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Thermo Scientific

Charged Aerosol Detectors

Corona Veo, Corona Veo RS

Operating Manual

4820.8101 Revision 2.1 • October 2019

ThermoFisher SCIENTIFIC

Original Operating Manual

The hardware descriptions in this manual revision refer to devices Corona Veo and Corona Veo RS. For the manual release history, see page 251.

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Printed manual version only

Printed in Germany on 100% chlorine-free bleached, high-white paper that is produced in an environmentally friendly process, leading to a paper profile of zero CO_2 emissions.

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Contacting Us

There are several ways to contact us:

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For technical support for HPLC products, contact your local Thermo Fisher Scientific support organization. For contact information, go to Contact Us on http://www.thermofisher.com.

Contents

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 Thermo Scientific™ Corona™ Veo™ and Corona Veo RS detector 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 detector, read this manual thoroughly.

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

Note the following:

- The detector configuration may vary; therefore, not all descriptions necessarily apply to your particular detector.
- 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 detector or component. However, this does not influence the descriptions. No claims can be derived from the illustrations in this manual.

The descriptions in this manual assume that the detector is installed in the HPLC system stack. If this is not the case, additional hardware is required and must be ordered separately. The information in this manual applies correspondingly.

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 detector or invalid test results.

AVIS Signale des renseignements jugés nécessaires pour éviter toute détérioration du détecteur ou tout résultat de tests erroné.

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

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 detector 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 HPLC system
- *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™ 7 Help and documents*
  The *Chromeleon 7 Help* provides extensive information and comprehensive reference material for all aspects of the software. For basic information about device installation and configuration, refer to the *Installation Guide*; for specific information about a certain device, refer to the *Instrument Configuration Manager Help.* In Chromeleon 7, devices are called modules.

  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*.

  For a concise overview of the most important workflows, refer to the *Reference Card*.
- *Chromeleon™ 6.8 Help*
  The *Chromeleon 6.8 Help* provides extensive information for all aspects of the software, including device installation and configuration.

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).

Third-party documentation includes the user documentation for the gas supply, as applicable:

- User documentation for the nitrogen generator
- User documentation for the air compressor

2 Safety

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

2.1 Safety Symbols and Signal Words

2.1.1 Safety Symbols and Signal Words in This Manual

English Version

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

French Version

Ce manuel comporte des consignes de sécurité afin de prévenir tout risque de blessure pour les personnes utilisant le détecteur. Les symboles de sécurité et mots d'avertissement du présent manuel sont notamment :

Soyez toujours attentif aux consignes de sécurité. N'utilisez pas l'instrument sans avoir compris l'intégralité des consignes de sécurité et réfléchi aux conséquences de vos actions.

ATTENTION Signale une situation de danger potentiel qui, si elle n'est pas évitée, pourrait entraîner des blessures mineures à modérées.

AVERTISSEMENT Signale une situation de danger potentiel qui, si elle n'est pas évitée, pourrait entraîner des blessures graves.

2.1.2 Observing this Manual

English Version

Observe the following:

- Before installing or operating the detector, read this manual carefully to be familiar with the detector and this manual. The manual contains important information with regard to user safety as well as use and care of the detector.
- Always keep the manual near the detector 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.

French Version

Respectez les consignes suivantes :

- Lisez le présent manuel attentivement avant toute installation ou utilisation du détecteur afin de vous familiariser avec le détecteur et avec le manuel. Ce manuel comporte des informations importantes relatives à la sécurité des utilisateurs, ainsi qu'à l'utilisation et à la maintenance du détecteur.
- Gardez toujours le manuel à proximité du détecteur afin de pouvoir vous y reporter rapidement.
- Conservez ce manuel et transmettez-le à tous les utilisateurs ultérieurs.

Lisez, comprenez et respectez tous les messages de sécurité et mentions de mise en garde figurant dans le présent manuel.

2.1.3 Safety Symbols on the Detector

English Version

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

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.
O —	Power supply is off Power supply is on
~	Indicates alternating current.
	Indicates a terminal for protective grounding.
	Indicates a terminal for functional grounding

French Version

Ce tableau répertorie les symboles de sécurité qui apparaissent sur le détecteur ou sur les étiquettes apposées sur celui-ci. Conformez-vous à tous les avis de sécurité présents dans ce manuel afin d'éviter tout risque de blessure de l'opérateur ou de détérioration du détecteur.

Symbole	Description
	Indique un danger potentiel. Référez-vous à ce manuel afin d'éviter tout risque d'accident corporel et/ou de dommage à l'appareil.
O —	L'appareil est mis hors tension L'appareil est mis sous tension
~	Indique un courant alternatif.
	Indique une mise à la terre de protection
	Indique une mise à la terre fonctionnelle

2.1.4 Rating Plate

English Version

The rating plate is present on the rear side of the detector near the electrical connections. The rating plate indicates the serial number, part number, module name, line and fuse rating, and the manufacturer's address.

To facilitate device identification, have the information from the rating plate available when communicating with Thermo Fisher Scientific.

French Version

La plaque signalétique est placée à l'arrière du détecteur, à proximité des connexions électriques. Elle indique le numéro de série, le numéro de référence, le nom du module, la série et le calibre des fusibles, ainsi que l'adresse du fabricant.

Afin de faciliter l'identification de l'appareil, gardez les informations de la plaque signalétique à votre portée lorsque vous communiquez avec Thermo Fisher Scientific.

2.2 Intended Use

The detector is designed for use in high-performance liquid chromatography (HPLC) or ultra-high performance liquid chromatography (UHPLC) applications.

The detector is designed for HPLC, UHPLC and microLC analyses, especially as part of the UltiMate 3000 system, but can also be used with other HPLC systems if adequate control inputs and outputs are available.

The intended use of a HPLC system is to analyze mixtures of compounds in sample solutions. The detector is for use by qualified personnel and in laboratory environment only.

The detector is intended for laboratory research use only. It is not intended for use in diagnostic procedures.

Laboratory Practice

Thermo Fisher Scientific recommends that the laboratory in which the HPLC 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

- For English version, see below.
- For French version, see page 24.

English Version

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 detector.

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

- Operate the detector only within its technical specifications.
- Use only the replacement parts and additional components, options, and peripherals specifically authorized and qualified for the detector by Thermo Fisher Scientific.
- Perform only the procedures that are described in this operating manual and in supporting documents for the detector.
  Follow all instructions step by step and use the tools recommended for the procedure.
- Open the enclosure of the detector 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 detector. 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.

French Version

Tous les utilisateurs doivent respecter les consignes générales de sécurité présentées dans cette section, ainsi que tous les messages de sécurité spécifiques et mentions de mise en garde décrits ailleurs dans ce manuel, lors de toutes les phases d'installation, utilisation, dépannage, maintenance, arrêt et transport du détecteur.

Si le détecteur est utilisé d'une manière non spécifiée par Thermo Fisher Scientific, la protection fournie par le détecteur peut être altérée. Respectez les consignes suivantes :

- Utilisez le détecteur uniquement dans le cadre de ses spécifications techniques.
- Employez exclusivement les pièces de rechange, composants supplémentaires, options et périphériques spécifiquement autorisés et certifiés pour le détecteur par Thermo Fisher Scientific.
- Ne réalisez que les procédures décrites dans le présent manuel d'utilisation et dans les documents relatifs au détecteur. Suivez toutes les instructions étape par étape et utilisez les outils recommandés pour la procédure.
- N'ouvrez pas le boîtier du détecteur et des autres composants, à moins que cela ne soit expressément indiqué dans le présent manuel.
- Thermo Fisher Scientific ne saurait être tenu responsable d'éventuels dommages, matériels ou autres, résultant de l'usage inapproprié ou incorrect du détecteur. En cas de question concernant l'usage approprié de l'instrument, veuillez contacter Thermo Fisher Scientific avant de poursuivre.

Normes de sécurité

Cet appareil est un instrument appartenant à la classe de sécurité I (équipé d'une borne de mise à la terre). Il a été fabriqué et contrôlé conformément aux normes de sécurité internationales.

2.3.2 Qualification of the Personnel

- For English version, see below.
- For French version, see page 26.

English Version

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

Installation

Only skilled personnel are permitted to install the detector 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 detector is designed to be operated only by trained and qualified personnel in a laboratory environment.

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

French Version

Respectez les consignes ci-après, qui portent sur la qualification du personnel chargé de l'installation et/ou de l'utilisation du détecteur.

Installation

Seul le personnel qualifié est autorisé à installer le détecteur et à effectuer des raccordements électriques conformément à la réglementation en vigueur. Thermo Fisher Scientific recommande que l'installation soit toujours effectuée par des personnes certifiées par Thermo Fisher Scientific (par souci de concision, appelées par la suite techniciens d'entretien Thermo Fisher Scientific).

Si une personne autre qu'un technicien d'entretien agréé par Thermo Fisher Scientific installe et configure le module, il est de la responsabilité de l'installateur d'assurer la sécurité du module et du système.

Fonctionnement général

Le détecteur est conçu exclusivement pour une utilisation dans un environnement de laboratoire et par du personnel formé et qualifié.

Tous les utilisateurs doivent connaître les dangers liés au détecteur et aux substances qu'ils utilisent. Tous les utilisateurs doivent se conformer aux indications figurant sur les fiches de données de sécurité (FDS).

2.3.3 Personal Protective Equipment

- For English version, see below.
- For French version, see page 28.

English Version

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.

French Version

Portez des équipements de protection individuelle et suivez les bonnes pratiques de laboratoire afin de vous protéger contre les substances dangereuses. L'adéquation de l'équipement de protection individuelle dépend des risques présentés par les substances. Pour des conseils concernant les dangers et l'équipement de protection requis pour les substances que vous utilisez, reportez-vous à la fiche technique de sécurité et de manipulation des substances fournie par le vendeur.

Une installation permettant de se rincer les yeux ainsi qu'un lavabo doivent se trouver à proximité du système. Si une substance, quelle qu'elle soit, entre en contact avec vos yeux ou votre peau, rincez abondamment la zone concernée à l'eau, puis consultez un médecin.

Vêtements de protection

Afin de vous protéger contre les éclaboussures chimiques, liquides dangereux ou toute autre contamination, portez des vêtements de protection appropriés, tels qu'une blouse de laboratoire.

Équipement de protection des yeux

Afin d'éviter les projections de liquides dans les yeux, portez un équipement de protection des yeux approprié, tel que des lunettes de protection avec écrans latéraux. En cas de risque de projection de liquides, portez des lunettes de sécurité.

Gants

Afin de vous protéger contre les liquides nocifs et d'éviter de vous blesser lors de la maintenance ou de l'entretien, portez des gants de protection appropriés.

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 HPLC system.

AVERTISSEMENT—Décharge électrique ou endommagement de l'instrument

Des tensions élevées sont présentes dans l'appareil et peuvent causer des chocs électriques ou endommager l'appareil.

- N'apportez aucune modification aux raccordements électriques ou aux bornes de mise à la terre.
- Si vous suspectez la présence d'un dommage électrique quelconque, débranchez le cordon d'alimentation et contactez le support technique de Thermo Fisher Scientific pour obtenir de l'aide.
- N'ouvrez pas le boîtier et ne retirez pas les capots de protection, à moins que cela ne soit expressément indiqué dans le présent manuel.
- Ne placez pas de réservoirs de liquides directement sur l'appareil. Le liquide peut s'écouler dans l'appareil et entrer en contact avec les composants électroniques, provoquant ainsi un court-circuit. Posez plutôt les réservoirs de liquides dans le bac à solvants disponible dans le système HPLC.

2.3.5 General Residual Hazards

- For English version, see below.
- For French version, see page 33.

English Version

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

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 detector 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 detector in the presence of flammable gases or fumes.

CAUTION—Escape of Hazardous Substances from PEEK Capillaries

In the HPLC 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, trichlormethane ($CHCl_3$), 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

Fused silica may be used in capillaries and tubes. To avoid personal injury always wear safety glasses when handling fused silica tubing, for example, when cutting fused silica tubing to length.

CAUTION—Allergic Reaction

Some capillaries in the HPLC 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.

French Version

Lors de l'utilisation du détecteur, veuillez prendre en considération les risques généraux liés aux substances chimiques :

AVERTISSEMENT—Substances dangereuses

Les solvants, phases mobiles, échantillons et réactifs peuvent contenir des substances toxiques, cancérigènes, mutagènes, infectieuses ou d'autres substances nocives. La manipulation de ces substances peut présenter des risques pour la santé et la sécurité.

- Assurez-vous de bien connaître les propriétés de toutes les substances que vous utilisez. Évitez l'exposition à des substances nocives. Au moindre doute concernant une substance, manipulez-la comme s'il s'agissait d'une substance potentiellement dangereuse.
- Portez des équipements de protection individuelle et suivez les bonnes pratiques de laboratoire.
- Réduisez le volume des substances au minimum requis pour l'analyse de l'échantillon.
- N'utilisez pas le détecteur dans un environnement potentiellement inflammable.
- Évitez d'accumuler les substances nocives. Assurez-vous que le lieu d'installation est bien ventilé.
- Éliminez les déchets dangereux de manière écologique, conformément à la règlementation en vigueur au niveau local. Suivez un programme d'élimination des déchets réglementé et approuvé.

AVERTISSEMENT—Danger biologique

Les matériaux d'origine humaine, tels que les microorganismes, les cultures cellulaires, les tissus, les fluides corporels et autres agents biologiques, peuvent transmettre des maladies infectieuses. Pour éviter les infections par ces agents :

- Partez du principe que toutes les substances biologiques sont, tout du moins potentiellement, infectieuses.
- Portez des équipements de protection individuelle et suivez les bonnes pratiques de laboratoire.
- Éliminez les déchets biologiques dangereux de manière écologique, conformément à la règlementation en vigueur au niveau local. Suivez un programme d'élimination des déchets réglementé et approuvé.

AVERTISSEMENT—Auto-inflammation des solvants

Les solvants possédant une température d'auto-inflammation inférieure à 150 °C peuvent s'enflammer au contact d'une surface chaude (par exemple, suite à une fuite dans le système chromatographique). Évitez d'utiliser ces solvants.

AVERTISSEMENT—Gaz dangereux

Certains échantillons et phases mobiles peuvent contenir des solvants volatiles ou inflammables. La manipulation de ces substances peut présenter des risques pour la santé et la sécurité.

- Évitez l'accumulation de ces substances. Assurez-vous que le lieu d'installation est bien ventilé.
- Évitez la proximité des flammes nues et des sources d'étincelles. N'utilisez pas le détecteur en présence de gaz ou de vapeurs inflammables.

ATTENTION—Fuite de substances dangereuses provenant de capillaires en PEEK

L'utilisation de capillaires en polyétheréthercétone (PEEK) est autorisée dans le système HPLC. Le gonflement ou l'exposition à des acides peuvent provoquer une fuite dans les capillaires en PEEK ou leur éclatement.

- Certaines substances chimiques, telles que le chloroforme ($CHCl_3$), le diméthyle sulfoxyde (DMSO) ou le tétrahydrofuranne (THF), peuvent provoquer un gonflement du PEEK.
- Certains acides concentrés, tels que l'acide sulfurique et l'acide nitrique, ou un mélange d'hexane, d'acétate d'éthyle et de méthanol, peuvent endommager le PEEK.
- Ces acides peuvent cependant être utilisés dans le cadre de procédures de nettoyage, à condition que l'exposition soit brève.
- Pour plus d'informations, reportez-vous à la documentation technique relative à la résistance chimique du PEEK.

ATTENTION

La silice fondue est utilisée dans cellules d'écoulement et dans les capillaires. Pour éviter tout risque de blessure, portez toujours de lunettes de sécurité en cas de manipulation de tubes de silice, par exemple, lorsque vous coupez des tubes de silice.

ATTENTION—Réaction allergique

Certains capillaires du système HPLC sont composés de MP35N™, un alliage à base de nickel et de cobalt. Le contact avec la peau peut provoquer des réactions allergiques chez les personnes sensibles au nickel ou au cobalt.

ATTENTION—Risque d'étincelles par décharge électrostatique

Les liquides circulant dans les capillaires peuvent générer de l'électricité statique. Cet effet se manifeste en particulier avec les capillaires isolants et les solvants non conducteurs (par exemple, l'acétonitrile pur). Une décharge d'énergie électrostatique peut provoquer la formation d'étincelles, ce qui peut présenter un risque d'incendie. Évitez la génération d'électricité statique à proximité du système chromatographique.

2.3.6 In Case of Emergency

WARNING—Safety Hazard

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

AVERTISSEMENT—Risque pour la sécurité

En cas d'urgence, débranchez le détecteur de la ligne électrique.

2.4 Solvent and Additive Information

To protect optimal functionality of the charged aerosol detector, observe these recommendations on the use of solvents and additives:

- Use only solvents and additives that are compatible with all parts in the flow path.
  For details about the materials that are used in the flow path of the detector, see the *Specifications* chapter. For information about the materials that are used in the flow path of the other modules in the HPLC system, refer to the specifications in the *Operating Manual* for the module.
- Observe the *Mobile Phase Guidelines for the Detector* in section 6.5.1, page 123.
- Follow any specific recommendations presented in other sections of this manual. Refer also to the *operating manuals for all modules in the HPLC system*. They may provide additional guidelines and information.

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. For details, see section 11.1, page 248.

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.

3 Detector Overview

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

3.1 Detector Features

The detector comprises the following main features:

- Charged aerosol detection (CAD) method for liquid chromatography for detection of all non-volatile and many semi-volatile analytes
- Detection based on measuring charge that is proportional to the amount of analyte, and, for non-volatile analytes, independent of the chemical structure of the analyte
  In comparison to UV detection, a chromophore is not required for detection, and in comparison to mass spectrometry, ionization of the analyte is not necessary.
- Detection with great sub-nanogram sensitivity and a wide dynamic range
- FocusJet™ nebulizer with concentric design for extended low pump flow rate range
- Adjustable evaporation temperature for optimization of analyte response and use with a wider range of eluents
  - Corona Veo RS detector: Adjustable range for the evaporation temperature
  - Corona Veo detector: Selectable evaporation temperatures
- Fast data sampling for full compatibility with HPLC and UHPLC applications
- Detector control by the Chromeleon Chromatography Management System for high degree of system integration, as well as maximum analysis efficiency due to comprehensive data analysis and evaluation features in Chromeleon

3.2 Operating Principle

The detector is designed for charged aerosol detection with full compatibility in HPLC and UHPLC applications. In charged aerosol detection, an aerosol of dried analyte particles is formed after nebulization of column eluate. Electrical charge is imparted to these dried particles. The detector then measures the charge. Measured charge is proportional to the amount of analyte in the sample.

The following picture shows the interior components of the detector, and illustrates how the detector operates:

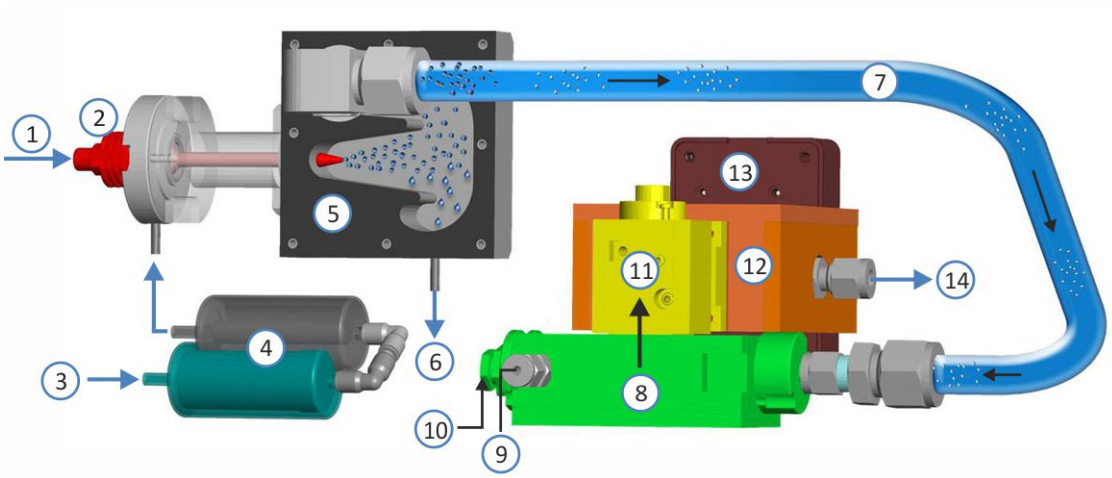


Figure 1: Operating principle of the detector

No.	Description	No.	Description
1	Mobile phase from column	8	Mixing chamber
2	Nebulizer	9	Charger gas inlet
3	Gas inlet	10	Corona charger
4	Gas filters	11	Ion trap
5	Spray chamber	12	Electrometer
6	Drain pump	13	Electrometer board
7	Evaporation tube	14	Gas exhaust

Mobile phase from the column enters the detector (no. 1) and flows to the nebulizer (no. 2). Pressurized gas streams through the gas inlet (no. 3) and passes through the charcoal gas filter and then the HEPA gas filter (no. 4). In the nebulizer (no. 2), the filtered gas and the mobile

phase merge at the nebulizer tip to create an aerosol within the spray chamber (no. 5).

The largest aerosol droplets condense within the spray chamber (no. 5) and are removed by the drain pump (no. 6) through the waste outlet. Smaller droplets pass into a temperature-controlled evaporation tube (no. 7), in which solvent and more volatile components are vaporized.

By the end of the evaporation tube, the resulting aerosol particles enter the mixing chamber (no. 8), where they collide with a secondary stream of ionized gas (no. 9) that has passed through a corona charger (no. 10). Each dried aerosol particle undergoes surface diffusional charging, where the level of charge per particle is proportional to particle size and the cumulative charge of the population is directly related to the analyte amount.

