minutes.

NOTICE

A firmware downgrade or incomplete firmware update may result in loss of functionality or malfunctioning of the device.

- Do not interrupt communication between the Chromeleon software and the device at any time during the procedure.
- At the beginning of the update process, a message appears showing the firmware version currently installed in the device and the version that will be transferred from the Chromeleon software. If the firmware installed in the device is a later version than the version in the Chromeleon software, cancel the download.

3. Monitor the Audit Trail of the Instrument Configuration Manager program to see whether the firmware update was successful or failed.
 - ◆ If the firmware update failed, turn the device off and on again and repeat the firmware update.
 - ◆ If the firmware update fails repeatedly, contact Thermo Fisher Scientific Technical Support for assistance.
4. After a successful firmware update, requalification of the device may be required. See the release notes for a recommendation.

7.11 Transporting or Shipping the Device

If you want to transport the device to a new location or if you need to ship the device, first prepare the device for transport and then move or ship the device as required. Follow the instructions in this section.

Observe the following safety guidelines:

NOTICE

To lift or move the device, grasp the device by the sides. Do not move or lift the device by the front door. This will damage the door or the device.

Follow these steps

1. Prepare the device for transport. See [Preparing the Device for Transport](#) (▶ page 119).
2. The step depends as follows:
 - ◆ To transport the device to a new location, follow the instructions in [Transporting the Device to a New Location](#) (▶ page 120).
 - ◆ To ship the device, follow the instructions in [Shipping the Device](#) (▶ page 121).

7.11.1 Preparing the Device for Transport

To prepare the device for transport, follow these steps:

1. Perform a long-term shut down of the device. See [Long-Term Shutdown](#) (▶ page 93).
2. Turn off the device with its main power switch and disconnect the power cord.
3. Remove all cables and flow connections to other devices.
4. Cover up the valve ports with the dummy plugs.
5. Remove the post-column cooler (if installed). For details, see [Replacing the Post-Column Cooler \(VH-C10 only\)](#) (▶ page 109).
6. Remove the pre-heater, if installed:
 - ◆ For removing the active pre-heater, see [Replacing the Active Pre-Heater](#) (▶ page 110).
 - ◆ For removing the passive pre-heater, see [Replacing the Passive Pre-Heater](#) (▶ page 112).

7. Remove the column:
 - a) Disconnect the capillaries from the column inlet and outlet.
 - b) Detach the column holder from the central wall inside the column chamber.
 - c) Detach the column holder from the column fitting.
8. Remove the column compartment from the Vanquish system:
Grasp the column compartment by its sides and slightly lift the column compartment up and out of the grooves on the mounting bars.

7.11.2 Transporting the Device to a New Location

Preparations

Prepare the device for transport. See [Preparing the Device for Transport \(▶ page 119\)](#).

Follow these steps

1. Observe the notes for handling and lifting the device safely.
2. Transport the device to the new location.
3. Install and set up the device in the system stack. Follow the instructions on mounting the system stack in the *Vanquish System Operating Manual*.
4. Set up the device:
 - a) Connect the device and set up flow connections (see [Installation \(▶ page 41\)](#)).
 - b) Prepare the device for operation (see [Preparing the Device for Operation \(▶ page 86\)](#)).
5. Before starting an analysis, let the device equilibrate and be sure that it is ready for operation.

7.11.3 Shipping the Device

Preparations

Prepare the device for transport. See [Preparing the Device for Transport](#) (▶ page 119).

Follow these steps

1. Follow the unpacking instructions in this manual in the reverse order.
Use only the original packing material and shipping container. If the original shipping container is not available, appropriate containers and packing material can be ordered from the Thermo Fisher Scientific sales organization.
2. If you need to return the device to Thermo Fisher Scientific for depot repair, contact your local Thermo Fisher Scientific support organization for the appropriate procedure.



CAUTION—Possible Contamination

Hazardous substances may have contaminated the device during operation and may cause personal injury to service personnel.

- Decontaminate all parts of the device that you want to return for repair.
- Fill in and sign the Health and Safety Form. Thermo Fisher Scientific refuses to accept devices for repair if the Health and Safety Form is missing, incompletely filled in, or unsigned.

Restarting the Device after Shipping

To restart the device after shipping, follow these steps:

1. Follow the unpacking instruction in this operating manual.
2. Install and set up the device in the system stack. Follow the instructions on mounting the system stack in the *Vanquish System Operating Manual*.
3. Set up the device:
 - a) Connect the device and set up flow connections (see [Installation](#) (▶ page 41)).
 - b) Prepare the device for operation (see [Preparing the Device for Operation](#) (▶ page 86)).
4. Before starting an analysis, let the device equilibrate and be sure that it is ready for operation.

8 Troubleshooting

This chapter is a guide to troubleshooting issues that may arise during operation of the device.

8.1 General Information about Troubleshooting

The following features help you to identify and eliminate the source for problems that may arise during operation of the device.

TIP For information about operating issues that might occur during the operation of a Vanquish system, refer to the *Vanquish System Operating Manual*.

If you are unable to resolve a problem following the instructions given here or if you experience problems that are not covered in this section, contact Thermo Fisher Scientific Technical Support for assistance. See the contact information at the beginning of this manual.

To facilitate device identification, have the serial number and technical name available when communicating with Thermo Fisher Scientific.

Status Indicators

The status indicator LED bar on the front side of the device and the **STATUS** LED on the keypad inside provide quick visual feedback on the operational status of the device. If the device firmware detects a problem, the status indicators are red. The problem is reported to the Chromeleon software and a message appears in the Audit Trail.

Alarms

Leaks are a potential safety issue. Therefore, if a leak sensor detects leakage, beeping starts to alert you in addition to the message in the Chromeleon Audit Trail and the status indicators changing to red. Follow the instructions in this manual to find and eliminate the source for the leakage.

Chromeleon Audit Trail Messages

If the device firmware detects a problem, the problem is reported to the Chromeleon software.

The Chromeleon software logs information about all events related to instrument operation for the current day in an Audit Trail. The Audit Trail is named with the current date, using the format `yyyymmdd`. For example, the Audit Trail for May 15, 2019, is named `20190515`.

The Instrument Audit Trails can be found on the ePanel Set (Audit ePanel). In addition, Audit Trails for each instrument are available in the Console Data view, in the folder of the Instrument.

Messages in the Chromeleon Audit Trail are preceded by an icon. The icon identifies the seriousness of the problem (refer to the *Chromeleon Help*). For possible causes and remedial actions, see [Messages](#) (▶ [page 126](#)).

Firmware Failure

If a firmware failure occurred during operation of the module, an exception log has been created about the processes during the firmware failure. The firmware sends the exception log to the Audit Trail when the module is connected in the Chromeleon software.

In this case, observe the following:

- Send the Audit Trail as **.cmbx** file to the Technical Support before you clear the log.
- To clear the exception log and continue operation of the module, perform the command **ExceptionLogClear**.

For more information, refer to the *Chromeleon Help*.

8.2 Messages

The table lists the most frequently observed messages for the device and provides troubleshooting assistance.

Each message consists of a code number and a text. The code number is the unique identifier for the problem while the wording may change.

Note the following:

- To facilitate finding a message, the table lists the messages sorted by code.
- If you cannot find the code you are looking for, check the message text. The two messages "Unexpected module behavior" and "Module malfunction detected" can be assigned to different codes. See the beginning of the table for more information.

TIP If you are unable to resolve the problem following the instructions in this manual, or if you encounter a message not listed in the table, write down the code and wording of the message and contact us. For details, see the *Contacting Us* section at the beginning of this manual.