In the ion trap (no. 11), higher mobility ions and smaller charged particles are removed. Lower mobility charged particles pass to a conductive filter and aggregate charge is measured with a sensitive electrometer (no. 12). Signal is processed by the electrometer board (no. 13) and sent to the chromatography data system. The resulting gas flow exits the detector through the gas exhaust (no. 14).

3.3 Interior Front Components

On the front, the detector provides easy access to the user-accessible components:

Figure 2: Front view of the detector (here: Corona Veo RS)

No.	Description
1	Liquid-crystal color display with integrated touch screen
2	Power LED
3	Leak tray (drip tray)
4	Drain ports (for leak and waste)
5	Leak sensor
6	*Corona Veo RS only* Stream-switching valve The Corona Veo RS detector is equipped with a 6-port 2-position stream-switching valve (SSV). The valve can be used to direct flow to the nebulizer or to external devices or to a waste reservoir.
7	Nebulizer (after installation) For details on the nebulizer, see section 3.4, page 44.
8	Capillary slots
8a	On the side of the white front cover
8b	On the top of the white front cover

3.4 Nebulizer

The FocusJet nebulizer is the liquid flow inlet of the charged aerosol detector. Eluate from the column flows into the nebulizer and merges with filtered gas that is supplied to the nebulizer. Due to the concentric flow design of the nebulizer, an aerosol is produced within the spray chamber.

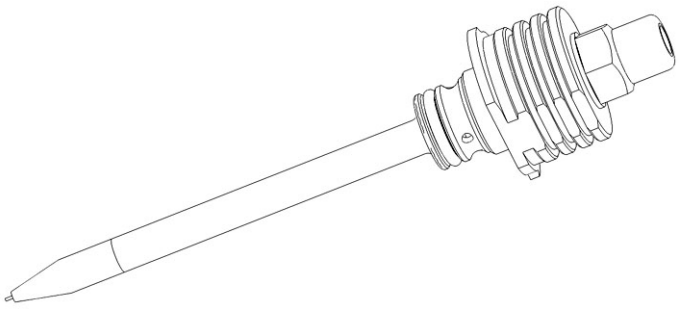


Figure 3: FocusJet nebulizer

3.5 Gas Filter Assembly

An assembly of two gas filters on the inner right side panel of the detector filters the supplied gas internally before it is used in the detector. The gas filters consist of a charcoal filter and a high-efficiency particulate air (HEPA) filter. Gas supplied through the gas inlet of the detector is first filtered in the charcoal gas filter (bottom filter) and then in the HEPA gas filter (top filter).

Sufficient filtering of the supplied gas, both externally and internally, ensures that the gas is clean and free from micro particles.

3.6 Excess Liquid and Leak Detection

As leaks are a potential safety issue, sensors in the charged aerosol detector monitor the following:

- Excess liquid inside the detector gas flow path
  The liquid sensor inside the detector detects any liquid that accumulates inside. When excess liquid is present, the liquid sensor is activated.

  When the liquid sensor detects excess liquid (flooding) inside the detector,

  - A critical error code appears on the detector display and beeping starts to alert you.
  - The detector will exit the **Run Mode**.
    If you operate the detector from a chromatography software, the running sequence (or batch) is aborted.
  - If the **Pump Off** relay is connected to the pump, the pump will stop mobile phase flow.
  - If not already turned on, the drain pump is turned on automatically.
  - *Corona Veo RS:* The stream-switching valve will actuate and divert the liquid flow away from the detector.

  Follow the instructions in this manual to find and eliminate the source for the leakage.

- Liquid leaks
  The leak sensor in the leak tray detects liquid leaks from flow connections. The liquid is collected in the leak tray and guided to the leak port on the right side of the detector. From the leak port, the liquid is guided to a waste reservoir.

  When the leak sensor detects leakage, a warning code appears on the display and beeping starts to alert you. Follow the instructions in the *Troubleshooting* chapter to find and eliminate the source for the leakage.

3.7 Software Operation

The detector is designed to be operated from the integrated touch-screen display or a computer configured with a chromatography software, such as the Chromeleon Chromatography Data System (CDS). The Chromeleon software provides complete instrument control, data acquisition, and data management.

TIP The charged aerosol detector can be operated also with other chromatography data systems. 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 detector and informs you about the scope of delivery.

4.1 Unpacking

Damaged Packaging, Defective on Arrival

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

If you suspect that the detector 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 the Detector

CAUTION—Heavy Load, Bulky Device

The detector is too heavy or bulky for one person alone to handle safely. To avoid personal injury or damage to the detector, observe the following guidelines:

- Physical handling of the detector, including lifting or moving, requires a team effort of two persons.
- A team effort is in particular required when lifting the detector into the system stack or when removing it.
- To lift or move the detector, grasp the detector by the sides. Do not move or lift the detector by the front bezel or white cover. This will damage the bezel or the detector.

ATTENTION—Charge lourde, instrument encombrant

Le détecteur est trop lourd ou encombrant pour être soulevé en toute sécurité par une seule personne. Afin d'éviter toute blessure corporelle ou détérioration du détecteur, veuillez respecter les consignes suivantes :

- Le maniement physique du détecteur, notamment son soulèvement ou son déplacement, requiert la présence d'au moins deux personnes.
- La présence de plusieurs personnes est requise en particulier pour placer le détecteur dans le système empilé ou pour l'en retirer.
- Pour lever ou transporter le détecteur, saisissez-le par les côtés. Ne déplacez pas ou ne levez pas le détecteur par le panneau avant. Cela risque d'endommager le panneau avant ou le détecteur.

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 detector by the sides. Slowly and carefully, pull the detector out of the shipping container and place it on a stable surface.
4. Remove the foam spacers and then the polythene packaging from the detector.
5. Place the detector on a stable surface.
6. Transport the detector to the installation site, if it is not already there, and place it in the system stack (see section 5.5.1 System Arrangement with an UltiMate 3000 System, page 67).

TIP Keep the shipping container and all packing material. These items will be needed if the detector is transported to a new location or shipped.

4.2 Scope of Delivery

The following items are included in the delivery:

- Detector with nebulizer
- Ship Kit
  For details about the kit content, see section 10.2 Ship Kit, page 241.
- Operating manual
- Power cord

5 Installation

This chapter specifies the requirements for the installation site and describes how to set up, install, and configure the detector in the HPLC system.

5.1 Safety Guidelines for Installation

Pay attention to the following safety guidelines:

Observe all warning messages and precautionary statements presented in section 2.3 Safety Precautions (see page 23).

CAUTION—Heavy Load, Bulky Device

The detector is too heavy or bulky for one person alone to handle safely. To avoid personal injury or damage to the detector, observe the following guidelines:

- Physical handling of the detector, including lifting or moving, requires a team effort of two persons.
- A team effort is in particular required when lifting the detector into the system stack or when removing it.
- To lift or move the detector, grasp the detector by the sides. Do not move or lift the detector by the front bezel or white cover. This will damage the bezel or the detector.

ATTENTION—Charge lourde, instrument encombrant

Le détecteur est trop lourd ou encombrant pour être soulevé en toute sécurité par une seule personne. Afin d'éviter toute blessure corporelle ou détérioration du détecteur, veuillez respecter les consignes suivantes :

- Le maniement physique du détecteur, notamment son soulèvement ou son déplacement, requiert la présence d'au moins deux personnes.
- La présence de plusieurs personnes est requise en particulier pour placer le détecteur dans le système empilé ou pour l'en retirer.
- Pour lever ou transporter le détecteur, saisissez-le par les côtés. Ne déplacez pas ou ne levez pas le détecteur par la porte avant. Cela risque d'endommager la porte ou le détecteur.

5.2 Installing the Detector

The detector is installed and set up by a Thermo Fisher Scientific service engineer. The service engineer checks that the installation is correct and that the detector operates as specified. The engineer also demonstrates the basic operation and main features.

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

1. Pay attention to the safety guidelines and observe all site requirements.
   For the safety guidelines when installing the detector, see section 5.1, page 52. For the site requirements, see section 5.3, page 55.
2. Set up the detector hardware. See section 5.5, page 67.
3. Set up the flow connections. See section 5.6, page 81.
4. Turn on the detector. See section 5.7, page 98.
   Adjust the display brightness and date and time as required.
5. *Installation in the Chromeleon software (optional)*
   When the display shows the **Main Menu** after the self-test, set up the detector in the software. See section 6.8.1, page 148.

TIP Before turning on the power to the detector 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.

6. Set the nebulizer gas pressure. See section 6.5.2, page 129.
7. *Recommended:*
   Perform Instrument Installation Qualification.

   In Chromeleon, a wizard is available to guide you through the qualification process:

   - On the Chromeleon 7 Console: Click **Tools > Instrument Qualification > Installation Qualification**.

- In the Chromeleon 6.8 Browser: Click **Qualification > Instruments IQ**.

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

NOTICE If the detector 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.

AVIS Si le détecteur est utilisé avec un autre système de gestion de données, consultez la documentation du logiciel que vous utilisez et/ou exécutez la qualification manuellement.
Le manuel *Instruments Installation Qualification Operating Instructions* fournit des informations sur les paramètres à adapter et sur les paramètres nécessaires.

8. *Recommended:*
   Perform Operational Qualification.

   The qualification kit includes all materials required for the qualification and detailed instructions.

Before using the detector for sample analysis, prepare the system and the detector for operation. See section 6.5, page 121.

Moving the Detector after Installation

If you have to move the detector after it has been set up and installed in the HPLC system, prepare the detector for transport and move it to the new location. Follow the instructions in section 7.12 Removing the Detector from the System Stack, page 200.

5.3 Site Requirements

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

5.3.1 Workbench

The detector is designed to be placed in the HPLC system. The HPLC system is designed to be placed on a workbench. If the workbench shall carry a complete HPLC system and possibly other instruments, the bench must be capable to bear the weight of all devices and instruments, including solvents.

For dimensions and weight of the detector, see chapter 9 Specifications, page 235.

Provide a sturdy workbench of a height that ensures convenient access to the interior of each device in the system. The workbench must stand in a secure and level position that is free of vibrations. The bench top must be dry, clean, and resistant to chemicals.

Allow sufficient free space on the sides and on the rear of the system for electrical connections and for proper air circulation. Allow at least 15 cm of clearance on the rear, at least 5 cm of clearance on each side, and at least 30 cm of clearance above the top.

Make sure that the power switch and power cord can be easily reached at any time.

5.3.2 Power Considerations

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

To avoid power fluctuations, the use of an uninterruptible power supply (UPS) is recommended.

A common ground for all system modules will avoid ground loops, which can create erratic results (for example, high baseline noise).

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. Therefore, connect the device to the specified line voltage only.
- Never connect the device to a power socket that is shared with other equipment (for example, multiple sockets).
- Do not use defective multiple socket or extension cords, as they could result in personal injury 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. Therefore, always unplug the power cord before starting repair work inside the device. If you were instructed to remove any covers or panels, do not connect the power cord to the device while the cover or panels are removed.

ATTENTION—Décharge électrique ou endommagement de l'instrument

- Le branchement de l'appareil à une tension supérieure ou inférieure à celle spécifiée présente un risque d'accident pour l'utilisateur ou de détérioration pour l'appareil. Par conséquent, branchez l'appareil uniquement à la tension spécifiée.
- Ne branchez jamais l'appareil à une prise électrique partagée avec d'autres appareils (telle qu'une prise multiple).
- N'utilisez pas de prises multiples ou de rallonges électriques défectueuses, celles-ci présentent un risque d'accident pour l'utilisateur ou de détérioration pour l'appareil.
- Lorsque l'appareil est éteint, il n'est pas complètement isolé électriquement tant que le cordon d'alimentation est branché. Réaliser des réparations alors que l'appareil est connecté à l'alimentation électrique peut entraîner des accidents corporels. Débranchez donc toujours le cordon d'alimentation avant de procéder à des travaux de réparation à l'intérieur de l'appareil. Si vous devez enlever des capots ou des panneaux, ne branchez pas le cordon d'alimentation à l'appareil tant que les panneaux et les capots sont déposés.

5.3.3 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 defective multiple socket or extension cords, as they could result in personal injury or damage to the device.
- 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.

AVERTISSEMENT—décharge électrique ou endommagement de l'instrument

- N'utilisez jamais de cordons d'alimentation autres que ceux fournis par Thermo Fisher Scientific pour l'appareil.
- Utilisez uniquement un cordon d'alimentation conçu pour le pays dans lequel vous utilisez l'appareil.
- N'utilisez pas de prises multiples ou de rallonges électriques défectueuses, celles-ci présentent un risque d'accident pour l'utilisateur ou de détérioration pour l'appareil.
- Ne branchez jamais l'appareil à une prise électrique partagée avec d'autres instruments (prises multiples par exemple).
- Utilisez l'appareil uniquement avec une prise d'alimentation avec borne de terre protectrice.
- En cas d'urgence, le cordon d'alimentation doit être facilement accessible à tout instant afin de pouvoir débrancher l'appareil de l'alimentation électrique.

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.

AVERTISSEMENT—Décharge électrique ou endommagement d'un produit

Une mauvaise utilisation des cordons d'alimentation peut entraîner des accidents corporels ou une détérioration de l'appareil. Utilisez les cordons d'alimentation fournis par Thermo Fisher Scientific uniquement pour l'usage auquel ils sont destinés. Ne les utilisez pas à d'autres fins, par exemple pour connecter d'autres instruments.

5.3.4 Condensation

NOTICE Condensation in the device can damage the electronics. Therefore, 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 detector to the power line.

AVIS La présence de condensation dans l'appareil peut endommager l'électronique.
Par conséquent, prévenez ou minimisez les conditions pouvant entraîner la formation de condensation dans l'appareil lors de son utilisation, de son expédition ou de son entreposage. Par exemple, évitez les changements rapides ou importants des conditions de l'environnement de travail.
Si vous suspectez la présence de condensation, laissez l'appareil se réchauffer à température ambiante. Ce processus peut durer plusieurs heures. Patientez jusqu'à disparition complète de la condensation avant de brancher le détecteur à la ligne électrique.

5.3.5 Operating Conditions

When operating the detector, make sure that the installation site meets these general environmental and operating conditions:

Temperature

Temperature fluctuations can affect the performance of the detector. Avoid locations with significant changes in temperature and strong air drafts. For example, do not place the detector in the direct sunlight, near heating or cooling sources, or under an air duct.

Humidity

The relative humidity of the operating environment is important for the performance of the detector. Operate the detector in the specified humidity range, with no condensation.

When the humidity is too high, condensation may occur, causing damage to the electronic components in the detector. When the humidity is too low, static electricity may accumulate and discharge, shortening the life of the electronic components.

Ventilation

Make sure that the installation site is well ventilated at any time to avoid potential health hazards and safety risks, which may be caused by handling hazardous substances, volatiles or gases.

Vibration

Vibrations may affect the performance of the detector. Therefore, the installation site should be free of vibrations. Avoid placing the detector in locations where vibrations are caused by other instruments.

5.3.6 Gas Ventilation

CAUTION—Hazardous Fumes

The exhaust gas of the detector may contain hazardous fumes that pose health and safety risks. Avoid an accumulation of gas. The exhaust gas must always be removed by proper ventilation. Make sure that the installation site is well ventilated. Do not vent directly into the laboratory.

ATTENTION—Vapeurs dangereuses

Le gaz de sortie du détecteur peut contenir des vapeurs dangereuses pouvant présenter des risques pour la santé et la sécurité. Évitez toute accumulation de gaz. Le gaz de sortie doit être systématiquement éliminé par une ventilation appropriée. Assurez-vous que le lieu d'installation est bien ventilé. Ne dégazez pas directement dans le laboratoire.

NOTICE A vacuum in the ventilation can cause a depressurization inside the detector. This can impair detector operation and lead to a decreased performance. Avoid a vacuum or a negative pressure in the ventilation of the detector.

AVIS Un vide dans la ventilation peut provoquer une dépressurisation à l'intérieur du détecteur. Ceci peut détériorer le fonctionnement du détecteur et résulter en une baisse des performances. Évitez tout vide ou pression négative dans la ventilation du détecteur.

Make sure that the location fulfils the following requirements for the gas ventilation from the detector:

- Operate the detector nearby the gas supply and ventilation sources.
- Ventilation must be at atmospheric pressure with no vacuum or negative pressure applied.
- Install the detector in a well-ventilated laboratory. Exhaust gases (including carrier gas, vaporized eluents and solute micro particles) exit on the rear side of the detector through the gas exhaust port. The exhaust gas may contain volatile organic compounds in low concentration. Make sure that the detector is properly vented. Direct the gas exhaust tubing to a fume hood or connect it to another ventilation device.

5.3.7 Gas Supply

CAUTION—Explosion Hazard or Damage to the Detector

When using tetrahydrofuran (THF), the use of air as supplied gas may pose an explosion hazard. This can pose a safety and health risk and damage the detector. Always use nitrogen with tetrahydrofuran or other highly combustible solvents.

ATTENTION—Danger d'explosion ou endommagement de l'instrument

Lors de l'utilisation de tétrahydrofuranne (THF), l'utilisation d'air pour l'alimentation de gaz peut entraîner un danger d'explosion. Ceci peut constituer un risque pour la sécurité et la santé, et endommager le détecteur. Utilisez toujours de l'azote avec le tétrahydrofuranne ou d'autres solvants hautement combustibles.

CAUTION—Excessive Gas Supply Pressure

An improper or excessive gas supply pressure can lead to an overpressure in the detector that can cause the safety valve in the detector to release gas. In extreme cases, the excessive pressure can cause the gas filters to rupture. This can pose a health and safety risk.

- Observe the gas supply pressure range that is specified for the detector. Do not exceed the maximum gas supply pressure.
- If you use high-pressure gas cylinders as gas supply, double-check the regulator outlet pressure to ensure that it is within the gas supply specifications of the detector. This is especially important when attaching the gas bottle for the first time and when changing gas bottles.
- If the overpressure relief valve is releasing gas as a result of an overpressure in the detector during operation, turn off the detector immediately. Remedy the situation as described in the *Resolving Gas Supply Overpressure* section in this manual.

ATTENTION—Pression d'alimentation de gaz excessive

Une pression d'alimentation de gaz inappropriée ou excessive peut conduire à une surpression dans le détecteur, ce qui peut amener la soupape de sécurité dans le détecteur à libérer du gaz. Dans des cas extrêmes, la pression excessive peut conduire à une rupture des filtres de gaz. Ceci peut présenter un risque pour la santé et la sécurité.

- Respectez la plage de pressions d'alimentation de gaz spécifiée pour le détecteur. Ne dépassez pas la pression d'alimentation de gaz maximale.
- Si vous utilisez des cylindrés de gaz de haute pression comme alimentation de gaz, contrevérifiez le régulateur de pression de sortie afin d'assurer qu'il se trouve dans les limites de la plage autorisée de le l'alimentation en gaz du détecteur. Ceci est particulièrement important lorsque vous raccordez des bouteilles de gaz pour la première fois et lors du remplacement des bouteilles de gaz.
- Si la soupape de surpression libère du gaz suite à une surpression dans le détecteur lors de l'utilisation, mettez immédiatement le détecteur hors tension. Remédiez à la situation comme décrit dans la section 8.5.3, page 224 de ce manuel.

CAUTION—Gas Filter Rupture upon Excessive Gas Supply Pressure

An excessive supply gas pressure can lead to an overpressure in the detector and can cause the gas filters to rupture. This can pose a health and safety risk.

- Turn on the gas supply only when the gas filters are properly connected to the detector and the protective cover is properly installed.
- Observe the gas supply pressure range that is specified for the detector. Do not exceed the maximum gas supply pressure.
- Before you start the replacement of the gas filter assembly, make sure that the gas supply and the detector gas flow are turned off.
- Observe the *Gas Supply Site Requirements* in this manual.

ATTENTION—Rupture de filtre à gaz suite à une pression d'alimentation de gaz excessive

Une pression d'alimentation de gaz excessive peut conduire à une surpression dans le détecteur, ce qui peut provoquer une rupture des filtres à gaz. Ceci peut présenter un risque pour la santé et la sécurité.

- Démarrez l'alimentation de gaz uniquement lorsque les filtres à gaz sont correctement raccordés au détecteur et lorsque le capot de protection est correctement installé.
- Respectez la plage de pressions d'alimentation de gaz spécifiée pour le détecteur. Ne dépassez pas la pression d'alimentation de gaz maximale.
- Assurez-vous que l'alimentation de gaz et le débit de gaz du détecteur sont éteints avant de commencer à remplacer le bloc de filtration de gaz.
- Observez les exigences de lieu relatif à l'alimentation de gaz dans ce manuel.

NOTICE—Gas Specifications

The requirements and specifications for the gas supplied to the detector have major impact on the detector performance. Observe the following notes:

- If the gas supply pressure is varying or dropping below the specified pressure range, it can impair the performance of the detector or even damage the detector.
- Non-volatile hydrocarbons, such as compressor oils, in the gas supplied to the detector can cause permanent damage to the detector.
- If the supply gas is contaminated with particles (size ≥ 0.1 µm), water vapor or other non-volatile substances, it can impair the performance or even damage the detector.
- Observe all requirements and specifications for the supply gas in this manual to avoid damage to the detector.