Message and Code	Description and Remedial Action
Unexpected module behavior. Code xx	xx = Two-digit to four-digit code number. When the message appears, write down the message code and turn off the module. Wait for 5 seconds and turn on the module again.
Module malfunction detected. Code xx	xx = Two-digit to four-digit code number. When the message appears, write down the message code. Turn off the module and contact Technical Support.
Code 36 Download failed.	The firmware download has not been successful. Repeat the download.
Code 37 Download firmware mismatch.	The firmware download has not been successful. Verify that the correct firmware file was selected. Repeat the download.
Code 84 Could not move X to its destination position. Code 85 Could not move X to its destination position.	(with X = bottom valve or top valve) The respective switching valve may be defective. Replace the switching valve, see Replacing the Column Switching Valve (▶ page 104). If the error message persists, contact Technical Support.
Code 86 Unexpected X behavior. Code 87 Unexpected X behavior.	(with X = bottom valve or top valve) The respective switching valve may be defective. Replace the switching valve, see Replacing the Column Switching Valve (▶ page 104). If the error message persists, contact Technical Support.

Message and Code	Description and Remedial Action
Code 89 Liquid leak sensor missing.	Contact Thermo Fisher Scientific Technical Support for assistance. Note that the device can be operated nevertheless, even if the leak sensor is defective or not present, if leak detection is disabled.
Code 90 Download firmware mismatch – invalid version.	You tried to download a firmware with an earlier version number than the firmware that is currently installed in the device. Downgrading the firmware may result in loss of functionality or malfunctioning of the device. If required, repeat the download with a firmware version later than the version currently installed in the device.
Code 91 Data changed during read.	<ul style="list-style-type: none"> This may be a temporary error. Turn off the module. Wait for 5 seconds and turn on the module again. The firmware may be defective. Update the firmware.
Code 118 USB Buffer Overflow.	This is a software problem. The module produces data faster than the computer on which the Chromeleon software is running reads the data. <ol style="list-style-type: none"> In the Chromeleon software, disconnect and reconnect the module. If this does not solve the problem, update the firmware or the Chromeleon software version. If the problem persists: Also, third-party software on the computer, for example, virus scanners, can cause the problem. Contact the onsite IT department.
Code 120 The request timed out.	Communication with the module failed. The module did not respond in time. For the module for which the message appears: <ol style="list-style-type: none"> Turn on the module if it is not yet turned on. Check the system interlink cables for proper connection.
Code 2033 Column-ID X operation failed.	(with X = column ID tag A, B, C, or D) First, verify that the column ID tag is installed properly. Second, reconnect the column ID tag. If the message persists, the column ID tag may be defective. Replace the column ID tag.
Code 2034 Column-ID X operation failed.	(with X = column ID tag A, B, C, or D) First, format the file system of the column ID tag in Chromeleon. If the message persists, the column ID tag may be defective. Replace the column ID tag.
Code 2035 Column-ID X operation failed.	(with X = column ID tag A, B, C, or D) First, verify that the column ID tag is installed properly. Second, reconnect the column ID tag. If the message persists, the column ID tag may be defective. Replace the column ID tag. If the error message persists, contact Technical Support.
Code 2048 X leak detected - eliminate within approx. xxx seconds.	(with X = gas or liquid) The leak sensor detected excessive gas or liquid in the column chamber. Eliminate the cause within the time indicated in the message. For details, see Resolving Liquid Leaks (▶ page 129) or Resolving Gas Leaks (VH-C10-A and VH-C10-A-02 only) (▶ page 130).

Message and Code	Description and Remedial Action
Code 2049 X leak detected.	<p>The leak sensor detected excessive gas or liquid in the column chamber.</p> <p>Eliminate the cause. For details, see Resolving Liquid Leaks (▶ page 129) or Resolving Gas Leaks (VH-C10-A and VH-C10-A-02 only) (▶ page 130).</p>
<p>Code 2070 Pre-heater X operation failed.</p> <p>Code 2071 Pre-heater X operation failed.</p> <p>Code 2072 Pre-heater X operation failed.</p>	<p>(with X = left or right pre-heater)</p> <p>Follow these steps:</p> <ol style="list-style-type: none"> 1. Verify that the active pre-heater is installed properly. Reconnect the active pre-heater if necessary. 2. If the message appears again, the active pre-heater may be defective. Replace the active pre-heater. See Replacing the Active Pre-Heater (▶ page 110).
Code 2088 Module malfunction detected (X).	<p>(with X = "Upper Compartment" or "Lower Compartment" or "Post Column Cooler" or "Main Power")</p> <p>When the message appears, write down the message code and turn off the module. Disconnect all active pre-heaters and turn on the module again. If the column compartment does not report any errors after that, the disconnected pre-heaters are defective. Replace the active pre-heaters. See Replacing the Active Pre-Heater (▶ page 110).</p> <p>If the error persists, contact Technical Support.</p>

8.3 Resolving Liquid Leaks

When

The leak sensor is wet. The leak sensor reports leakage.

Parts and additional items required

- Replacement part as required
- Cloth or tissue

Preparations

When resolving leakage, observe the safety guidelines and general rules for maintenance and service as presented in [Maintenance and Service](#) (▶ [page 95](#)).

Follow these steps

1. Locate the source of the leak.
As leakage usually occurs at a connection, visually inspect all components and connections in the flow path.
2. Tighten or replace the connection or component as required.
3. With a cloth or tissue, thoroughly absorb all liquid that has collected in the leak tray and under the leak sensor. Be careful not to bend the sensor.
4. Allow the sensor to adjust to the ambient temperature for a few minutes.
5. If leakage is no longer reported, you can resume operation.

8.4 Resolving Gas Leaks (VH-C10-A and VH-C10-A-02 only)

When

If the gas leak sensor is exposed to a certain concentration of gas.

Follow these steps

1. Open the column compartment door.
2. Open the column chamber cover.
For details, see [Accessing the Interior Components](#) (▶ page 50).
3. As leakage usually occurs at a connection, tighten all flow connections.
4. Ventilate the interior of the column chamber thoroughly.
The Status LED on the front side remains red as long as the sensor is exposed to gases.
5. If no error is reported, close the column chamber cover and the column compartment door and resume operation.

9 Specifications

This chapter provides the physical and performance specifications, including information about the materials used in the flow path of the device.

9.1 Performance Specifications

The device performance is specified as follows:

Type	Specification
Capacity	2 column slots
Pressure range	VC-C10: 2 – 70 MPa (20 – 700 bar, 290 – 10100 psi) VH-C10: 5 – 151 MPa (50 – 1517 bar, 700 – 22002 psi)
Temperature range (column chamber)	VC-C10: 5 °C – 85 °C, max. 18 °C below ambient VH-C10: 5 °C – 120 °C, max. 18 °C below ambient
Temperature accuracy (column chamber)	±0.5 °C (up to 80 °C)
Temperature stability (column chamber)	±0.05 °C
Temperature precision (column chamber)	±0.1 °C
Heat up time (column chamber)	from 20 °C to 50 °C in less than 15 minutes ±1 °C from 25 °C to 40 °C in 5 minutes (typically) ±1 °C
Cool down time (column chamber)	from 50 °C to 20 °C in less than 15 minutes ±1 °C
Column switching valves	2-position-6-port valve 6-position-7-port multi-position valve
Communication	1 USB port (USB 2.0, "B" type connector)
System Interlink	2 system interlink ports (RJ45-8 connectors)
Control	Chromeleon 7 The device can be operated also with other data systems. For details, contact the Thermo Fisher Scientific sales organization. Keypad with 4 buttons for performing certain functions directly from the device.
Materials in the flow path	Valve: ceramic/titanium; capillaries: MP35N or stainless steel (for details, see the pre-heater and post-column cooler specifications) NOTICE For information about the chemical resistance of materials refer to the technical literature.
Solvent and additive information	See Solvent and Additive Information (▶ page 25).
Safety features	VH-C10-A-03, VC-C10-A-03: Liquid leak sensor VH-C10-A/-02: Liquid leak sensor; Gas leak sensor
Good Laboratory Practice (GLP) features	Predictive Performance functions for scheduling maintenance procedures based on the actual operating and usage conditions of the device. All system parameters logged in the Chromeleon Audit Trail.