AVIS—Spécifications relatives aux gaz

Les exigences et spécifications relatives à l'alimentation de gaz pour le détecteur ont un impact majeur sur les performances du détecteur. Respectez les avis suivants :

- Si la pression d'alimentation de gaz varie ou tombe au-dessous de la plage de pressions spécifiée, ceci peut détériorer les performances du détecteur, voire endommager celui-ci.
- Les hydrocarbures non volatils, comme les huiles de compresseur, présents dans l'alimentation de gaz vers le détecteur peuvent provoquer un endommagement permanent de l'appareil.
- Si l'alimentation de gaz est contaminée par des particules (taille ≥ 0,1 µm), de la vapeur d'eau ou d'autres substances non volatiles, ceci peut provoquer une détérioration des performances, voire endommager le détecteur.
- Respectez les exigences et spécifications relatives à l'alimentation de gaz données dans ce manuel afin d'éviter tout endommagement du détecteur.

Make sure that the location fulfils the following requirements:

- The gas supply and the gas supply pressure for the detector must meet the gas specifications in the *Specifications* section.
- Make sure that the gas supply is regulated to a stable gas pressure that is within the specified gas pressure range.
- The gas supplied to the detector must be either air or nitrogen. Do not use helium or other supply gases.
- Nitrogen gas (typically ≥ 95% nitrogen purity) is recommended for most applications. Air may be used when working with mobile phases of low combustibility.
- With highly combustible mobile phases, such as tetrahydrofuran (THF) and other ethers and ketones, use only nitrogen as supply gas.

- The use of a non-bottled gas source is recommended, such as
  - A nitrogen generator with suitable air compressor or with a suitable in-house air source
  - Medical-grade nitrogen from an in-house liquid nitrogen source

TIP Use of smaller compressed nitrogen cylinders or liquid nitrogen containers may be a quick and easy source of nitrogen during installation. However, it is not recommended for routine operation.

- The gas consumption of the detector is typically ≤ 4 L/min.
- The supply gas must be free from water vapor, free from particles, and must not contain non-volatile hydrocarbons, such as compressor oils.
  If necessary, use a sub-micron particle filter or carbon filter in combination with a water condensation trap located close to the gas source.
- Make sure that the gas supply is ready for operation. Follow the instructions in the *User Documentation* for the gas supply.

5.4 Accessing the Front Components

On the right side of the interior front panel, magnets secure the white front cover. On the left side of the cover, a tab slides into a slot on the black front bezel.

To access the interior components in the detector, remove the white cover on the right side of the front panel. To allow easy access from the front, the user-accessible components and flow connections in the detector are located directly behind the white cover.

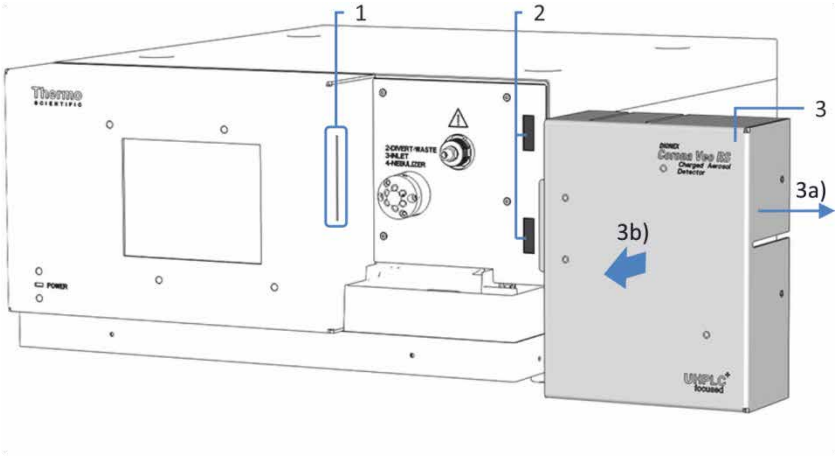


Figure 4: Removing the white front cover (here: Corona Veo RS)

No.	Description
1	Slot in the black front bezel to secure the white front cover
2	Magnets for attachment of the white front cover
3	White front cover To remove the cover:
3a	Slide to the right
3b	Take off from the detector

5.5 Setting Up the Hardware

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

5.5.1 System Arrangement with an UltiMate 3000 System

If the detector is part of an UltiMate 3000 system, for example for analytical HPLC applications, stack the individual modules as shown below.

The system arrangement may vary depending on the system configuration.

No.	Description
1	Solvent Rack (optional)
2	Pump
3	Autosampler
4	Column Compartment
5	Charged Aerosol Detector

Figure 5: UltiMate 3000 system configuration with charged aerosol detector (example for system arrangement)

Positioning the Detector in the System Stack

The arrangement of the system modules depends on the application.

Observe the following guidelines:

- Place the charged aerosol detector in a position so that the connections between column outlet and nebulizer inlet are minimized.
  A short distance between column outlet and nebulizer inlet reduces post-column band broadening effects and optimizes chromatographic resolution.
- *In UltiMate 3000 systems*
  If the charged aerosol detector is the only detector in the UltiMate 3000 system stack, follow these steps:

  1. To position the charged aerosol detector, grasp the detector by the sides (in team effort) and position the detector on the workbench. Place the detector in the lowest position in the system stack.

  2. Set up the system stack above the charged aerosol detector (see Figure 5 on page 67).
     For cable connections in an UltiMate 3000 system with a Corona Veo (RS) detector, see section 5.5.2, page 69.

- If an optical detector is used in addition to the charged aerosol detector, the system arrangement may vary.
  For details on series or parallel flow configurations with the charged aerosol detector, see section 5.6.5.3, page 94.

5.5.2 Setting Up Cable Connections to the Detector

The following connectors and components are provided on the detector rear panel:

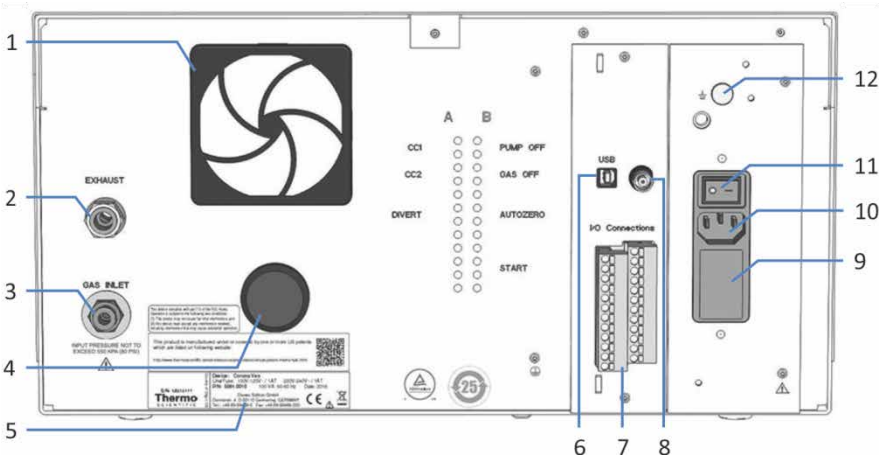


Figure 6: Rear panel of the detector (here: Corona Veo detector)

No.	Description
1	Cooling fan
2	Gas exhaust Allows connection to ventilation.
3	Gas inlet Allows connection to a gas supply.
4	*Corona Veo only* Manual gas regulator knob Adjustment knob that allows regulating the nebulizer gas pressure For Corona Veo RS detectors, a plug is installed instead.
5	Rating plate, indicating the serial number, part number, module name, line and fuse rating, and the manufacturer's address
6	USB (Universal Serial Bus) port ("B" type connector) Allows connection (USB 1.1 and 2.0 compatible) to other modules in the system, such as UltiMate 3000 modules, or the computer on which the data management system is installed, such as the Chromeleon software.
7	I/O connection terminals 2 terminals with TTL inputs and relay outputs that allow connection to external devices. For example, between charged aerosol detector and pump to enable direct communication in case of an operating issue. Certain problems in the charged aerosol detector cause an automatic stop of the pump flow to prevent a build-up of excess liquid inside the detector.

No.	Description
8	Analog signal output (optional) Installable option to connect a suitable coaxial cable when digitalized data output over the USB port to a compatible chromatography software is not available • Carries a signal from 0-1 V that is proportional to the current that is being measured • Uses a BNC connector (Bayonet Neill-Concelman) For installation details, see the *Installation Instructions* in the Analog Signal Output Kit.
9	Fuse holder
10	Power-inlet connector
11	Main power switch (on/off control)
12	Functional grounding

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.

Connecting the Detector

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 detector.

AVIS

- N’utilisez jamais de câbles de communication défectueux. Si vous suspectez qu’un câble est défectueux, remplacez-le.
- Afin d’assurer un fonctionnement sans accroc, utilisez uniquement les câbles fournis par Thermo Fisher Scientific pour connecter le détecteur.

1. Place the detector in the system as required by the system configuration. For details, see section 5.5.1 System Arrangement with an UltiMate 3000 System, page 67.
2. Verify that the power switch on the detector is set to OFF.
3. Connect the power cord to the power-inlet connector on the detector.

NOTICE Before connecting the detector to the power line, be sure that no condensation is present in the device. Condensation in the device can damage the electronics. 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 completely gone before proceeding.

AVIS Assurez-vous de l'absence de condensation dans l'appareil avant de brancher le détecteur à la ligne électrique. La présence de condensation dans l'appareil peut endommager l'électronique. Si vous suspectez la présence de condensation, laissez l'appareil se réchauffer à température ambiante. Ce processus peut durer plusieurs heures. Patientez jusqu'à disparition complète de la condensation avant de poursuivre.

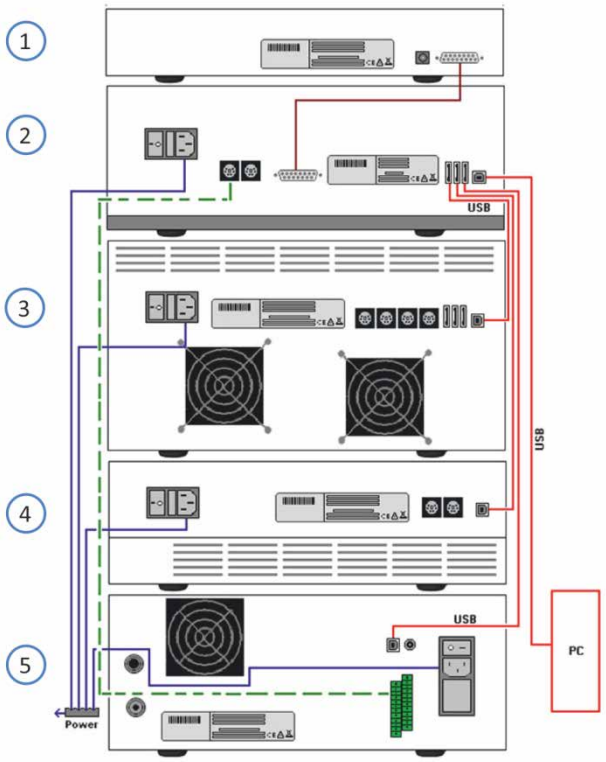
4. Connect the free end of the power cord to an appropriate power source.
5. Connect the interface cables to the detector:
   - For the USB cable, see section 5.5.2.2 page 73.
   - For the I/O connection cable, see section 5.5.2.3, page 74.

TIP For an overview of connections with an UltiMate 3000 system, see section 5.5.2.1, page 72.

5.5.2.1 Connections in an UltiMate 3000 System

If the detector is part of an UltiMate 3000 system, for example for analytical HPLC applications, interconnect the system modules on the rear panel as shown below.

Apart from the solvent rack, all modules in an UltiMate 3000 system can be connected separately to the computer via the USB port on the rear panel of the respective module. However, Thermo Fisher Scientific recommends interconnecting all modules, and then connecting the system to the computer with only one connection.



No.	Description
1	Solvent Rack (optional)
2	Pump
3	Autosampler
4	Column Compartment
5	Charged Aerosol Detector

Figure 7: Rear panel connections in an UltiMate 3000 system with charged aerosol detector (example)

Observe the information on connecting the individual detector ports in the following sections.

5.5.2.2 USB Port

This section describes how to connect the USB port of the detector to

- A data system computer to operate the detector from a chromatography software, such as the Chromeleon software

  –and/or–

- other system modules, such as UltiMate 3000 modules.

USB Connections

All USB connections require standard USB A-to-B type cable.

Figure 8: USB cable

The flat, rectangular end of the cable is the "A" connector. The smaller, hexagonal end is the "B" connector.

TIPS

- The USB standard limits the USB cable length to 3 meters. Each USB device can be separated from the computer or next USB hub by no more than 3 meters.
- *After* connecting the USB cables and *before* turning on the power to a device for the first time, verify that the chromatography software is installed on the computer. When the power is turned on, the required USB drivers are automatically found and the Windows™ operating system can detect the device.
- The USB port is USB 1.1 and USB 2.0 compatible.
- To ensure trouble-free operation, use only the cables shipped with the detector.
- The detector has no USB hub on its rear panel. Thus, it can only be connected to USB hubs of other modules in the UltiMate 3000 system or directly to the computer.
- *If the detector is to be operated in an UltiMate 3000 system*
  It is not possible to use the USB hub on the UltiMate 3000 autosampler for connection of the detector to the computer.

Connecting the USB Port

Depending on the connection option, follow the respective steps:

- *If the detector is to be connected directly to the chromatography software*
  Connect the detector to the data system computer via the USB port on the rear panel.

  For information about operation from the Chromeleon software, see section 6.8, page 148.
- *If the detector is to be operated in an UltiMate 3000 system*
  Connect the detector to an internal USB hub on the pump of the UltiMate 3000 series (except the LPG-3400XRS pump).
  - Thermo Fisher Scientific recommends connecting all modules to the pump, and then connecting the system to the computer via only one connection.
  - If the system includes a UV detector in addition to the charged aerosol detector, connect the UV detector directly to the computer.

5.5.2.3 *I/O Connection Terminals*

The detector is equipped with two I/O terminals for connection to

- a pump within the HPLC system, such as the UltiMate 3000 system, to establish the **Pump Off** connection

  –and/or–
- other external devices, which can synchronize their operation with the detector, such as an autosampler, a data station, or switching valves.

The terminals include 7 connection ports (4 TTL inputs and 3 relay outputs):

- I/O terminal A comprises 2 relay outputs and 1 TTL input
- I/O terminal B comprises 3 TTL inputs and 1 relay output

Parts and tools required

From the detector ship kit

- Digital I/O 2-conductor cable
- Slotted screwdriver

Preparations

Check the I/O capabilities of the device that you want to connect with the detector.

Follow these steps

1. Connect the wires of the cable to the pins of the terminal ports:

   a) With the slotted screwdriver, loosen the screw of the pin on the I/O terminal to which you want to connect a wire.

   b) Insert the loose wire into the pin.

   TIP Connect positive polarity, negative polarity and ground for proper functioning of the I/O connection.

2. Tighten the screw of the pin with the slotted screwdriver.
3. Connect the other end of the cable to the external device.

For the functions of the connector pins and the pin assignment of the I/O terminals, see section 11.2, page 252.

For details on the **Pump Off** I/O connection, see section 5.5.2.4, page 76.

5.5.2.4 Pump Off I/O Connection

The I/O connection terminals on the rear panel of the detector comprise a dedicated **Pump Off** output for connection to a pump within an HPLC system, such as the UltiMate 3000 system.

The **Pump Off** output provides a safety feature for the detector: If the gas supply to the detector is interrupted or stopped, the **Pump Off** output will be activated so that the detector sends a signal to the pump to stop the pump flow and avoid flooding of the detector.

Thermo Fisher Scientific recommends that you always connect the **Pump Off** output to the pump within an HPLC system.

To use the **Pump Off** safety feature, observe these guidelines for the pump:

- The support relay on the pump must be designed to stop liquid flow. Check the I/O capabilities of the pump before you connect the pump to the detector.
- For information about connecting an UltiMate 3000 pump (except the LPG-3400XRS pump, see below) to the **Pump Off** output of the detector, refer to *Chromeleon Help*.
- For information about connecting an UltiMate 3000 LPG-3400XRS pump to the **Pump Off** output of the detector, refer to the *Operating Instructions* for the LPG-3400XRS pump.
- For information about connecting other pumps to the **Pump Off** output of the detector, refer to the *Operating Instructions* of the respective pump.

5.5.3 Nebulizer Installation

For installation instructions of the FocusJet nebulizer, refer to the *Installation Guide* that is shipped with the nebulizer.

After the detector has been turned on, set the nebulizer gas pressure that is specified for your nebulizer. See section 6.5.1, page 123.

Observe the following safety guidelines for the nebulizer installation:

CAUTION—Sharp Tip of Nebulizer Capillary

The capillary inside the nebulizer that protrudes from the nebulizer tip is sharp and may be fragile. Touching the nebulizer capillary can cause personal injury and damage to the capillary. To avoid personal injury, always wear safety glasses when handling the nebulizer. Do not touch the nebulizer tip. Handle the nebulizer with care.

ATTENTION—Pointe acérée du capillaire de nébuliseur

Le capillaire en silice fondue à l'intérieur du nébuliseur fait saillie à partir de l'embout de nébuliseur. Ce capillaire est fragile et acéré ; ceci peut provoquer un risque d'accident corporel et d'endommagement du capillaire. Afin d'éviter de vous blesser, revêtez toujours des lunettes de protection lorsque vous manipulez le nébuliseur. Ne touchez pas l'embout du nébuliseur. Manipulez le nébuliseur avec précaution.

NOTICE—Sensitive Nebulizer

The nebulizer is highly sensitive to contamination and damage. Observe the following notes:

- The nebulizer is highly sensitive to contamination. Even minute particles on the nebulizer can lead to contamination and poor detector performance. Always wear clean-room gloves when you install or remove the nebulizer.
- The capillary inside the nebulizer may be fragile and subject to mechanical vibrations during transport. If the nebulizer was packaged separately, visually inspect the nebulizer surfaces and the nebulizer tip prior to installation.
- Operating the nebulizer with a gas pressure other than the pressure specified for this nebulizer can cause unpredictable deviations in performance of the nebulizer and the detector. After installation of the nebulizer, set the nebulizer gas pressure to the pressure that is specified for your nebulizer. The nebulizer gas pressure is defined on the gas pressure certificate that is shipped with the nebulizer.

AVIS—Nébuliseur sensible

Le nébuliseur présente une sensibilité élevée à la contamination et l'endommagement. Respectez les consignes de sécurité suivantes :

- Le nébuliseur présente une sensibilité élevée à la contamination. Même la présence de particules infimes sur le nébuliseur peut provoquer une contamination ou de mauvaises performances du détecteur. Lorsque vous installez ou retirez le nébuliseur, portez des gants pour salle blanche.
- Le capillaire à l'intérieur du nébuliseur est fragile et peut être soumis à des vibrations mécaniques lors du transport. Si le nébuliseur a été emballé séparément, inspectez visuellement les surfaces du nébuliseur et l'embout de nébuliseur avant l'installation. Pour des photos du nébuliseur, consultez la section ci-dessous.
- L'utilisation du nébuliseur avec une pression de gaz autre que la pression spécifiée peut aboutir à une perte de performance du nébuliseur et du détecteur. Après installation du nébuliseur, réglez la pression de gaz sur le nébuliseur sur la pression spécifiée pour votre nébuliseur. La pression de gaz sur le nébuliseur est définie sur le certificat de pression de gaz expédié avec le nébuliseur.

5.5.4 Connecting the Gas Inlet and Exhaust Tubes

This section describes the connection of the gas inlet and exhaust tubes to the detector.

Parts required

- Gas supply
- Ventilation appliance
- From the detector ship kit:
  - Gas exhaust tubing
  - Gas inlet tubing
  - If you wish to use a different gas inlet tubing with metric dimensions: Inch-to-metric adapter

Tools required

Tubing cutter (optional)

Preparations

1. Observe the site requirements for the gas supply and the ventilation (see section 5.3, page 55).
2. Check the gas tubes. Observe the following:
   - Use only the gas tubes that are shipped with the detector as well as additional or spare parts 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 gas tubes or connection unions that are stressed, nicked, kinked, or otherwise damaged.

Follow these steps

1. Connect the gas inlet tubing to the gas supply and route it to the detector.
2. Connect the gas exhaust tubing to the ventilation and route it to the detector. Make sure that the exhaust gas is removed by a fume hood or other proper ventilation appliance and does not vent directly into the laboratory.

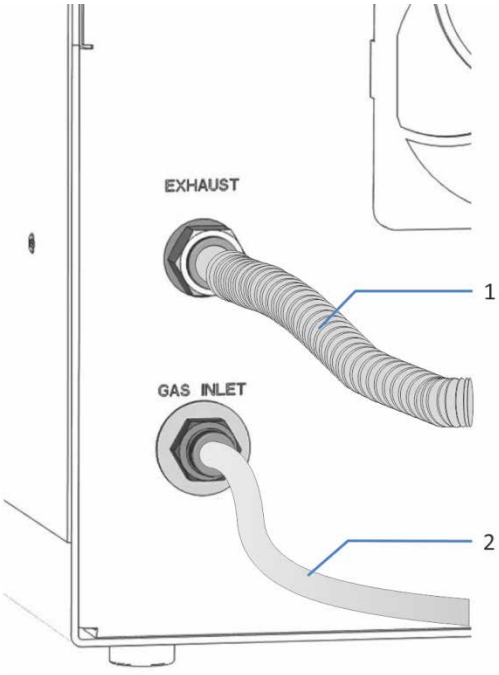
3. Check the length of the gas tubes.
   The gas tubes should go straight to the detector. If the gas tubes are longer than required, use a tubing cutter to cut the tubes to the required length.

   - Make sure that the cut is at a right angle to the length of the gas tubes.
   - A proper cut is especially important to provide a good connection to the push-in fitting on the gas inlet. Slanted or angular cuts can lead to gas leaks.