Active pre-heater

Type	Specification
Temperature range	40 °C to upper temperature limit of column chamber 5 °C above environment and / or eluent temperature at active pre-heater input
Wetted parts	MP35N
Biocompatible	yes
Heating performance	80 °C at 2.5 mL/min 120 °C at 1 mL/min
Temperature accuracy	± 2 °C (up to 80 °C)
Temperature stability	± 0.5 °C
Temperature precision	± 1 °C

Passive pre-heaters

Type	Specification
Temperature range	Same as column chamber
Wetted parts	MP35N
Biocompatible	Yes

Type	Specification
Temperature range	Same as column chamber
Wetted parts	Stainless steel
Biocompatible	No

Post-column cooler (VH-C10 only)

Type	Specification
Temperature range	40 °C to 80 °C
Wetted parts	MP35N
Biocompatible	yes
Cooling performance	down to 50 °C at 2 mL/min and 120 °C compartment temperature
Temperature accuracy	± 2 °C (up to 80 °C)
Temperature stability	± 0.5 °C
Temperature precision	± 1 °C

9.2 Physical Specifications

The physical conditions of the device are specified as follows:

Type	Specification
Range of use	Indoor use only
Ambient operating temperature	5 °C - 35 °C
Ambient storage temperature	-20 °C - 45 °C
Ambient operating humidity	20% - 80% relative humidity (non-condensing)
Ambient storage humidity	Maximum 60% relative humidity (non-condensing)
Operating altitude	Maximum 2000 m above sea level
Pollution degree	2
Power requirements	100 – 240 V AC, ± 10 %; 50/60 Hz, max. 310 W / 330 VA
Overvoltage category	II
Emission sound pressure level	< 50 dB(A), typically < 45 dB(A)
Dimensions (height x width x depth)	70 x 11.1 x 42 cm
Weight	13 kg, no column switching valves installed, 14 kg, two column switching valves installed

10 Accessories, Consumables and Replacement Parts

This chapter describes the standard accessories that are shipped with the device and the accessories that are available as an option. This chapter also provides information for reordering consumables and replacement parts.

10.1 General Information

The device must be operated only with the replacement parts and additional components, options, and peripherals specifically authorized and qualified by Thermo Fisher Scientific.

Accessories, consumables, and replacement parts are always maintained at the latest technical standard. Therefore, part numbers are subject to change. If not otherwise stated, updated parts will be compatible with the parts they replace.

10.2 Ship Kit

The ship kit includes the items listed in the table. The kit content is subject to change and may vary from the information in this manual. See the content list included in the kit for the most recent information about the kit content at the time when the device is shipped.

Ship kit

Item	Quantity in shipment
Leg front side (including drain port)	1
Leg rear side	1
Screws	4
Screwdriver, Torx T20	1
Column holder kit (pack of 6 column holders) including: <ul style="list-style-type: none"> • Column holder left for left-side positioning of the column (2 pieces) • Column holder right for right-side positioning of the column (2 pieces) • Column holder double for positioning two columns at the same height (2 pieces) 	2
USB cable type A to B High Speed USB 2.0, 1 m	1
Standard installation kit including: <ul style="list-style-type: none"> • Screws (4 pieces) • T-slot nuts (4 pieces) • Spacers (4 pieces) • Crosspiece (2 pieces) 	1
Column ID (pack of 2 column ID tags)	2

For reordering information, see [Consumables and Replacement Parts](#) (▶ [page 139](#)).

10.3 Optional Accessories

Item	Part No.
Active pre-heater, 0.1 x 380 mm, MP35N	6732.0110
Active pre-heater, 0.1 x 610 mm, MP35N	6732.0150
Conversion kit, VH/VC-C10 For the extended configuration of up to three column compartments, more than one conversion kit may be required. Only service personnel certified by Thermo Fisher Scientific are permitted to install the extended configuration with up to three column compartments or to perform the left-side installation of the column compartment.	Contact Sales
Passive pre-heater, 0.1 mm x 530 mm, MP35N	6732.0174
Passive pre-heater, 0.18 mm x 530 mm, stainless steel	6732.0170
Post-column cooler, 1 μ L, 0.1 x 240 mm (VH-C10 only)	6732.0510
Valve 2-p 6-p VC-C10 The column compartment can hold one or two column switching valves.	6230.1520
Valve 6-p 7-p VC-C10 The column compartment can hold one or two column switching valves.	6230.1530
Valve 2-p 6-p 150MPa bio VH-C The column compartment can hold one or two column switching valves.	6036.1560
Valve 6-p 7-p 150MPa bio VH-C The column compartment can hold one or two column switching valves.	6036.1570

10.4 Consumables and Replacement Parts

Power cords

Description	Part No.
Power cord, Australia	6000.1060
Power cord, China	6000.1080
Power cord, Denmark	6000.1070
Power cord, EU	6000.1000
Power cord, India, SA	6000.1090
Power cord, Italy	6000.1040
Power cord, Japan	6000.1050
Power cord, UK	6000.1020
Power cord, USA	6000.1001
Power cord, Switzerland	6000.1030

Cables and fuses

Description	Part No.
Fuses kit The kit includes the appropriate fuses for the Vanquish system modules. For the column compartment, use only 4 AT (5 x 20 mm), 250 V AC slow-blow fuses.	6036.0002
USB cable, type A to type B, high-speed, USB 2.0 Cable length: 0.5 m	6720.8910
USB cable, type A to type B, high-speed, USB 2.0 Cable length: 1 m	6035.9035

Miscellaneous

Description	Part No.
Column compartment doors	6732.3890
Column ID tags	6732.0610
Column switching valve cover	6732.1843
Immersion sensor PT100 For column compartment OQ/PQ	6705.0060
Packing material	6732.7004
Passive pre-heater, 0.1 mm x 530 mm, MP35N (VH-C)	6732.0174
Passive pre-heater, 0.18 mm x 530 mm, stainless steel (VC-C)	6732.0170
Post-column cooler 1µL, 0.1 x 240 mm (VH-C10 only)	6732.0510

Description	Part No.
PQ Kit For column compartment OQ/PQ, including a P700 thermometer and immersion sensor PT100. Note: To continue to use an already available PQ Kit 5705.0050A, it is required to order the temperature sensor clip.	6732.0010
Temperature sensor clip For column compartment OQ/PQ	6732.0009
Viper inline filter	6036.1045
Viper union	6040.2304

11 Appendix

This chapter provides additional information about compliance.

11.1 Compliance Information

11.1.1 Declarations of Conformity

CE Declaration of Conformity

The device has satisfied the requirements for the CE mark and is compliant with the applicable requirements.

cTUVus Compliance



The cTUVus label on the device indicates that the device has satisfied the requirements for the cTUVus mark. Compliance with the applicable standards has been evaluated by TÜV Rheinland of North America Inc.

RoHS Compliance

This product complies with the RoHS (Restrictions of Hazardous Substances) directives:

- *European RoHS Directive*
Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment
- *China RoHS regulations*
Measures for Administration of the Pollution Control of Electronic Information Products

One of the following logos may be present on the device if applicable:

Logo	Description
	The green logo marks items that do not contain the hazardous substances identified by the regulations.
	The orange logo including a one-digit or two-digit number marks items that contain hazardous substances identified by the regulations. The number indicates the environment-friendly use period (EFUP) of the item. During this period, the item (when used as intended) will not cause serious damage to human health or environment. For more information, go to http://www.thermofisher.com/us/en/home/technical-resources/rohs-certificates.html

11.1.2 WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive. It is marked with the following symbol:



Figure 43: WEEE symbol

Thermo Fisher Scientific has contracted with one or more recycling or disposal companies in each European Union (EU) Member State, and these companies should dispose of or recycle this product. For further information, contact Thermo Fisher Scientific.

11.1.3 FCC Compliance

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 instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his expense.

11.1.4 Manual Release History

Revision	Covering
3.0	VC-C10-A-03, VH-C10-A-0x
2.0a	VH-C10-A-02
2.0	VH-C10-A-02
1.0	VH-C10-A

The instructions were prepared in English (original instructions). Other language versions are translations based on the English original instructions.

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