   TIP If you wish to use a different gas inlet tubing with metric dimensions, use the inch-to-metric adapter to connect the tubing to the gas inlet of the detector.

4. Connect the gas inlet tubing to the push-in fitting of the gas inlet on the rear panel of the detector.

5. Connect the gas exhaust tubing to the push-in fitting of the exhaust output of the detector.



No.	Description
1	Gas exhaust tubing
2	Gas inlet tubing

Figure 9: Gas inlet and exhaust on the detector

5.6 Setting Up the Liquid Flow Connections

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

5.6.1 Guidelines and Overview of Actions

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 section 2.3 Safety Precautions (see page 23).

Les raccordements fluidiques peuvent contenir des substances dangereuses. Respectez les messages d'avertissement et mentions de mise en garde figurant à la section 2.3 (reportez-vous à la page 23).

NOTICE *Before* you connect the charged aerosol detector in the system flow path:
When you install devices or components to the system, always flush them to waste before connecting them in the system flow path.
Flushing the charged aerosol detector will be performed later during equilibration.

AVIS *Avant* de raccorder le détecteur d'aérosols chargés au trajet d'écoulement du système :
Lorsque vous installez des appareils ou des composants dans le système, vidangez-les bien avant de les raccorder au trajet d'écoulement du système.
La vidange du détecteur d'aérosols chargés sera réalisée ultérieurement lors de l'équilibrage.

- 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 on capillaries and tubes, see section 5.6.2 Connecting Fittings, Capillaries, and Tubing, page 84.
- To guide capillaries and tubes for liquid flow connections to the detector, use the capillary slots of the white front cover when the cover is installed.

Setting Up the Flow Connections

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

1. Connect the detector drainage (see section 5.6.3, page 86).
2. Connect the in-line filter (optional) (see section 5.6.4, page 90).
3. Connect the detector in the system flow path (see section 5.6.5, page 91).
4. *Corona Veo RS only: If the stream-switching valve is to be used*
   Connect the stream-switching valve in the flow path (see section 5.6.6, page 96).

TIP Components or connections in the flow path to other system modules may be closed with plugs to protect the component or connection during transport. When you remove the plugs to connect the detector in the system, keep the plugs. You may need them to close the connections again, for example, for future transport.

5.6.2 Connecting Fittings, Capillaries, and Tubing

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

5.6.2.1 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 detector 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.

> **TIP** This is especially important in an UltiMate 3000 system, because different fitting systems are used in the system.

For further information:

- ♦ See section 5.6.2.2 Connecting Viper Capillaries, page 84.
- ♦ See section 5.6.2.3 Guidelines for Conventional Fitting Systems, page 85.

5.6.2.2 Connecting Viper Capillaries

This section describes how to connect Viper™ capillaries that are designed to be finger-tight.

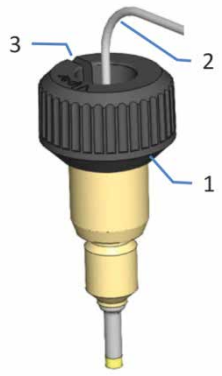
To connect Viper capillaries with knurl, follow these steps:

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 connections *only* when the system pressure is down to zero.

AVIS

- Serrez ou desserrez les capillaires Viper *uniquement* à la main. N'utilisez aucun outil autre que la molette fournie avec le capillaire.
- Afin d'éviter d'endommager le capillaire ou le raccord, ne serrez et ne desserrez les raccords Viper que si le système est sous pression atmosphérique.



No.	Description
1	Knurl
2	Capillary
3	Slot

Figure 10: Viper fitting with knurl

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. If the connection leaks:

   a) Tighten the connection a little more.

   b) If leakage continues, remove the capillary.

   c) Clean the capillary ends carefully by using a lint-free tissue wetted with isopropanol.

   d) Reinstall the capillary.

   e) If the connection continues to leak, install a new Viper capillary.

5.6.2.3 Guidelines for Conventional Fitting Systems

Observe the following guidelines for conventional (non-Viper) fitting systems:

- When making a connection, ensure that the capillary is fully inserted into the connection port and is held in place while tightening the nut. This is to minimize dead volume by ensuring that the ferrule is seated in the correct position.
- Fittings that were used with one connection port should not be used in another connection port. This is to avoid increased dead volume or damage to the system and leakage.
- Do not over-tighten these fitting connections. If you observe leakage on the connection, tighten a little further.
- If leakage still exists, first consider cleaning the connection port with a cleaning swab (part no. 6040.0006). Replace the capillary and/or fitting if this does not eliminate the problem.

5.6.3 Setting Up the Detector Drainage

5.6.3.1 *Connecting the Drain Ports*

Two drain ports at the right side panel of the detector guide liquid leaks or waste liquids from the detector to the waste reservoir.

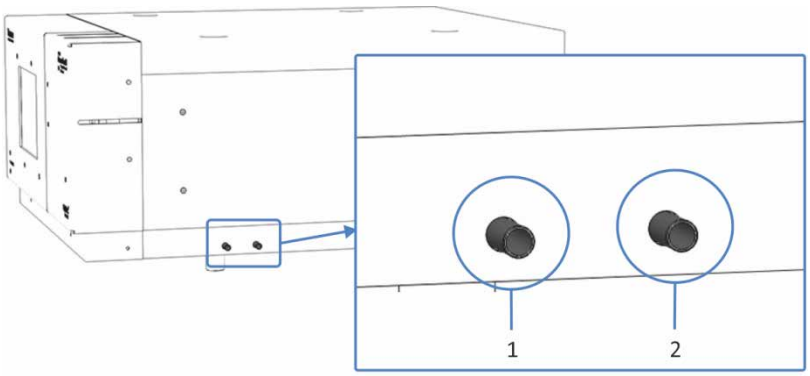


Figure 11: Drain ports

No.	Description	No.	Description
1	Leak port For liquid leaks from the internal leak tray (left port)	2	Waste port For waste liquid from the drain pump during operation (right port)

Parts required

From the detector ship kit:

- 4 L pieces and 2 tee pieces
- Drain tubing (flexible hose, to be cut for use for both ports)

NOTICE—Detector Flooding

Liquid returning into the detector through leak or waste port can cause the liquid sensor to report an error and/or can cause internal detector flooding.

- Use a separate drain line for the leak port and the waste port.
- Do not combine the drain lines of the two ports.
- Avoid extending the drain lines other than described in this section. Make sure that the drain lines have no loops or kinks and drain freely into the waste reservoir.

AVIS—Inondation du détecteur

Un retour du liquide dans le détecteur par l'orifice de fuite de liquide ou l'orifice de déchets peut entrainer le capteur de fuites de liquide à reporter une erreur et/ou entraîner l'inondation de l'intérieur du détecteur.

- Utilisez des conduites d'évacuation séparées, une pour l'orifice de fuite de liquide et une pour l'orifice de déchets.
- Ne combinez pas les conduites d'évacuation de deux orifices.
- Évitez toute extension des conduites d'évacuation autre que celle décrite dans cette section. Assurez-vous que les conduites d'évacuation ne sont pas ondulées ou pliées et le liquide peut s'écouler sans obstacles dans le bac de déchets.

Tools required

Tubing cutter

Preparations

Cut the drain tubing to size to receive the following 4 tubes:

- 2 tubes to interconnect L piece and tee piece (no. 1b and no. 2b in Figure 12 on page 88)
- 2 tubes to route the drain lines to the waste reservoir (no. 1e and no. 2e in Figure 12 on page 88)

Make sure that the cuts are at right angle to the length of the line and that the cuts are not crimped.

Follow these steps

Set up the two drain lines and connect them to the drain ports as shown in Figure 12.

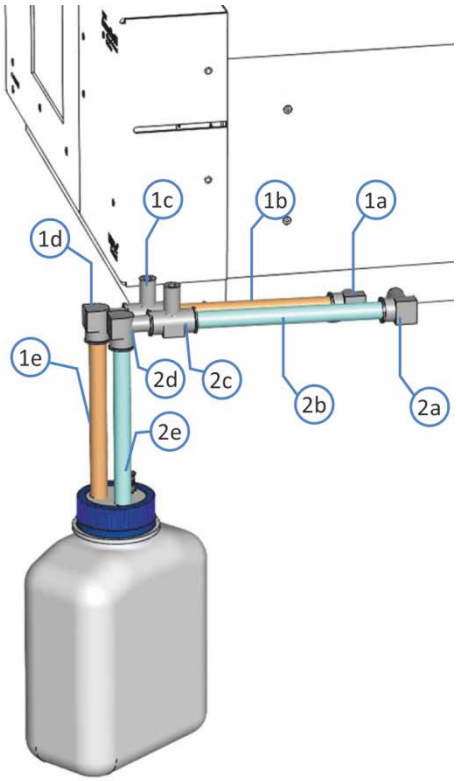


Figure 12: Drain ports connected with drain lines

No.	Description	No.	Description
1	Leak port drain line(left port), consisting of:	2	Waste port drain line (right port), consisting of:
1a	L piece on the port	2a	L piece on the port
1b	Interconnecting drain line	2b	Interconnecting drain line
1c	Tee piece on second L piece	2c	Tee piece on second L piece
1d	L piece on tee piece	2d	L piece on tee piece
1e	Drain line to waste reservoir	2e	Drain line to waste reservoir

5.6.3.2 Guidelines for Detector Drainage

General Guidelines

- Connect the ports separately with a drain line for each port. Do *not* use a connection tube to connect both ports with each other.
- You can easily push the drain tubing into the connecting pieces with your hand (no tools required). Push the tubing into the connecting piece as far as it goes in to establish a self-sealing connection. When installing the tubing, do not bend it against the preformed bending direction.
- If the workbench has a front raised lip higher than 1.5 cm (0.6 inch), the liquid cannot be directed over the elevated edge. In this case, route the tubing to the rear of the workbench and direct the liquid into an appropriate waste container.
- The tee piece with the opening facing upward helps removing air from the drain system and thus prevents liquid from flowing back into the interior of the modules.
- Both drain ports may be directed to the same waste container using separate drain lines.
- Make sure that the tubing and waste bottle are below the height of the detector.
- Make sure that no bending, pinching or squeezing of the drain tubes is present at any point in the flow path.

Drainage in an UltiMate 3000 system

In an UltiMate 3000 system, you can use the components from the drain kit for UltiMate 3000 systems to direct liquid leaks to waste via the drain system. The kit is shipped with the UltiMate 3000 pumps and can be ordered separately. The kit includes all required components and detailed installation instructions.

If there is more than one UltiMate 3000 detector in your system and you need an additional tee piece, you can find one in the ship kit of the UltiMate 3000 fluorescence, multi wavelength, or diode array detector.

5.6.4 Installing the In-Line Filter (optional)

The in-line filter can be installed in the flow path before the detector optionally to prevent particulate matter from entering the nebulizer.

Parts required

In-line filter, including pre-installed filter frit (from detector ship kit)

No.	Description
1	Filter cap (end nut)
2	Filter housing

Figure 13: In-line filter

Follow these steps

1. Locate and unpack the in-line filter.
2. Open the filter cap of the filter assembly.
3. Rinse the filter housing with deionized water.
4. Install the filter cap, and tighten it carefully until contact between the cap and filter is felt. The connection should be finger-tight.

NOTICE Do not use a wrench or pliers to close the filter cap. Do not overtighten the filter cap, as this can crush the filter.

AVIS N'utilisez pas de clé à molette ou des pinces pour fermer le capot du filtre. Ne serrez pas de manière excessive le capot du filtre, cela peut casser le filtre.

5. Connect the in-line filter to the system flow path in a post-column position. Observe the direction of flow as indicated on the filter.

   a) Connect the capillary from the column outlet to the upstream end of the in-line filter and route it to the waste reservoir.

   b) Flush the in-line filter with mobile phase at a flow rate of about 5 mL/min.

   c) Connect the downstream end of the in-line filter as required by the system flow path (see next section).

5.6.5 Connecting the Detector in the System Flow Path

Depending on the modules in your HPLC system, you can connect the inlet capillary to the detector as follows:

- Directly from the column

  –or–

- From the flow cell of a first detector, such as a diode array detector, in the HPLC system flow path (series flow connection)
  In a series liquid flow configuration, one flow path from the pump is used for both detectors installed in the system.

TIP Alternatively, you can connect the detector from a flow-splitting device (parallel flow connection). In a parallel liquid flow configuration, one flow path from the pump is split for two detecting devices. For further information on series and parallel liquid flow configurations, see section 5.6.5.3, page 94.

Parts required

From the detector ship kit:

- RheFlex fittings
- Inlet capillary, PEEK, 0.005" x 1/16" (I.D. x O.D.), red

TIP Keep the capillary connection to the charged aerosol detector as short as possible to minimize peak dispersion.

Preparations

1. Flush the system modules and capillaries upstream of the detector to waste thoroughly before you connect the detector to the system flow path.
2. *If the in-line filter is to be used*
   Connect the in-line filter in the flow path. See section 5.6.4, page 90.
3. Remove the white cover from the detector front side.
4. On the nebulizer, remove the plug from the nebulizer flow inlet.
5. *Corona Veo RS only: If the stream-switching valve is to be used*
   Remove the protective cover from the stream-switching valve.

Follow these steps

Route and connect the capillary to the liquid flow inlet of the charged aerosol detector as required by the system arrangement:

- See section 5.6.5.1 Connecting the Capillary from the Column, page 92.

  –or–

- See section 5.6.5.2 Connecting the Capillary from a First Detector, page 93.

Follow the respective instructions.

5.6.5.1 *Connecting the Capillary from the Column*

If the charged aerosol detector is the only detector in the HPLC system flow path, connect the inlet capillary between column and liquid flow inlet of the charged aerosol detector.

Preparations

See section 5.6.5, page 91.

Follow these steps

1. Connect the red inlet capillary to the column outlet or in-line filter outlet using a fitting.
2. Route the red inlet capillary to the charged aerosol detector.

3. Connect the other end of the red capillary to the liquid flow inlet of the detector using a fitting.
   This step depends as follows:
   - *Corona Veo detector and Corona Veo RS detector: Direct connection to the nebulizer*
     Connect the red inlet capillary to the nebulizer.
   - *Corona Veo RS detector: Connection to the stream-switching valve*
     Connect the stream-switching valve. See section 5.6.6, page 96.

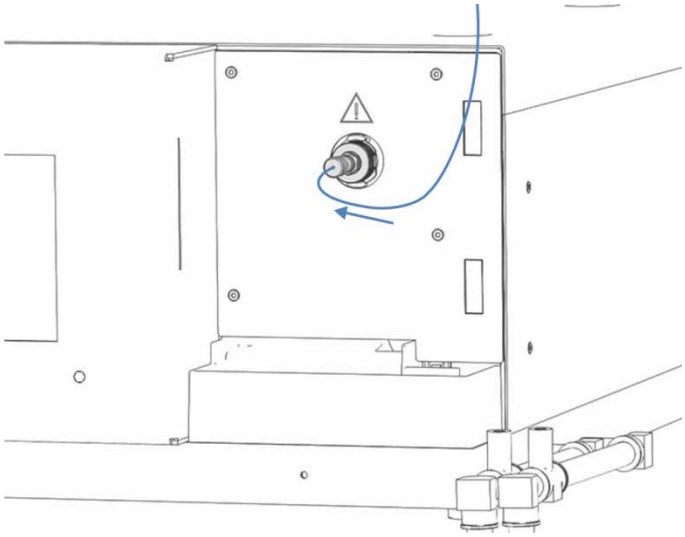


Figure 14: Inlet capillary connected to the detector (here: Corona Veo detector)

4. After you have set up the capillary connections to the detector, you can re-install the white cover on the front panel.
   Guide capillaries and tubes through the capillary slots of the white cover.

5.6.5.2 *Connecting the Capillary from a First Detector*

If the charged aerosol detector is the second detector in the HPLC system flow path, for example after a diode array detector, connect the inlet capillary between flow cell and charged aerosol detector.

Preparations

- See section 5.6.5, page 91.
- Observe all notes and specifications for the first detector in the HPLC system. With optical detectors, such as diode array detectors, mind

any backpressure specifications for flow cells, in particular when using the in-line filter. Refer to the *Operating Manual* for the first detector.

Follow these steps

1. Connect a capillary from the column compartment to the first detector. Refer to the instructions in the *Operating Manual* for the first detector in the HPLC system flow path.

NOTICE The charged aerosol detector must be the last detector connected in the flow path.

AVIS Le détecteur chargé d'aérosols doit être raccordé en dernier dans le trajet d'écoulement.

2. Connect the red inlet capillary to the outlet of the first detector or the in-line filter outlet.
3. Route the red inlet capillary to the charged aerosol detector.
4. Connect the other end of the red capillary to the liquid flow inlet of the detector using a fitting.
   This step depends as follows:
   - *Corona Veo detector and Corona Veo RS detector: Direct connection to the nebulizer*
     Connect the red inlet capillary to the nebulizer.
   - *Corona Veo RS detector: Connection to the stream-switching valve*
     Connect the stream-switching valve. See section 5.6.6, page 96.
5. After you have set up the capillary connections to the detector, you can re-install the white cover on the front panel.
   Guide capillaries and tubes through the capillary slots of the white cover.

5.6.5.3 *Series and Parallel Detector Configuration*

The detector can be used in series or parallel liquid flow configuration with other detectors (for example, a UV detector or mass spectrometer).

Series Configuration

Observe the following guidelines for a series liquid flow configuration:

- The charged aerosol detector must be the last detector connected in the flow path.
- Other detectors contribute to extra-column volume, which may have an adverse effect on the peak shape measured by the charged aerosol detector.
- Be aware of any backpressure limits of flow cells of detectors in the flow path before the charged aerosol detector. Connect the capillary from the flow cell directly to the charged aerosol detector. Avoid connecting any additional components in the flow path between the two detectors. Refer to the *Operating Manual* for the first detector.
- If you want to bypass the first detector, use the Viper union to interconnect the capillary from the column with the capillary connected to the nebulizer. Keep the capillary connection as short as possible to minimize peak dispersion.
- Observe all notes and specifications for flow cells of the first detector in the system from the *Operating Manual* for the first detector.

Parallel Configuration

Observe the following guidelines for parallel liquid flow configuration with another detector or mass spectrometer:

- When operating a parallel detector or a mass spectrometer in addition to the charged aerosol detector, use a flow splitter for balanced distribution of liquid flow from the system.
- When you use a passive flow-splitting device and thus adjust (balance) the liquid flows, consider the backpressure from the detector. Observe the flow rate specifications in the Performance Specifications section (section 9.1, page 236).

TIP Thermo Fisher Scientific recommends using an adjustable analytical flow splitter (adjustable from 1:1 to 20:1) for flexible, accurate and precise liquid flow. For ordering information, see section 10.3, page 244.

5.6.6 Connecting the Stream-Switching Valve (Corona Veo RS only)

The Corona Veo RS detector is equipped with a 6-port 2-position stream-switching valve (SSV). The valve can be used to direct flow to the nebulizer or to external devices or to a waste reservoir.

To connect the stream-switching valve, connect ports no. **2**, **3**, and **4** of the valve. The ports of the stream-switching valve are assigned as follows:

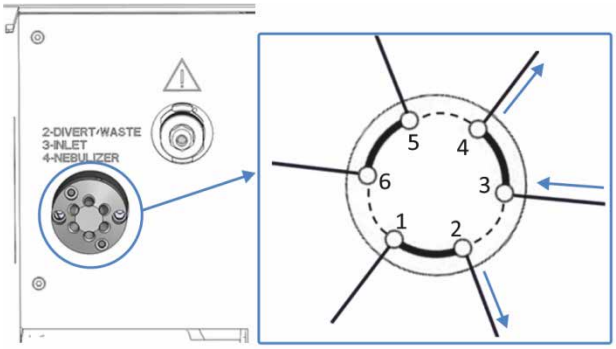


Figure 15: Ports on the stream-switching valve

No.	Ports
2	**Divert/Waste** Outlet to direct flow away from the detector
3	**Inlet** Inlet for capillary from column
4	**Nebulizer** Outlet to direct flow to the nebulizer inlet
1, 5, 6	Not used

Parts required

From the detector ship kit:

- RheFlex fittings
- Inlet capillary, PEEK, 0.005" x 1/16" (I.D. x O.D.), red
- Interconnecting capillary, Viper, stainless steel, 0.13 x 100 mm (I.D. x L)
- Waste capillary, PEEK, 0.015" x 1/16" (I.D. x O.D.), gray

Preparations

Set up the flow connections up to the stream-switching valve. See section 5.6.5, page 91.

Make sure that one end of the red inlet capillary is connected to the component before the charged aerosol detector in the system flow path.

Follow these steps

1. On the stream-switching valve, connect the other end of the red inlet capillary to port **3-Inlet** using a RheFlex fitting.
2. Set up the connection between stream-switching valve and nebulizer:
   a) Connect one end of the Viper capillary to port **4-Nebulizer**.
   b) Connect the other end of the Viper capillary to the nebulizer inlet.
3. On the stream-switching valve, connect the gray waste capillary to port **2-Divert/Waste** using a RheFlex fitting. Route the capillary to the waste reservoir.

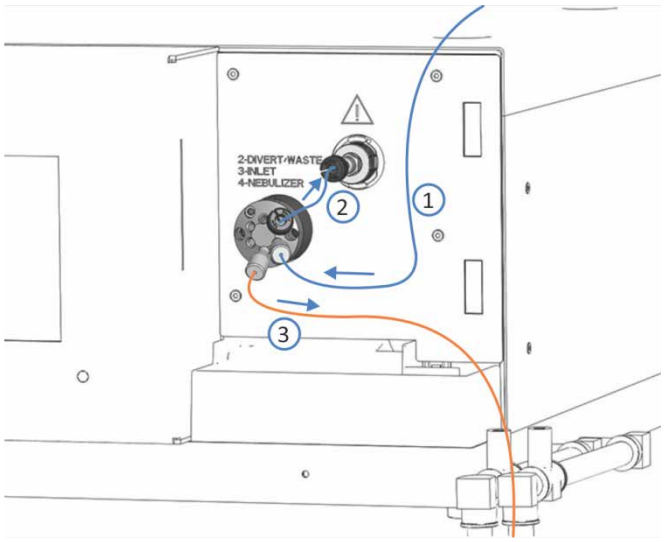


Figure 16: Capillaries connected to the stream-switching valve

5.7 Turning On the Detector

NOTICE Make sure that the pump flow to the detector is turned off. To properly turn on the detector gas flow and *only then* turn on the pump flow to the detector, follow the instructions in section 6.5.4, page 135.

AVIS Assurez-vous que le débit de la pompe vers le détecteur est éteint. Pour démarrer correctement le débit de gaz du détecteur, puis *uniquement après cela*, démarrer le débit de la pompe vers le détecteur, suivez les instructions de la section 6.5.4, page 135.

TIP Before turning on the power to a UltiMate 3000 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.

1. Turn on the detector with its main power switch.

   TIP The drain pump turns on automatically upon power-up.

2. Wait until the detector completes the following sequence of events after power-up:

   - *Self-test diagnostics*
     The detector runs a series of internal tests. During these self-diagnostics, all of the main components are checked. When testing is complete and has been successful, the display will show the start-up screen with the current detector firmware version. Select **Continue** to proceed to the warm-up screen.

     If an error is detected during the self-test, the detector is not ready for analysis, and the status of the self-test and a dedicated error code appear on the detector display. For further information, see chapter 8 Troubleshooting, page 207.

- *Warm-up phase*
  In the warm-up state, the detector monitors the internal temperature of the components. The warm-up time may be longer if the ambient temperature is cool or cold. When the detector has properly warmed up, the display will show the **Main Menu**.

Figure 17: Start-up screen (left image) and warm-up screen (right image)

3. *As required*
   - Adjust the brightness of the detector display in the **Main Menu**. See section 6.4.1, page 109.
   - Set date and time on the detector display on the **Date & Time Setup** screen. See section 6.4.3.2, page 117.

Turn the detector off with the main power switch, when instructed to do so, for example, during maintenance.

6 Operation

This chapter describes the elements for detector 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 detector has been completed. If this is not the case, refer to the instructions in chapter 5 Installation before proceeding (see page 51).

- For a description of the detector display, see section 6.4, page 107.
- For a basic description of instrument control and automated sample analysis with the Chromeleon software, see section 6.8, page 148. Details on control and operation of the detector are available in the *Chromeleon Help*.

6.2 Safety Guidelines for Operation

English Version

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

Observe all warning messages and precautionary statements presented in section 2.3 Safety Precautions (see page 23).

CAUTION—Explosion Hazard or Damage to the Detector

When using tetrahydrofuran (THF), the use of air as supplied gas may pose an explosion hazard. This can pose a safety and health risk and damage the detector. Always use nitrogen with tetrahydrofuran or other highly combustible solvents.

NOTICE Pay attention to the following general 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 detector, turn off the pump flow and remedy the situation immediately.

NOTICE Pay attention also to the following specific guidelines for detector operation:

- Pump flow without gas flow causes detector flooding.
  Verify that the detector gas flow is always turned on before you turn on the pump flow to the detector. Do not direct pump flow to the detector without gas flow being turned on.
- Turn on the gas supply and detector gas flow only when the nebulizer is installed, the components in the gas flow path are properly connected, and the protective cover of the gas filter assembly is installed.
- *To start detector gas flow and pump flow*
  Turn on the detector gas flow first, wait at least 5 minutes and only then turn on the pump flow.

- *To stop pump flow and detector gas flow*
  Turn off the pump flow first, wait at least 5 minutes and only then turn off the detector gas flow. During the waiting period, the drain pump drains any remaining mobile phase to waste.
- Exceeding the pump flow rate limit will damage the detector. Operate the detector only within the allowed pump flow rate range.
- If the overpressure relief valve is releasing gas as a result of an overpressure in the detector during operation, turn off the detector immediately. Remedy the situation as described in the *Resolving Gas Supply Overpressure* section in this manual.
- Contamination of the mobile phase can damage the detector. Avoid contamination of the mobile phase. Observe the Mobile Phase Guidelines for the Detector in section 6.5.1, page 123.
- Observe the Site Requirements for gas supply and ventilation in section 5.3, page 55.
- Observe the Specifications in chapter 9, page 235.

French Version

Veuillez prendre en considération les consignes de sécurité suivantes lors de l'utilisation du détecteur :

Respectez tous les messages d'avertissement et mentions de mise en garde figurant à la section 2.3 (reportez-vous à la page 23).

ATTENTION—Danger d'explosion ou endommagement de l'instrument

Lors de l'utilisation de tétrahydrofuranne (THF), l'utilisation d'air pour l'alimentation de gaz peut entraîner un danger d'explosion. Ceci peut constituer un risque pour la sécurité et la santé, et endommager le détecteur. Utilisez toujours de l'azote avec le tétrahydrofuranne ou d'autres solvants hautement combustibles.

AVIS Veuillez respecter également les consignes générales suivantes :

- Lors de l'utilisation du système chromatographique, configurez toujours la limite inférieure de pression pour la pompe. Cela évite toute détérioration due à une fuite ou à l'utilisation à vide de la pompe.
- Si une fuite se produit, éteignez immédiatement le détecteur, arrêtez le débit de la pompe et remédiez au problème.

AVIS Veuillez respecter également les consignes de sécurité spécifiques suivantes pour l'utilisation du détecteur:

- Mettre le débit de la pompe sans mettre le débit du gaz entraîne l'inondation intérieure du détecteur.
  Vérifiez toujours que le débit de gaz du détecteur est sous tension avant de mettre sous tension le débit de la pompe. Ne dirigez pas le débit de la pompe vers le détecteur sans avoir démarré le débit de gaz.
- Démarrez l'alimentation de gaz et le débit de gaz du détecteur uniquement lorsque le nébuliseur est installé, lorsque les composants dans le trajet d'écoulement de gaz sont correctement raccordés, et lorsque le capot de protection du bloc de filtration de gaz est installé.
- *Pour démarrer le débit de gaz du détecteur et le débit de la pompe*
  Démarrez le débit de gaz du détecteur en premier, patientez au moins 5 minutes, puis uniquement après cela, démarrez le débit de la pompe.
- *Pour interrompre le débit de la pompe et le débit de gaz du détecteur*
  Interrompez le débit de la pompe en premier, patientez au moins 5 minutes, puis uniquement après cela, interrompez le débit de gaz du détecteur. Durant la période d'attente, la pompe de vidange évacue toute phase mobile restante vers l'évacuation.
- Tout dépassement de la limite du débit de la pompe endommagerait le détecteur. Utilisez le détecteur uniquement dans les limites de la plage de débit autorisée pour la pompe.
- Si la soupape de surpression libère du gaz suite à une surpression dans le détecteur lors de l'utilisation, mettez immédiatement le détecteur hors tension. Remédiez à la situation comme décrit dans la section 8.5.3, page 224 de ce manuel.
- Une contamination de la phase mobile peut endommager le détecteur. Évitez toute contamination de la phase mobile. Suivez les consignes concernant la phase mobile pour le détecteur de la 6.5.1, page 123.
- Respectez les exigences relatives à l'alimentation de gaz et à la ventilation. Reportez-vous à la section 5.3, page 55.
- Respectez les spécifications pour l'utilisation. Reportez-vous à la section 9.1, page 236.

6.3 Control Elements and Status Indicator

The detector is designed for operation directly from the detector touch-screen display or from a computer running with the chromatography software.

- Touch-screen display with soft keys
  The soft keys allow you to operate the detector directly from the display. See section 6.4 Touch Screen Display, page 107.
- Status indicator
  The **Power** LED (Light Emitting Diode) on the front side of the detector provides a quick visual check of the status of the detector:

Power LED Color	Description
Off (dark)	The power to the detector is turned off.
Blue	The power to the detector is turned on.

6.4 Touch Screen Display

The display with the integrated touch screen provides keys immediately below the screen for control and navigation. The role of the keys depends on the screen that is presented. These keys are termed *soft keys*, as the definition of these keys is context sensitive.

General Soft Key Functions

Depending on the screen, general soft key functions are available:

Soft key	Description
Continue	To show available options for a selected (highlighted) parameter
Save	To save changed settings
Exit	To exit a screen
Entry in parenthesis	If an entry is displayed in parenthesis, this indicates a touch-sensitive, user-selectable entry. When you select an entry within the parenthesis, additional options will become available.

TIP If the detector is connected to a chromatography software, such as the Chromeleon software, the soft key functions are disabled.

Overview of Screens

The following table provides an overview and brief functional description of the available menus and screens:

Screen	Available functions
Main Menu (section 6.4.1, page 109)	• Turning on/off gas flow • Adjusting display brightness • Obtaining general detector information
Run Mode Menu (section 6.4.2, page 110)	Adjusting detector parameters for sample analysis
Diagnostics Screen (section 6.4.2.1, page 112)	Monitoring internally calibrated parameters
Graph Screen (section 6.4.2.2, page 113)	Monitoring and adjusting the detector signal during data acquisition
Evaporation Temperature Screen (section 6.4.2.3, page 114)	Setting and monitoring the evaporation tube temperature

Screen	Available functions
System Setup Menu (section 6.4.3, page 115)	Editing general operational settings, such as defining default values
Gas Regulator Screen (section 6.4.3.1, page 116)	*Only available with Corona Veo RS detectors* Setting and monitoring the internal nebulizer gas pressure and the pressure unit
Date & Time Setup Screen (section 6.4.3.2, page 117)	Setting date and time and service intervals for the gas filter and preventive maintenance
Contacts & Inputs Screen (section 6.4.3.3, page 118)	Activating output signals and monitoring input signals
Analog Output Control Screen (section 6.4.3.4, page 120)	• Installing an analog output board in the detector firmware • Adjusting analog output signal settings
Drain Screen	Checking the drain pump status and turning the drain pump off and on
SSV Position Screen	*Only available with Corona Veo RS detectors* Obtaining the stream-switching valve position

6.4.1 Main Menu

The **Main Menu** displays the serial number of the detector, the installed firmware version and the detector status.

The display shows the **Main Menu** after successful self-test diagnostics and warm-up phase upon power-up. To navigate to the **Main Menu** from other screens, use the dedicated soft key.

If no errors or warnings are active, the **Status** is **Normal**.

Figure 18: Main Menu screen (example)

Soft key functions

Soft key	Description
Bright+ **Bright-**	Increasing the display brightness Decreasing the display brightness
Gas On **Gas Off**	Starting or stopping the gas flow in the detector When the gas flow is turned on, the soft key name changes to **Gas Off**.
System Menu	Accessing the **System Setup Menu** (see section 6.4.3, page 115)
Run Mode	Starting sample analysis and gas flow (if not yet turned on) and accessing the **Run Mode Menu** (see section 6.4.2, page 110)

6.4.2 Run Mode Menu

The **Run Mode** starts sample analysis and turns on the gas flow automatically if the gas flow was turned off.

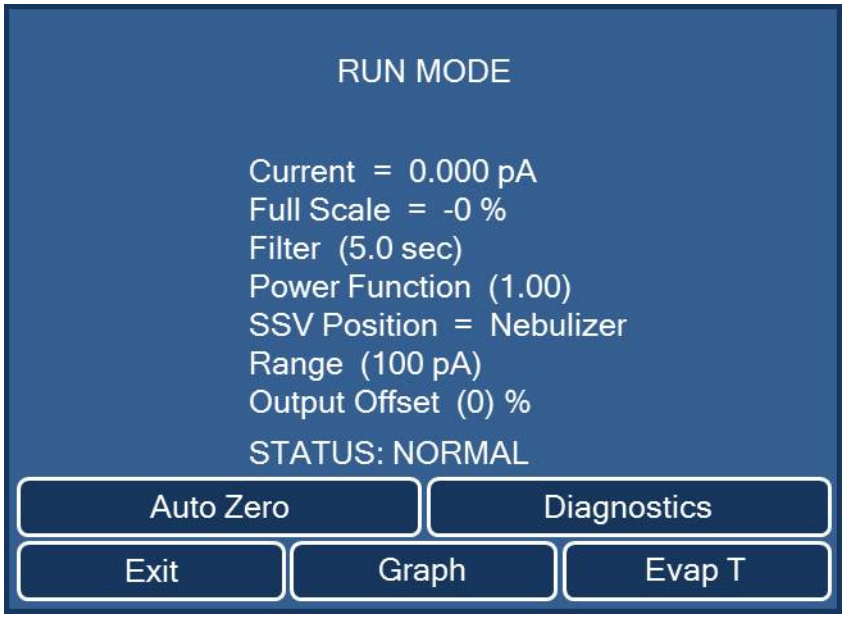


Figure 19: Run Mode Menu screen

Navigating in the menu and screens

- To start the **Run Mode** and open the menu, use the dedicated soft key in the **Main Menu**.
- To stop the **Run Mode**, press the **Exit** soft key and, on the next screen, press the **Continue to Exit** soft key.
- To navigate to screens from the **Run Mode Menu**, use the dedicated soft keys. To close screens and return to the menu, press the **Exit** soft key.

Displayed parameters

The screen provides parameters (in parenthesis) for making real-time adjustments to instrument settings. Changes made to parameters on the **Run Mode Menu** screens will not alter the internal memory of the detector. To adjust a parameter, select the respective parameter in parenthesis.

Parameter	Description	Options	Default
Current	Displays the detector signal during data acquisition	Read-only	n.a.
Full Scale	Only available if an analog output is installed on the analog output screen Displays the level of output current in scale of analog output range	Read-only	n.a.
Filter	Digital filter constant that is applied to the output current	0.1, 0.2, 0.5, 1.0, 2.0, 3.6, 5.0, 10.0 seconds	5.0 sec.
Power Function	Data linearization function	0.67 – 2.00	1.00
SSV Position	Only available with Corona Veo RS detectors Displays the position of the stream-switching valve (**Nebulizer** or **Diverted**) **TIP** If the stream-switching valve is not set to **Nebulizer** yet, the detector will automatically actuate the valve.	Read-only	**Nebulizer**
Range	Only available if an analog output is installed on the analog output screen Setting the signal current range for the analog output of the detector	1 pA to 500 pA (in steps of 1,2, and 5)	100 pA
Output Offset	Only available if an analog output is installed on the analog output screen Percent offset added to the analog output of the detector	-50 % to +50 %	0 %
Status	Displays the detector status If no errors or warnings are active, the **Status** is **Normal**.	Read-only	Normal

Soft key functions

Soft key	Description
Autozero	Adjusting the output signal to zero at the current range in use This function can be turned off on the **Contacts & Inputs** screen (see section 6.4.3.3, page 118).
Diagnostics	Accessing the **Diagnostics** screen (see section 6.4.2.1, page 112)
Graph	Accessing the **Graph** screen (see section 6.4.2.2, page 113)
Evap T	Accessing the **Evaporation Temperature** screen (see section 6.4.2.3, page 114)

6.4.2.1 Diagnostics Screen

The **Diagnostics** screen displays real-time information and values with regard to factory-set and internally calibrated parameters.

If no errors or warnings are active, the **Status** is **Normal**.

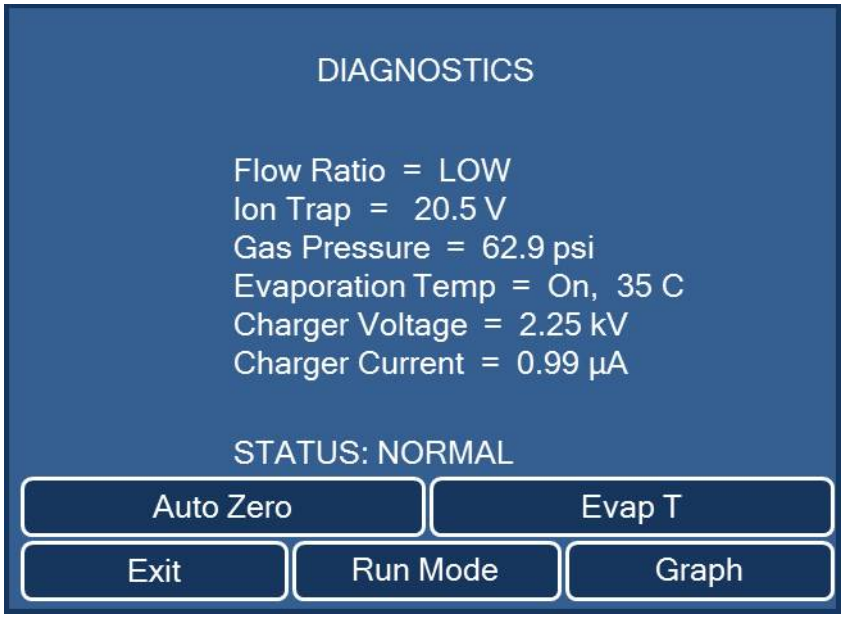


Figure 20: Diagnostics screen (here: Corona Veo RS)

Diagnostic parameter	Description	Typical Values
Flow Ratio	Indicates the ratio of nebulizer gas pressure to the charging gas pressure (low, normal or high), calibrated at factory	Normal
Ion Trap	Voltage that is used to remove highly mobile gas ions	18 V - 20.9 V
Gas Pressure	Indicates the inlet pressure from the gas supply	40 - 65.0 psig ± 0.1 psig (276 - 448 kPa, 2.8 - 4.5 bar)
Evaporation Temp	• Indicates if the evaporation tube heater is operating • Displays the actual evaporation temperature	On, 35 °C
Charger Voltage	Indicates the applied voltage to the corona needle to charge the (secondary) ion gas stream	1.8 kV - 3.0 kV
Charger Current	Indicates the current required to produce ions in the (secondary) gas stream	0.99 µA - 1.01 µA

6.4.2.2 Graph Screen

The **Graph** screen displays the online detector signal during data acquisition, the gain applied and the display update rate (in seconds per division). The graphical display can be customized using the soft keys described in the table below.

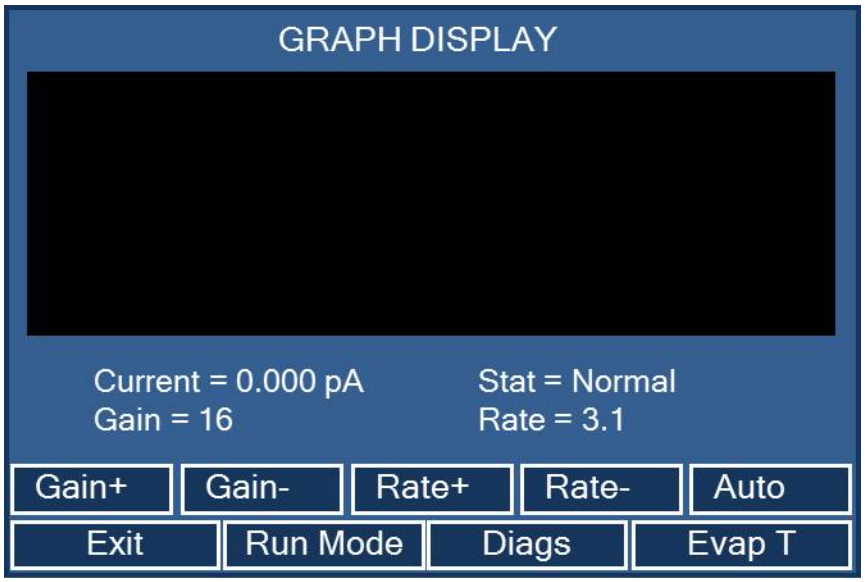


Figure 21: Graph screen (here: Corona Veo RS)

Parameter	Description
Current	Displays the detector signal (read-only)
Stat	Displays the detector status (read-only) If no errors or warnings are active, the **Status** is **Normal**.
Gain	Displays the gain of output current for the graphical display
Rate	Indicates the display rate for the screen in seconds per division

Soft key	Function
Gain+ **Gain-**	Changing the default signal range This function refers to the online plot range as is displayed.
Rate+ **Rate-**	Changing the default time-constant window of the online plot *Example:* A rate of 4.7 indicates each horizontal division is 4.7 seconds and the entire chromatogram is 47 seconds.
Auto	Adjusting the auto-rate/gain setting The online plot will scale the signal automatically to the peak with the largest magnitude on the online plot.

6.4.2.3 Evaporation Temperature Screen

The **Evaporation Temperature** screen provides the means to set and monitor the temperature of the evaporation tube. To adjust a parameter, select the respective parameter in parenthesis.

If no errors or warnings are active, the **Status** is **Normal**.

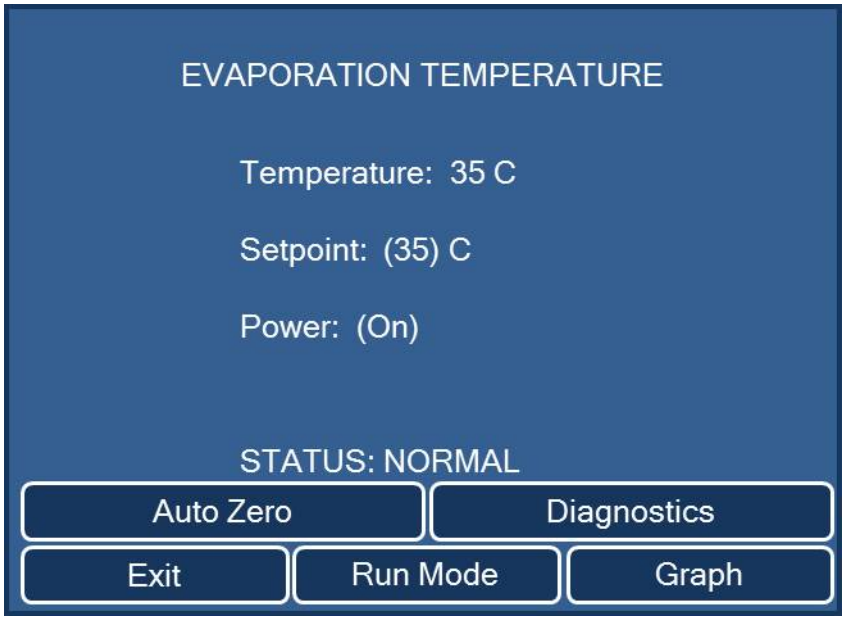


Figure 22: Evaporation Temperature screen (here: Corona Veo RS)

Parameter	Description	
Temperature	Displays the actual evaporation temperature (read-only) **TIP** The actual temperature reached depends on several factors, including mobile phase composition, liquid flow rate, mobile phase temperature, gas temperature, and ambient temperature.	
Setpoint	Allows setting the evaporation temperature The default evaporation temperature is set to 35 °C. **TIP** Before you start sample analysis, wait approximately 30 minutes after you changed the temperature setpoint to ensure that the evaporation tube comes to equilibrium for the set temperature. The available temperature settings depend on the detector:	
	Detector	**Temperature setpoints**
	Corona Veo:	Selectable values: 35 °C or 50 °C
	Corona Veo RS:	Settable range: ambient +5 °C to +100 °C, in 0.1 °C steps
Power	Turning on or off the temperature control for the evaporation tube	

6.4.3 System Setup Menu

The **System Setup Menu** displays the the actual pressure of the gas supplied to the nebulizer and provides means to edit a variety of default parameters that relate to the overall operation of the detector.

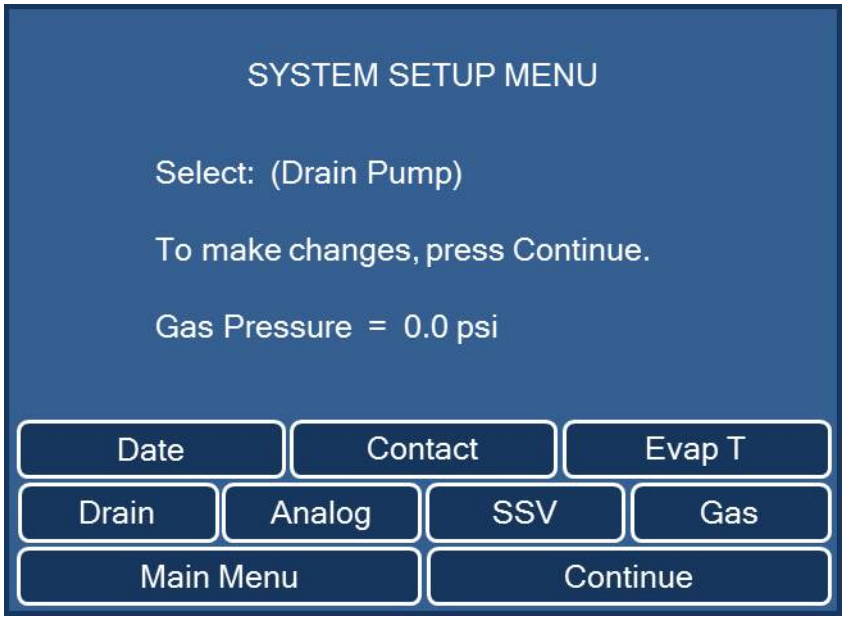


Figure 23: System Setup Menu (here: Corona Veo RS)

Navigating in the menu and screens

To navigate to the **System Setup Menu**, to the screens or return to the **Main Menu**, use the dedicated soft keys.

Accessing screens to change detector parameters

1. Select the desired soft key to display its function in parenthesis on the screen.
2. Select **Continue** to enter the parameter screen.
3. On the respective parameter screens: If you changed a parameter, select the **Save** soft key to save the setting as the new default setting for the detector.

Soft key functions

Soft key	Description
Date	Accessing the **Date & Time** screen (see section 6.4.3.2, page 117)

Soft key	Description
Contact	Accessing the **Contacts & Inputs** screen (see section 6.4.3.3, page 118)
Evap T	Accessing the **Evaporation Temperature** screen (see section 6.4.2.3, page 114)
Gas	*Only available with Corona Veo RS detectors* Accessing the **Gas Regulator** screen (see section 6.4.3.1, page 116)
SSV	*Only available with Corona Veo RS detectors* Adjusting the position of the stream-switching valve (**Nebulizer** or **Diverted**)
Drain	Checking the drain pump status and turning the drain pump off and on
Analog	Installing an analog output board in the detector firmware (see section 6.4.3.4, page 120)

6.4.3.1 *Gas Regulator Screen (Corona Veo RS only)*

This screen is only available with Corona Veo RS detectors.

The **Gas Regulator** screen provides functions for setting the nebulizer gas pressure and pressure unit.

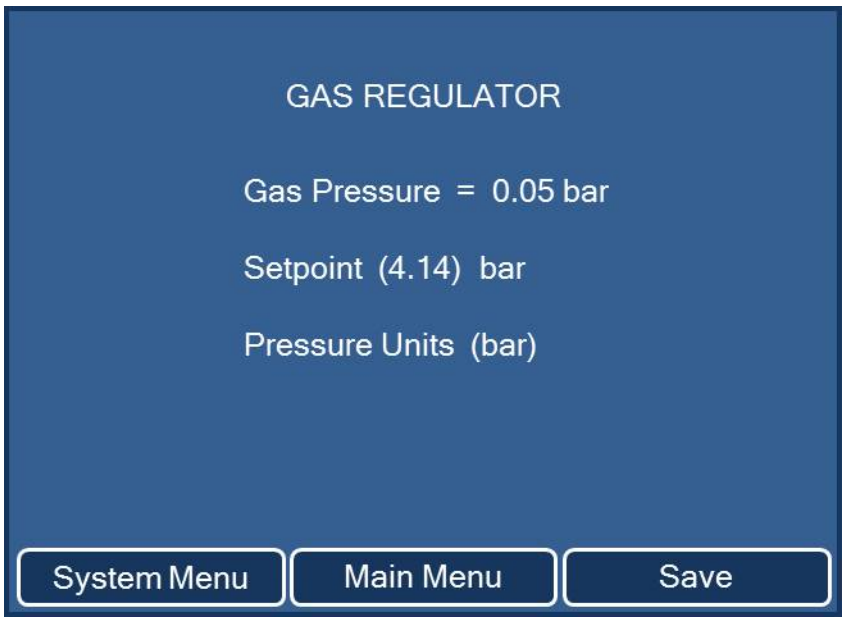


Figure 24: Gas Regulator screen (Corona Veo RS only)

To adjust a parameter, select the respective parameter in parenthesis. The available parameters or pressure values are displayed. Select the desired parameter and press the **Save** soft key to save your changes.

Parameter	Description	Options
Pressure	Displays the actual pressure of the gas supplied to the nebulizer	Read-only
Setpoint	Specifies the nebulizer gas pressure as specified on the certificate that was shipped with the nebulizer	40 - 65.0 psig ± 0.1 psig (276 - 448 kPa, 2.8 - 4.5 bar)
Pressure Units	Defines the default unit setting for the gas pressure	psi, bar, kPa

6.4.3.2 Date & Time Setup Screen

The screen provides functions for setting the current date and time and resetting the gas filter change interval and next preventive maintenance (PM) date.

Figure 25: Date & Time Setup screen (here: Corona Veo RS)

- To change date or time, select the respective entry in parenthesis and set the desired values. Press the **Save** soft key to save changes.

- To view or change the service interval dates, use the soft keys:

Soft key	Description
Reset Filter Chg Date	Displaying and resetting the next due date for gas filter replacement • The interval is automatically set for 12 months after gas filter replacement. • The interval can be changed manually. • If the date is expired, it appears red.
Reset next PM Date	Displaying and resetting the next due date for preventive maintenance • The interval is automatically set for 12 months after preventive maintenance. • The interval can be changed manually. • If the date is expired, it appears red.

6.4.3.3 *Contacts & Inputs Screen*

The screen provides functions for activating the individual outputs, activating the response when a signal change to an input contact occurs and viewing the state of the inputs related to the I/O terminals.

For details on the contact (relay) outputs and the inputs, see section 11.2, page 252.

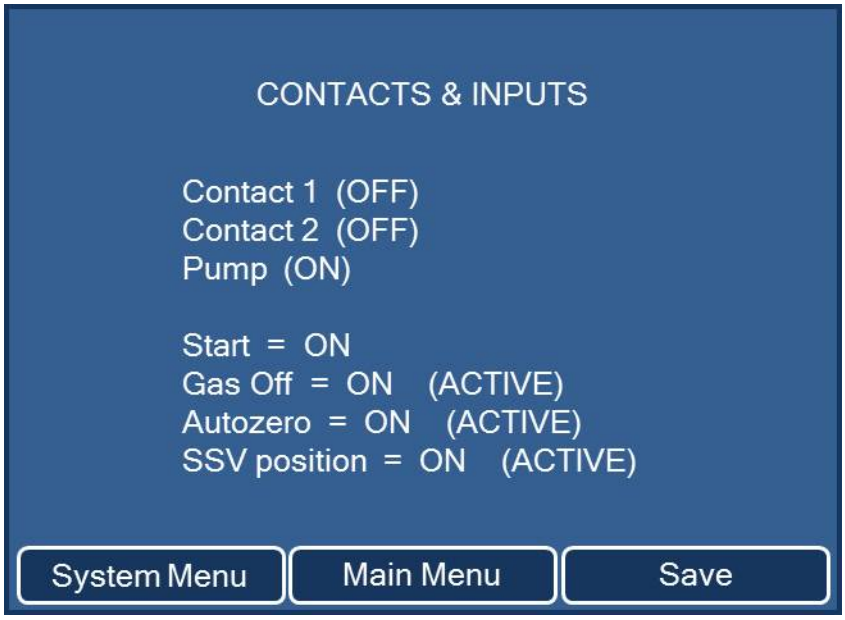


Figure 26: Contacts & Inputs screen (here: Corona Veo RS)

To enable or disable a contact or input, select the respective entry in parenthesis, make the desired setting, and press **Save** to save changes.

Parameter	Type	Description
Contact 1 **Contact 2**	Relay output	Enabling or disabling contact outputs for use with compatible chromatography data systems to interact with external devices
Pump	Relay output	Enabling or disabling the dedicated output for connection to an external compatible LC pump with dedicated input If this output is enabled, the interconnection between charged aerosol detector and pump enables direct communication in case of an operating issue. Certain problems in the charged aerosol detector cause an automatic stop of the pump flow to prevent a build-up of excess liquid inside the detector.
Start	TTL input	Displaying the status of the dedicated input for use with compatible chromatography data systems to initiate data collection
Gas Off	TTL input	Activating or deactivating the dedicated input to shut down the gas flow to the detector Requires a compatible LC system and chromatography system to program this parameter.
Autozero	TTL input	Activating or deactivating the dedicated input to adjust the output signal to zero at the current range in use
SSV Position	TTL input	Activating or deactivating the dedicated input for external control of the stream-switching valve The input corresponds to the **Divert** pin on the terminal block on the rear side of the detector.

6.4.3.4 Analog Output Control Screen

The **Analog Output Control** screen provides functions for installing an analog output board in the detector firmware and adjusting analog output signal settings.

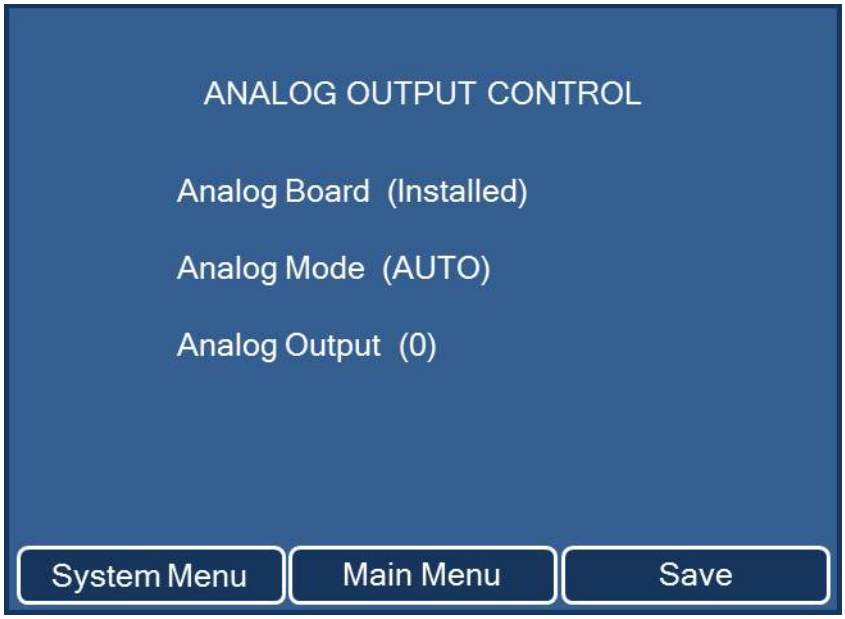


Figure 27: Screen for analog output board control

Parameter	Description
Analog Board	Setting the analog output board in the detector firmware as **Installed** or **Not Installed** **TIP** If an analog output board is installed on the screen, the parameters **Full Scale**, **Range** and **Output Offset** are available in the **Run Mode Menu**.
Analog Mode	Adjusting the analog output mode: • In **Auto** mode, the detector adjusts the **Analog Output** automatically. • In manual (**Man**) mode, the **Analog Output** can be set freely.
Analog Output	Displays the analog output signal in the range of **0 – 999** in mV In manual mode, the output can be set freely.

6.5 Preparing the Detector for Operation

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

Before Operating the Detector for the First Time

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

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

- *Before connecting the charged aerosol detector to the system flow path*
  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 system modules in preparation for the charged aerosol detector, see section 6.5.3, page 133.
- *When the charged aerosol detector is connected in the system flow path*
  Flush the detector only when the detector gas flow is turned on. Deliver pump flow to the detector for flushing (see below).

AVIS Avant de commencer à utiliser le détecteur, rincez abondamment le trajet d'écoulement à travers le système :

- *Avant de raccorder le détecteur d'aérosols chargés au trajet d'écoulement du système*
  Lorsque vous installez des appareils ou des composants dans le système, vidangez-les avant de les raccorder au trajet d'écoulement du système. Pour vidanger les modules du système en préparation du raccordement du détecteur d'aérosol s chargés, reportez-vous à la section 6.5.3, page 133.
- *Lorsque le détecteur d'aérosols chargés est raccordé au trajet d'écoulement du système*
  Vidangez le détecteur uniquement lorsque le débit de gaz du détecteur est sous tension. Refoulez le débit de la pompe vers le détecteur pour la vidange (voir ci-dessous).

1. Observe all mobile phase guidelines for the detector. See section 6.5.1, page 123.
2. Verify the nebulizer gas pressure setting. Set the nebulizer gas pressure as specified on the nebulizer certificate. See section 6.5.2, page 129.
3. Equilibrate and prepare the other system modules (without the detector) for sample analysis. See section 6.5.3, page 133.
   Verify that any air bubbles are completely flushed out of the system flow path.
4. Turn on the detector gas flow and equilibrate the detector. See section 6.5.4, page 135.

Before Starting Sample Analysis

Before starting an analysis:

- Make sure that the pump flow rate that is delivered to the charged aerosol detector is within the specified range. See section 9.1, page 236.
- Check the liquid level in the solvent reservoirs. Verify that the amount of solvent is sufficient for the analysis.
- Observe the same steps as upon first-time operation. See page 122.

6.5.1 Mobile Phase Guidelines for the Detector

CAUTION—Explosion Hazard or Damage to the Detector

When using tetrahydrofuran (THF), the use of air as supplied gas may pose an explosion hazard. This can pose a safety and health risk and damage the detector. Always use nitrogen with tetrahydrofuran or other highly combustible solvents.

ATTENTION—Danger d'explosion ou endommagement de l'instrument

Lors de l'utilisation de tétrahydrofuranne (THF), l'utilisation d'air pour l'alimentation de gaz peut entraîner un danger d'explosion. Ceci peut constituer un risque pour la sécurité et la santé, et endommager le détecteur. Utilisez toujours de l'azote avec le tétrahydrofuranne ou d'autres solvants hautement combustibles.

NOTICE Inappropriate or contaminated mobile phase can damage the detector. The quality of the mobile phase significantly influences the performance of the detector. Observe the following guidelines to avoid damage to the detector.

AVIS Une phase mobile inappropriée ou contaminée peut endommager le détecteur. La qualité de la phase mobile influence significativement les performances du détecteur. Afin d'éviter toute détérioration du détecteur, respectez les consignes suivantes.

6.5.1.1 General Guidelines

- Use only volatile mobile phases. All constituents, i.e. solvents and additives, of the mobile phase should be sufficiently volatile to allow evaporation under the conditions used.
- Non-volatile solutes in the mobile phase, even at trace amounts, produce a detector signal (background current, noise, drift). Minimize their concentration.

TIP A careful consideration in the selection of the mobile phase components will be helpful in minimizing the baseline noise and optimizing the performance during analysis.

- Consider other possible sources of mobile phase and eluent contamination.
  Examples: Labware, pH electrodes, columns and system components

  In many cases, it is preferable to use materials dedicated for use only with volatile mobile phases.

6.5.1.2 *Mobile Phase Selection*

Minimizing Non-Volatile Matter in the Mobile Phase

NOTICE Long-term exposure of the detector to non-volatile mobile phases will damage the detector. Do not use non-volatile buffers.

AVIS Une exposition à long terme du détecteur à des phases mobiles non volatiles, comme des tampons inorganiques endommagerait le détecteur. N'utilisez pas de tampons non volatils.

Observe the following guidelines to minimize the concentration of non-volatile matter in the mobile phase:

- Prepare all mobile phases with volatile solvents. As a general rule, use solvents that are at least as volatile as water, that is lower boiling point and higher vapor pressure.
- Use ultra-pure water with high resistivity and low total organic carbon obtained fresh from a thorough flushed and well-maintained point-of-use purification system.

TIP Bottled water and stagnant water from a purification system typically contain a higher level of non-volatile impurities than freshly obtained ultra-pure water.

- Choose solvents that are specified to have low residue after evaporation.
  For example, LC/MS-grade solvents typically have a lower residue after evaporation specification than HPLC-grade solvents and are often the better choice to achieve consistently low baseline noise.

  TIP Many organic solvents have low viscosity, low surface tension and high volatility, which lead to a high mass transport efficiency within the detector. For such solvents, it is especially recommended to select a grade with lowest residue after evaporation.

- If a particular solvent causes high background current or noise, try a different grade or vendor.
- Most HPLC-grade or better solvents are pre-filtered and additional filtration may increase the concentration of impurities within the mobile phase. It is therefore recommended to only filter the aqueous buffer salt portion of a mobile phase.

  TIP With solvent gradients, non-volatile impurities in the weaker solvent (for example, water in reversed-phase) can be concentrated on the column and elute later to produce large peaks or baseline artifacts.

- With highly combustible mobile phases, such as tetrahydrofuran (THF) and other ethers and ketones, use only nitrogen as supply gas.
- *When changing the operating mobile phase*
  Make sure that the solvents are miscible and will not cause precipitation of buffer salts. If required, use an appropriate intermediate solvent, if required.

  TIP Keep this in mind particularly when switching between chromatographic methods.

- The stability of water or highly aqueous (< 5% organic modifier) mobile phase is highly susceptible to microbial growth. Prepare such mobile phases freshly on a daily basis
- Select an optimal evaporation temperature to selectively evaporate background components of the mobile phase. Observe the guidelines in the *Evaporation Temperature* section.

- If the detector is inadvertently exposed to a non-volatile mobile phase, use water or appropriate solvent with no additives to remove the salts from the detector.

Typical compatible solvents for use with the detector

- Water
- Methanol
- Isopropanol
- Acetonitrile
- Acetone
- Methylene chloride
- Hexane
- Chloroform
- Tetrahydrofuran

  NOTE: Use THF with nitrogen gas only.

6.5.1.3 *Mobile Phase Delivery System*

- The pump should deliver continuous flow and at the same time ensure the intermixing of solvents from different reservoirs, if applicable.
- The mobile phase reservoirs should be clean borosilicate glass that is dedicated for use with volatile mobile phases.
  In some applications, however, it may be necessary to use plastic reservoirs, for example when using extreme pH aqueous eluents (such as > pH 12).
- Consider the pump flow rate limit of the detector when preparing analysis. Operate the detector only within the allowed pump flow rate range.
- It is recommended to use online degassers for HPLC systems with the detector. Make sure to thoroughly flush any degasser channel that has been exposed to non-volatile buffers. In some cases, it may be necessary to dedicate degasser channels to only use volatile mobile phases.

6.5.1.4 Additives

General Guidelines for Additives

- Use only high-purity volatile additives for the mobile phase, such as pH modifiers, buffer salts and ion pairing reagents.
- Choose the grade of additives that has the lowest concentration of non-volatile impurities. Common impurities are iron, copper, sodium and potassium.
- Avoid using non-volatile additives, such as citrate, phosphate, potassium, sodium, sulfonic acids and Tris.
- Use the lowest concentration of non-volatile additive required to achieve the desired chromatographic performance.
- Make sure that the mobile phase pH is within the allowed range of the detector: 2.0 to 9.5. More importantly, make sure that the mobile phase pH is well within the operating range of the LC column and the system.

TIP Many columns will exhibit bleed, which refers to the release of non-volatile impurities into the eluent, if operated near the extremes of their pH range. For most silica-based columns, the pH range is 2.0 to 8.0.

Overview of typical additives and buffers for use with the detector

Additive/Buffer	pKa	Buffer range	Recommended max. concentration	pH at max. concentration in water
Trifluoroacetic acid (TFA)	0.3	--	0.1% v/v	1.9
Formic acid	3.75	2.8 – 4.8	0.3% v/v	2.5
Ammonium formate			10 mM	
Acetic acid	4.76	3.8 – 5.8	0.3% v/v	3.0
Ammonium acetate			10 mM	
Ammonium bicarbonate	7.8, 9.8, 10.3	7.0 – 11.0	10 mM	

- Acetic acid (AA) and especially formic acid (FA) are recommended as primary choices of acidic modifier for use with the detector. They are relatively volatile and the pH at typical concentrations is well within the compatibility range of most columns.
- Trifluoroacetic acid (TFA) is frequently used as acidic modifier with the detector. However, as indicated in the table above, the pH of 0.1% v/v TFA is beyond the range of many columns. Use a lower concentration if possible to minimize column bleed.
- TFA and other perfluorocarboxylic acids, such as heptafluorobutyric acid (HFBA), can function both as acidic modifiers and anionic ion pairing reagents. These additives are less volatile than AA and FA and will more readily form non-volatile salts with other additives or sample components. If you use these additives, do not use basic additives, such as ammonium or ammonium salts, or cationic ion pairing reagents, such as triethylamine (TEA).
- TFA is known to be unstable after exposure to air. Single use vials of TFA are therefore recommended if choosing this additive.
- If using cationic ion pairing reagents, such as TEA, practice the same precautions as with anionic pairing reagents to avoid formation of non-volatile salts with other additives and to stay within the range of column and detector pH compatibility.
- AA and FA and their corresponding ammonium salts are recommended as primary choices to control pH within the above indicated buffer range.
- Ammonium bicarbonate may be used to control pH at higher levels but requires use of an elevated evaporation temperature, such as 50 °C. Although the buffer range extends to pH 11.0, make sure to keep the pH below the detector maximum of 9.5. More importantly, make sure to keep the pH well below the compatibility range of your column.
- If using a pH electrode to adjust buffer pH, only do so in aqueous solutions without organic modifiers. Always make pH measurements in separate aliquots of the aqueous solution to avoid cross-contaminating the mobile phase buffers with non-volatile salts from the pH electrode calibrations.

6.5.2 Setting the Nebulizer Gas Pressure

Before operating the detector, verify the nebulizer gas pressure setting.

NOTICE Operating the nebulizer with a gas pressure other than the pressure specified for this nebulizer can cause unpredictable deviations in performance of the nebulizer and the detector. After installation of the nebulizer, set the nebulizer gas pressure to the pressure that is specified for your nebulizer. The nebulizer gas pressure is defined on the gas pressure certificate that is shipped with the nebulizer.

AVIS L'utilisation du nébuliseur avec une pression de gaz autre que la pression spécifiée peut entraîner des écarts imprévisibles de performance du nébuliseur et du détecteur. Après installation du nébuliseur, réglez la pression de gaz sur le nébuliseur sur la pression spécifiée pour votre nébuliseur. La pression de gaz sur le nébuliseur est définie sur le certificat de pression de gaz expédié avec le nébuliseur.

Follow these steps

- *Corona Veo detectors*
  Use the gas regulator knob on the rear side of the detector to set the nebulizer gas pressure. See section 6.5.2.1, page 129.
- *Corona Veo RS detectors*
  Use the parameters on the display to set the nebulizer gas pressure. See section 6.5.2.2, page 132.

6.5.2.1 Corona Veo Detectors

When

- After installation or replacement of the nebulizer
- If the nebulizer gas pressure has fallen outside the specified pressure
- If the gas regulator knob has drifted

TIP The gas regulator knob may sometimes drift so that the gas pressure needs to be readjusted.

Preparations

Make sure that the nebulizer is installed.

Follow these steps

1. *If the pump flow is turned on and the detector is in Run Mode*

   a) Turn off the pump flow. Wait several minutes for the detector pressure to stabilize.

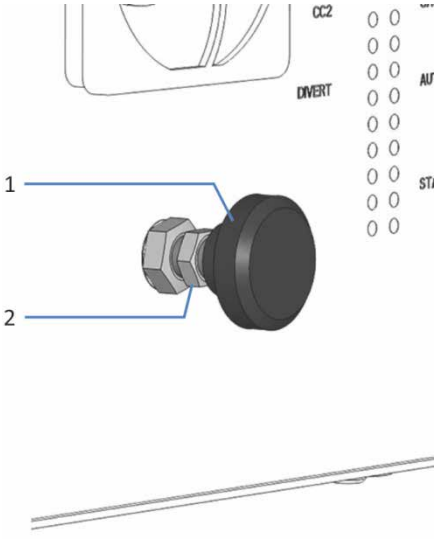
   b) In the **Run Mode Menu** on the detector display, select the **Exit** soft key to stop the **Run Mode** and return to the **Main Menu**.

> **TIP** If you operate the detector from a chromatography data system, disconnect the detector to unlock the display functions and access the **Main Menu**.

2. Navigate to the **System Setup Menu**, to display the actual pressure of the gas supplied to the nebulizer.

> **TIP** Write down the nebulizer gas pressure reading for later monitoring of the pressure.

3. On the rear side of the detector, locate the manual gas regulator.



No.	Description
1	Gas regulator knob
2	Lock nut (small nut)

Figure 28: Gas regulator knob on Corona Veo detector

4. Loosen the lock nut of the gas regulator knob (no. 2 in Figure 28).

5. Turn the gas regulator knob to adjust the gas pressure setpoint to the value that is defined on the gas pressure certificate. Observe the following:

   - Per knob revolution, turning the knob will change the pressure by approximately 20 psi (138 kPa, 1.4 bar).
   - To increase the gas pressure, turn the knob slowly clockwise.
   - To decrease the gas pressure, turn the knob slowly counterclockwise.
   - Monitor the increase or decrease of the gas pressure on the detector display while turning the knob.

   When the gas pressure setpoint matches the gas pressure from the nebulizer certificate, continue with the next step.

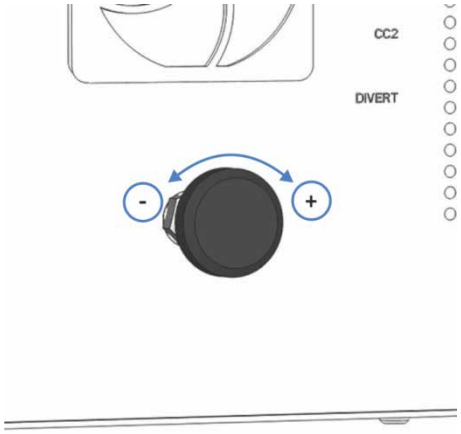


Figure 29: Adjusting the gas pressure with the knob

6. Hold the regulator knob firmly in position and retighten the lock nut with the other hand to avoid changing the pressure upon tightening. Verify that the pressure setpoint on the display does not change while tightening the lock nut.
7. Wait until the gas pressure reading has stabilized and reached the setpoint. On the **Diagnostics** screen, monitor the pressure reading of the **Gas Pressure** parameter (see section 6.4.2.1, page 112).

6.5.2.2 Corona Veo RS Detectors

When

- After installation or replacement of the nebulizer
- If the nebulizer gas pressure has fallen outside the specified pressure for the nebulizer
- If you use the gas regulation modes (only available when operating the detector from a chromatography data system)

Preparations

Make sure that the nebulizer is installed.

Follow these steps

1. *If the pump flow is turned on and the detector is in Run Mode*

   a) Turn off the pump flow. Wait several minutes for the detector pressure to stabilize.

   b) In the **Run Mode Menu** on the detector display, select the **Exit** soft key to stop the **Run Mode** and return to the **Main Menu**.

   TIP If you operate the detector from a chromatography data system, disconnect the detector to unlock the display functions and access the **Main Menu**.

2. In the **Main Menu**, press the **Gas** soft key to navigate to the **Gas Regulator** screen and display the gas regulator parameters.

   TIP Write down the nebulizer gas pressure reading indicated as the **Pressure** parameter for later monitoring of the pressure.

3. On the **Gas Regulator** screen, select the **Setpoint** parameter and set the pressure to the value that is defined on the gas pressure certificate.
4. Select the **Save** soft key to save the new pressure setting. Press **Exit** to return to the **Main Menu**.
5. Wait until the gas pressure reading has stabilized and reached the setpoint. On the **Diagnostics** screen, monitor the pressure reading of the **Gas Pressure** parameter (see section 6.4.2.1, page 112).

6.5.3 Equilibrating the System

Before you use the detector with the system and start sample analysis, flush the system thoroughly.

Make sure that the chromatography system is properly equilibrated. System equilibration should include the following operations:

1. Remove the analytical column from the system flow path.
2. Disconnect the detector from the system flow path.
3. Verify that a starting solution of 80% water and 20% methanol is miscible with the previously used mobile phase.
   - If the starting solution is not miscible, flush with an intermediate solvent.
   - If the system has been used with non-volatile buffers, extensive flushing with an intermediate solvent is required.
4. Flush the system with the starting solution of 80% water and 20% methanol without the detector until the system is free of any other liquid composition, for example solvent from a previous run.

   TIP If you use an online degasser in the system, flush each channel of the online degasser before you use the channels for sample analysis with the charged aerosol detector.

5. Pre-program all temperature-controlled devices in the system to the starting temperature required for the application. Warming up (or cooling down) the temperature-controlled devices can include, for example, the column compartment or the sample compartment thermostatting in the autosampler.
6. Change the solvent to the mobile phase required for the application. If the mobile phase for application is not miscible with the starting solution, use an intermediate solvent.
7. Flush the system with the mobile phase for the application until the system is free of the starting solution (80% water and 20% methanol). The detector is still disconnected from the system flow path.
8. Install an analytical column that is dedicated for use with volatile solvents to the system flow path.

9. Flush the system with the mobile phase for the application until the internal column volume has been replaced with fresh mobile phase. Flush with minimum 50 column volumes.

10. Monitor the pump pressure and pressure ripple. Check that the pump pressure reading is correct for the application, and the ripple is within reasonable limits for the application.

11. *If the system includes a first detector in the flow path before the charged aerosol detector, such as a UV/VIS detector*
Prepare the first detector for sample analysis, for example turning on the lamp. Refer to the *Operating Manual* for the respective detector.

12. Continue with the equilibration of the charged aerosol detector. See section 6.5.4, page 135.

6.5.4 Detector Equilibration

6.5.4.1 Turning On the Detector Gas Flow

Follow the instructions in this section to turn on the detector gas flow.

CAUTION—Escaping Gas

Gas can escape from open gas connections when the detector gas flow and/or the gas supply is turned on. The escaping gas can pose a health and safety risk.

Turn on the gas supply and detector gas flow only when the nebulizer is installed, the components in the gas flow path are properly connected, and the protective cover of the gas filter assembly is installed.

ATTENTION—Fuite de gaz

Du gaz peut s'échapper des raccordements de gaz ouverts lors du démarrage du débit de gaz du détecteur et/ou de l'alimentation de gaz. Cette fuite de gaz peut présenter un risque pour la santé et la sécurité.

Démarrez l'alimentation de gaz et le débit de gaz du détecteur uniquement lorsque le nébuliseur est installé, lorsque les composants dans le trajet d'écoulement de gaz sont correctement raccordés, et lorsque le capot de protection du bloc de filtration de gaz est installé.

NOTICE—Detector Gas Flow and Pump Flow
Improper handling of detector gas flow and pump flow start and stop can damage the detector. Observe the respective order of steps:

- *To stop pump flow and detector gas flow*
  Turn off the pump flow first, wait at least 5 minutes and only then turn off the detector gas flow. During the waiting period, the drain pump drains any remaining mobile phase to waste.
- *To start detector gas flow and pump flow*
  Turn on the detector gas flow first, wait at least 5 minutes and only then turn on the pump flow.

AVIS—Débit de gaz du détecteur et débit de la pompe
Toute manipulation incorrecte lors du démarrage ou de l'arrêt du débit de gaz du détecteur et du débit de la pompe peut endommager le détecteur. Respectez l'ordre respectif des étapes :

- *Pour interrompre le débit de la pompe et le débit de gaz du détecteur*
  Interrompez le débit de la pompe en premier, patientez au moins 5 minutes, puis uniquement après cela, interrompez le débit de gaz du détecteur. Durant la période d'attente, la pompe de vidange évacue toute phase mobile restante vers l'évacuation.
- *Pour démarrer le débit de gaz du détecteur et le débit de la pompe*
  Démarrez le débit de en premier, patientez au moins 5 minutes, puis uniquement après cela, démarrez le débit de la pompe.

Preparations

1. Make sure that you observe the site requirements for the gas supply. See section 5.3.7, page 61.
2. Turn on the gas supply to the detector. Observe the gas supply pressure specifications for the detector. See section 9.1 Performance Specifications, page 236.

Follow this step

Turn on the gas flow in the detector:

- In the **Main Menu** on the detector display, press the **Run Mode** soft key.
  The **Run Mode Menu** is displayed, the gas flow is turned on, and data acquisition is started.

  –or–
- In the **Main Menu** on the detector display, alternatively you can press the **Gas On** soft key to turn on the gas flow only.

6.5.4.2 *Equilibrating the Detector*

Preparations

1. Equilibrate the system. See section 6.5.3, page 133.
2. Turn on the detector gas flow. See section 6.5.4.1, page 135. Pump flow must be turned off. Wait at least 5 minutes before you continue.

Follow these steps

1. On the **Evaporation Temperature** screen, set the evaporation temperature. To optimize the evaporation temperature for your application, observe the guidelines in section 6.7.4, page 142.

2. To deliver pump flow to the charged aerosol detector, follow these steps:

   a) Make sure that the pump flow rate limit is set to the maximum flow rate specified for the charged aerosol detector.

   b) Turn on the pump flow to the detector. Have the pump deliver flow to the detector.

   Observe the Mobile Phase Guidelines for the Detector in section 6.5.1, page 123.

   The following table provides an overview of typical flow rates for certain column internal diameters:

Column Inner Diameter	Typical Flow Rate
4.6 mm	1.0 mL/min
3.0 mm	0.5 mL/min
2.0 mm	0.2 mL/min
1.0 mm	0.05 mL/min

3. Allow the detector to equilibrate until you observe a steady baseline.
   - Monitor the background signal of the detector. It will increase initially and should then start to fall. Over a short period of time, the signal should fall to a low level and then stabilize.
   - The detector is ready for data acquisition when the baseline is stable. The time required to obtain a stable baseline depends on the application.

4. Perform an autozero of the detector baseline. In the **Run Mode Menu** of the display, press the **Autozero** soft key.
   The detector is now ready for sample analysis.

6.6 Operating the Detector

Consider this section for routine operation of the detector.

Preparations

Prepare the detector for operation. See section 6.5, page 121.

NOTICE Operate the detector only within the allowed flow rate range. Exceeding the flow rate limit will damage the detector.

AVIS Utilisez le détecteur uniquement dans les limites de la plage de débit autorisée. Tout dépassement de la limite de débit endommagerait le détecteur.

Starting Data Acquisition

1. To start data acquisition, select the **Run Mode** soft key from the **Main Menu** screen.
2. Equilibrate the detector. See section 6.5.4.2, page 136.
3. To monitor the progress of data acquisition on the display, you can watch the online data signal of the detector in real-time using
   - The **Current** parameter in the **Run Mode Menu**, or
   - The **Graph** screen

TIP For information on starting and stopping data acquisition with the Chromeleon software, see section 6.8.2, page 150.

Stopping Data Acquisition

To stop the **Run Mode**, press the **Exit** soft key and, on the next screen, press the **Continue to Exit** soft key.

Stream-Switching Valve Operation (Corona Veo RS only)

The stream-switching valve can be used to direct flow to the nebulizer or to external devices or a waste reservoir. In addition, the stream-switching valve will divert liquid away from the detector in the event of an alarm condition.

If the detector is controlled from a chromatography software, such as the Chromeleon software, the valve can be actuated as part of the chromatographic method. This way, it can be used to direct flow away from the detector as a timed function to:

- Eliminate the solvent front or unwanted peaks from detection, thus simplifying the chromatogram
- Direct flow to another detector, liquid handling and/or fraction collector

6.7 Optimizing the Performance

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

For information on the default parameters on the detector display, see section 6.4, page 107.

6.7.1 Optimization Guidelines

General Guidelines

Consider the following guidelines for optimization of the detector performance:

- Consider the influences of the parameters on the detection (see section 6.7.2 Overview of Optimization Parameters, page 141).
- Ensure that the operating conditions are suitable. This includes:
  - Stable environmental conditions, such as a stable temperature
  - No air drafts
  - No vibrations or mechanical shocks caused by external sources
  - Stable backpressure and correct waste and leak drainage setup
- Use an on-line degasser to degas the solvent in the pump.
- Monitor the usage of specific detector components that are subject to wear and stress and schedule appropriate maintenance intervals. See section 7.4.1 Maintenance Plan, page 170.
- Observe the guidelines and recommendations on the use of mobile phases with the charged aerosol detector. See section 6.5.1 Mobile Phase Guidelines for the Detector, page 123.
- Maintain the nitrogen or air source for your detector at regular intervals to ensure optimum performance. Observe the instructions in the *User Documentation* for the nitrogen generator.
- When the mobile phase was stored over a period of time, high background current may be observed. Replace old mobile phase with freshly prepared mobile phase.

- If you use the detector for the analysis of complex biological samples, proper sample preparation is especially important.
- Minimize dead volumes before the detector. This is a commonly overlooked but important cause of band broadening. Use capillaries with a small internal diameter of the shortest length possible.

Column Guidelines

- Use a dedicated column for each specific analysis to avoid cross-contamination of the column.
- Columns that are unstable and/or have a tendency to release particles from the column bed (i.e. "column bleed") will produce noise in the detector. Avoid such columns.

  When operated near the extremes of their pH value, temperature and/or pressure operating range, columns may also be subject to "column bleed".
- Do not use a column that has been used with non-volatile mobile phases.
- Flush new columns to waste for several hours before you connect them to the system.
- If you perform a gradient, it is recommended to perform blank injections with the desired method gradient profile prior to analysis. This "pre-conditioning" of the column improves the performance of both, the analytical column and the detector.

6.7.2 Overview of Optimization Parameters

The following table serves as an overview of parameters that influence the performance of the detector during data acquisition.

Parameter	Affects
Filter constant	Sensitivity, baseline noise
Evaporation temperature	Baseline noise, background current
Power function value	Linear range
Data collection rate	Peak resolution, disk space, possibly baseline noise

For further information about the parameters, refer to the *Chromeleon Help*.

6.7.3 Filter Constant

The filter constant is applied to the output current to electronically reduce the baseline noise during the analysis.

When setting a filter constant, observe the following:

- A small filter constant, such as 0.2 seconds, removes little baseline noise.
- A large filter constant, such as 10.0 seconds, smoothes the baseline significantly.
- Consider also the filter constant when setting the data collection rate. Set the two parameters together in order to optimize the amount of data points collected, and reduce short-term noise, while still maintaining peak height, symmetry, and resolution.

6.7.4 Evaporation Temperature

The temperature-controlled evaporation tube dries the aerosol droplets that come from the spray chamber. The evaporation tube evaporates the more volatile components in the droplets to produce dried particles composed of non-volatile analyte and background residue.

The efficiency of the drying procedure depends on the set temperature. Additional factors, such as the mobile phase composition, the pump flow rate and the sample composition, also play an important role.

Note the following when selecting an evaporation temperature:

- The default evaporation temperature is set to 35 °C.
- When selecting a different evaporation temperature, observe the evaporation temperature specification for the detector. See section 9.1 Performance Specifications, page 236.
- Changes in the evaporation temperature affect the response of the detector.
- When the temperature is changed, the evaporation tube requires time to equilibrate. Wait approximately 30 minutes before you start sample analysis to make sure that the detector is only ready for analysis when the evaporation tube is equilibrated.

Guidelines for selecting the evaporation temperature

The following guidelines are recommended for selecting an optimal evaporation temperature:

NOTICE Do not use non-volatile additives, such as sodium phosphate. Observe the Mobile Phase Guidelines for the Detector in section 6.5.1, page 123.

AVIS N'utilisez pas d'additifs non-volatiles, tels que le phosphate de sodium. Observez les consignes pour la phase mobile de la section 6.5.1, page 123.

- In general, use the lowest evaporation temperature within the specified temperature range that provides acceptable limits of sensitivity.
- As a starting point, use an evaporation temperature of 35 °C.
- Higher evaporation temperature settings can be used when analytes of interest have low volatility, relative to the background. Since the volatility of background residue is typically unknown, experimentation is required for optimizing this parameter for a given method.
- Perform screening runs at two evaporation temperature settings:
  - *Corona Veo RS detector*
    Use a minimum of two evaporation temperatures. Typically, 35 °C and 40 °C are appropriate if the temperature range is unknown. If required, perform additional tests in a maximum of 5 °C increments.
  - *Corona Veo detector*
    Use the two evaporation temperatures (35 °C and 50 °C) to perform screening runs if the required temperature setting is unknown.

- Consider that higher evaporation temperature settings may inadvertently reduce response for low-analyte levels, even if they are considered as non-volatile analytes.
- Remember to check the limits of sensitivity by actual analysis of low-level standards. Also, check the analyte signal reproducibility at each evaporation temperature setting.
- For detection of semi-volatile analytes, you can use lower evaporation temperature settings. However, this may lead to higher background levels and noise.

How to optimize the evaporation temperature (Corona Veo RS only)

- Perform three or more injections of a reference standard for the analytical method for which you want to optimize the evaporation temperature.
- Use a different evaporation temperature setting for each reference injection, ranging from low to high temperature. Select the most appropriate setting as starting point. See the *Guidelines for selecting the evaporation temperature* above.

TIP Using performance metrics such as the precision and sensitivity of the detector can help to achieve the optimal evaporation temperature.

6.7.5 Gas Regulation Mode (Corona Veo RS Detector only)

This section applies only to the Corona Veo RS detector.

The modes are only available in the chromatography data system, such as the Chromeleon software.

The detector provides two gas regulation modes (gas flow modes) to optimize the efficiency of the nebulizer: **Analytical** and **MicroLC**. Each mode sets a specific nebulizer gas pressure for the analysis, based on the gas pressure specified for the nebulizer from the nebulizer certificate.

The modes are designed as a simple way to optimize the nebulizer efficiency when you use very high (analytical) or very low (microLC) flow rates in the specified flow range for the detector. These modes of operation are only available when you use compatible chromatography software.

To select the gas regulation mode for your application, note the following:

- **Analytical** mode
  - The pressure for the gas regulator is set to the nebulizer gas pressure setting as defined on the nebulizer certificate.
  - For use with high pump flow rates within the pump flow range allowed for the detector
  - This mode is set as a default in Chromeleon.
- **MicroLC** mode
  - The nebulizer gas pressure setting is automatically reduced by a fixed fraction of the nebulizer pressure.
  - This mode optimizes the nebulizer gas pressure for certain pump flow rates and certain types of mobile phase compositions.
  - For use with very low pump flow rates within the pump flow range allowed for the detector

TIP The resulting nebulizer gas pressure will be below the gas pressure specified in the nebulizer certificate (for example, below 55 psi or 3.8 bar or 379 kPa).

6.7.6 Power Function Value

The signal of the detector has a wide dynamic range with over four orders of magnitude. The nature of the response is inherently nonlinear.

The *Power Function Value* (PFV) applies a power transformation to the data output of the detector. Power transformations can improve the linearity of response over a given range of interest.

The transformation is applied to the data output in real time. The data output is raised to the selected power.

As a standard, the **Power Function** is set to 1.00. For most applications and compounds, this is a good universal setting.

Guidelines for selecting a power function value

To optimize the power function value, observe the following guidelines:

- An optimal power function value improves the linearity of response over a given range of interest.
- Selecting the optimal value depends primarily on the analysis conditions and the desired range of quantitation.

6.7.7 Baseline Noise

Baseline noise can originate from many factors. To minimize the baseline noise, observe the following:

- The quality of the mobile phase has a major impact on the performance of the detector. Only use mobile phases of the highest quality available. Keep impurities and contaminants to a minimum. Follow the Mobile Phase Guidelines for the Detector in section 6.5.1, page 123.
- Flush the system modules at regular intervals to remove any non-volatile residues, if applicable.
- Follow the maintenance schedules to keep the system modules in optimum performance state.
- Keep the supplied gas in optimum quality for the detector. Observe the gas supply requirements in section 5.3.7, page 61.
- Fluctuations in pump backpressure can cause baseline noise. If the noise is synchronized with the pump stroke, check your HPLC pump.

6.7.8 Data Collection Rate

When you operate the detector from a chromatography data system, you can select the digital data collection rate in order to optimize the performance of the detector.

The data collection rate is the number of data points per second (Hz) that the chromatography software collects from the detector and stores as raw data.

When you select a data collection rate, observe the following guidelines:

- In general, each peak should be defined by at least 20 data points. For chromatograms with co-eluting peaks or low signal-to-noise ratios, 40 data points per peak are recommended.
- If the data collection rate is too low, the start points and end points of peaks will not be determined accurately.
- If the data collection rate is too high, data files may need more disk space and post-run analyses may require more processing time.
- If all peaks are relatively wide, select a lower data collection rate (for example, 1.0 Hz). This saves disk space and allows for a faster display of data in the Chromeleon software.
- If any peaks of interest are less than a few seconds, select a higher data collection rate (10.0 Hz, for example).
- Consider also the filter constant when setting the data collection rate. Set the two parameters together in order to optimize the amount of data points collected, and reduce short-term noise, while still maintaining peak height, symmetry, and resolution.
- If you use the Chromeleon software, consider the maximum data collection rate, depending on the respective detector type and Chromeleon version:
  - With the Corona Veo, data can be generated with a maximum collection rate of 100 Hz.
  - With the Corona Veo RS, data can be generated with a maximum collection rate of 100 Hz in Chromeleon 6.80 or 200 Hz in Chromeleon 7.

6.8 Software Operation

This section describes the basic steps for operating the Corona Veo (RS) charged aerosol detector with the Chromeleon software. The steps are slightly different for Chromeleon 7 and Chromeleon 6.8. For additional information, refer to the Help and documents provided with the software.

6.8.1 Setting Up the Detector in the Software

This section describes the basic steps for operating the Corona Veo (RS) charged aerosol detector with the Chromeleon 7 software. The steps are identical for the Chromeleon 6.8 software, but the terminology may differ. For additional information, refer to the Help and documents provided with the software.

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

TIP In order to start the Chromeleon Instrument Controller, you must log on under Windows with local administrator privileges, or as a member of the Windows **Chromeleon Operators** user group.

Loading the USB Drivers

1. Turn on the power to the data system computer if it is not yet already on.
2. Turn on the power to the charged aerosol detector.
   Windows will automatically detect the new devices and perform the USB installation. If Windows fails to detect the devices and launches a wizard instead, this indicates that you connected the devices to the computer and turned on the power for the first time *before* you installed the Chromeleon software. In this case, cancel the wizard, install the software, and then repeat the steps.

Starting the Instrument Controller and Instrument Configuration Manager

1. Start the Chromeleon Instrument Controller.
   Right-click the Chromeleon tray icon on the Windows taskbar (the icon is crossed out in red) and click **Start Chromeleon Instrument Controller**. The icon changes to gold, indicating that the Instrument Controller Service is starting. The icon changes to gray when the Instrument Controller Service is running (idle).

   If the Chromeleon tray icon is not available on the Windows taskbar, click **Start > All Programs** (or **Programs**, depending on the operating system) **>Thermo Chromeleon 7 > Services Manager > Start Instrument Controller**.
2. Start the Chromeleon 7 Instrument Configuration Manager.
   Click **Start > All Programs** (or **Programs**, depending on the operating system) **> Thermo Chromeleon 7 > Instrument Configuration Manager**.

Adding the charged aerosol detector to a System

1. *If no system is set up yet*
   On the **Edit** menu, click **Add Instrument** to add a new instrument (system).
2. Select the instrument (system) and click **Add Module** on the **Edit** menu to add the charged aerosol detector.
3. In the **Add module to instrument** dialog box, on the **Manufacturers** list, select **Thermo Scientific** and on the **Modules** list, select the **Corona Veo Charged Aerosol Detector**.
4. On the **General** configuration page, make sure that simulation mode is deactivated and click **Browse** to select the module address.

   The Chromeleon software connects to the module and transfers the settings from the detector firmware to the software. Check and change the settings on the other configuration pages if necessary. For information about the settings, click **Help** or press the **F1** key.
5. On the **File** menu, click **Save Installation** and then close the Instrument Configuration Manager.

6.8.2 Operating the Detector from the Software

6.8.2.1 Chromeleon 7

Starting the Instrument Controller and Client

1. Start the Chromeleon Instrument Controller.
   Right-click the Chromeleon tray icon on the Windows taskbar (the icon is crossed out in red) and **Click Start Chromeleon Instrument Controller**. The icon changes to gold, indicating that the Instrument Controller Service is starting. The icon changes to gray when the Instrument Controller Service is running (idle).

   If the Chromeleon tray icon is not available on the Windows taskbar, click **Start > All Programs** (or **Programs**, depending on the operating system) **> Thermo Chromeleon 7 > Services Manager > Start Instrument Controller**.

2. Start the Chromeleon 7 client.
   Click **Start > All Programs** (or **Programs**, depending on the operating system) **> Thermo Chromeleon 7 > Chromeleon 7**.

Controlling the System from the ePanel Set

When the chromatography system is not running an automated analysis, you can control the system modules from the ePanel Set. Use the ePanel Set to view status information and perform commands.

To access the ePanel Set:

1. On the **Console**, click the **Instruments** Category Bar.

2. In the Navigation Pane, click the instrument that you want to control.
   The Chromeleon software connects to the instrument and displays the ePanel Set.

   The ePanel Set opens to the **Home** panel, which shows basic status information about each module in the system and provides access to the instrument Audit Trail.

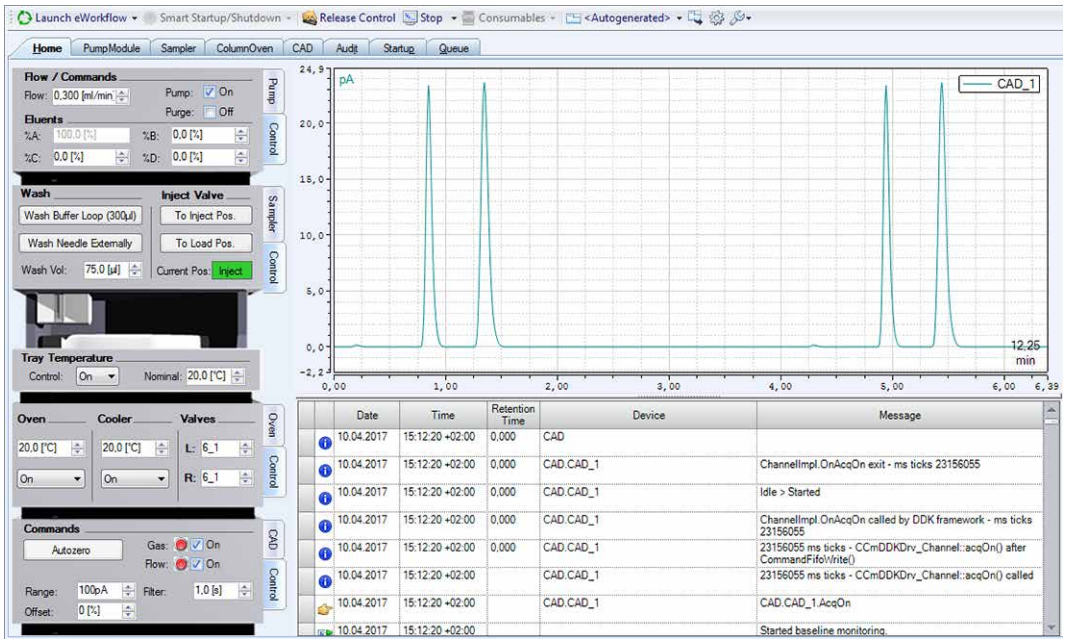


Figure 30: Chromeleon 7 ePanel for an UltiMate system with Corona Veo RS detector (example)

3. On the ePanel Set, click the tab for a module.
4. Use the controls (for example, buttons, sliders) to perform commands.
5. If a function that you want to perform is not available on a panel, press the **F8** key to open the **Command** window. From this window, you can access all commands that are available for the system.

TIP The commands and parameters that are available in the **Command** window may vary, depending on the user level in the **Command** window (**Normal**, **Advanced**, or **Expert**). To change the user level, right-click in the commands list and select a different user level.

Monitoring the Baseline

When an instrument is idle, you can monitor the baseline signals without starting a sequence. During baseline monitoring, the monitored signals are displayed on the real-time signal plot on the ePanel for the module. You may have to add the signal to the plot in the Plot Properties (for details, refer to the *Help*).

To monitor the baseline signals:

1. Open the ePanel Set.
2. On the toolbar above the ePanel Set, click **Monitor Baseline**.
3. In the **Select Channels to Monitor** dialog box, select the signals that you want to monitor.
4. To stop monitoring the baseline, click **Stop** on the toolbar.

TIP Monitor baseline data is overwritten each time baseline monitoring is started. If you want to save the data permanently, define the location in the **Monitor Baseline Save Preferences** dialog box. For details, refer to the *Help*.

Running Automated Sample Analysis

Automated sample analysis with the chromatography system involves creating and running a sequence. In a sequence, you determine how the injections of a sample are analyzed and in which order they are processed. Each injection of a sequence is processed by using an instrument method, which defines the property values and timed control commands for each module. For details how to create an instrument method using the Instrument Method Wizard, refer to the *Help*.

Creating the sequence

Chromeleon 7 supports two methods for creating a new sequence:

- eWorkflows (preferred method)
  eWorkflows provide a set of predefined templates and rules for creating a new sequence.

TIP If no eWorkflows are available, you can create a new eWorkflow as described in the *Help*. As an alternative, use the Sequence Wizard to create the sequence.

a) On the **Console**, click the **eWorkflows** Category Bar.

b) In the **Navigation Pane**, click the eWorkflow name.

c) In the Work Area, click the instrument name, and then click **Launch**.

d) The eWorkflow Wizard guides you through the process. Complete the steps in the wizard. For detailed information about a wizard page, click the Help icon.

After you finish the wizard, the sequence is displayed in the Data view of the **Console**.

- Sequence Wizard

a) On the **Console** menu bar, click **Create**.

b) The Sequence Wizard guides you through the process. Complete the steps in the wizard. Specify the number of samples and/or standards, the instrument method, processing method, and report template that you want to use. For detailed information about a wizard page, click the Help icon.

After you finish the wizard, the sequence is displayed in the Data view of the **Console**.

Starting the new sequence

1. On the **Sequence Control Bar**, click **Start**.
2. The sequence is appended to the queue and a Ready Check is performed.
   If the Ready Check passes and if the instrument is not currently running another sequence, the sequence is started.

6.8.2.2 Chromeleon 6.8

Starting the Chromeleon Server

1. Start the Chromeleon 6.8 Server.
   Right-click the Chromeleon Server Monitor icon on the Windows taskbar (the icon is crossed out in red) and click **Start Server**. The icon changes to gold, indicating that the Chromeleon Server is starting. The icon changes to gray when the Chromeleon Server is running (idle).

   If the Server Monitor icon is not available on the Windows taskbar, click **Start > All Programs** (or **Programs**, depending on the operating system) **> Chromeleon > Server Monitor > Start**.
2. Start the Chromeleon 6.8 client.
   Click **Start > All Programs** (or **Programs**, depending on the operating system) **> Chromeleon > Chromeleon**.

Controlling the System from the Panel Tabset

When the chromatography system is not running an automated analysis, you can control the system devices from the *panel tabset*. Use the panels on the panel tabset to view status information and perform commands.

To access the panel tabset:

1. Click **View > Default Panel Tabset** or click the  icon on the toolbar.
2. Select the Chromeleon server and click **OK**.
3. If more than one timebase is configured on the server, Chromeleon 6.8 displays a panel tabset for each timebase. Click the **Expand Timebase View**  icon for the timebase that you want to control.

   The panel tabset opens to the **Home** panel, which shows basic status information about each device in the system and provides access to the Audit Trail.
4. On the panel tabset, click the tab for a device.
5. Use the controls (for example, buttons, sliders) to perform commands.
6. If a function that you want to perform is not available on a panel, press the **F8** key to open the **Commands** dialog box. From this dialog box, you can access all commands that are available for the system.

TIP The commands and parameters that are available in the **Commands** dialog box vary, depending on the display filter level (**Normal**, **Advanced**, or **Expert**) in the **Commands** dialog box. To change the display filter level, right-click the commands list and select a different filter level.

Monitoring the Baseline (Manual Data Acquisition)

When an instrument is idle, you can monitor the baseline signals without starting a sequence. During baseline monitoring, the monitored signals are displayed on the online signal plot on the panel for the device. You may have to add the signal to the plot in the plot properties (for details, refer to the *Help*).

To monitor the baseline signals:

1. Open the panel tabset.

2. On the toolbar, click the **Acquisition On/Off** icon.
3. In the **Data Acquisition** dialog box, select the channel or channels that you want to monitor.
4. To stop monitoring the baseline, click the **Acquisition On/Off** icon on the toolbar again. If you want to save the data, select the **Save to sequence** check box in the **Stop Data Acquisition** dialog box, specify the sequence, and then click **Yes**.
   If the check box is cleared, monitor baseline data is overwritten each time baseline monitoring is started.

Running Automated Sample Analysis

Automated sample analysis with the chromatography system involves creating and running a sequence. In the sequence, you determine how the samples are analyzed and in which order they are processed. Each sample of a sequence is processed using a program file (PGM file), which defines the property values and timed control commands for each device. For details how to create a program file using the PGM Wizard, refer to the *Help*.

Creating the sequence
The Sequence Wizard helps you create a new sequence:

1. To start the Sequence Wizard, select one of the following alternatives:
   - On the panel tabset, click the **Sequence Control** tab, and then click **Create Sequence**.
   - In the Chromeleon 6.8 Browser, click **File > New > Sequence (using Wizard)**.
2. Complete the steps in the wizard. For detailed information about a wizard page, click **Help**.

TIP If a program and/or quantification method is not yet available when you create the sequence, you can create and specify them later. For details, refer to the *Help*.

3. After you finish the wizard, the sequence is displayed in the Chromeleon 6.8 Browser.

Starting the new sequence
Select one of the following alternatives:

- Start the sequence from the **Sequence Control** panel:

  a) On the **Sequence Control** panel, click **Load Sequence**.

  b) Select the sequence and click **Open** to add it to the batch list.

  c) Click **Start Batch**.

- Start the sequence from the Chromeleon 6.8 Browser:

  a) In the Chromeleon 6.8 Browser, select the sequence.

  b) On the **Batch** menu, click **Edit > Add**.

  c) Select the sequence and click **Open** to add it to the batch list.

  d) Click **Start**.

A Ready Check is performed. If the Ready Check passes and if the timebase is not currently running another sequence, the sequence is started.

6.8.3 Signal Channels in Chromeleon

The following signal channels are available for the detector in the Chromeleon software:

- **CAD_1**
  The signal channel is available for data acquisition.

  As a standard, the detector measures the current in **pA**.

- **Gas regulator pressure**
  The signal channel records and monitors the nebulizer gas pressure during data acquisition.

  As a standard, the detector measures the pressure in **psi**.

  It is recommended to record the signal channel for troubleshooting purposes.

  For proper gas pressure regulation, or if baseline noise or poor precision occurs, the information from the signal channel can provide helpful information to identify and eliminate the source for the problem.

- **Evaporation tube temperature**
  The signal channel records and monitors the actual temperature of the evaporation tube during data acquisition.

  The temperature is recorded in **°C** as a default.

  It is recommended to always record the evaporation temperature signal channel for troubleshooting purposes.

  If a problem occurs, the information from the signal channel can provide helpful information to identify and eliminate the source for the problem.

Recording signal channels

On the **Signals** page of the detector configuration, adapt the settings as follows:

- To allow raw data collection for a signal, select the **Enabled** check box next to the signal name. If a check box is cleared, the detector cannot collect raw data for the signal.
- To change a signal name, overwrite the existing name directly in the **Name** field.

6.8.4 Chromeleon Audit Trail

If the device firmware detects a problem, the problem is also reported to the Chromeleon software, in addition to the code on the detector display.

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, 2013, is named 20130515.

- *Chromeleon 7*: The Instrument Audit Trails can be found on the ePanel Set (Audit ePanel). In addition, Audit Trails for each instrument are available in the Chromeleon 7 Console Data view, in the folder of the instrument.
- *Chromeleon 6.8*: The Daily Audit Trails can be found on the panel tabset (Sequence Control panel). In addition, Daily Audit Trails are available in the Browser, in the folder of the timebase.

Messages in the Chromeleon Audit Trail are preceded by an icon. The icon identifies the seriousness of the problem. The table shows the icons and explains the severity level.

Icon	Severity	Description
	Warning	• The queue (Chromeleon 7) or batch (Chromeleon 6.8) can be started. • The current run is not interrupted. Nevertheless, Thermo Fisher Scientific recommends taking appropriate remedial action to resolve the problem.
	Error	The software attempts to correct the problem. An error does not interrupt the current analysis. However, if the error occurs during the Ready Check, the analysis will not be started.
 or 	Abort	• The queue (Chromeleon 7) or batch (Chromeleon 6.8) cannot be started. • A running queue or batch is stopped immediately.

6.9 Shutting Down the Detector

If the detector will not be operated for some time, follow the instructions on shutting down the detector in this section.

6.9.1 Short-Term Shutdown (Interruption of Operation)

If the detector is not used for a few days, allow the detector to remain connected to the system, and the detector and system to be turned on.

To interrupt operation of the detector for a short period (short-term shutdown), for example, overnight, observe these guidelines for the 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.
- Keep the detector connected to the system flow path.
- Turn off the pump flow.
- If you operate the detector from a chromatography data system, keep the detector connected to the data system.

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

Shutting Down the Detector

NOTICE

Observe the following to avoid damage to the charged aerosol detector:

- Always flush the detector with an appropriate pure solvent before interrupting operation. Follow the steps below.
- Avoid leaving the detector exposed to highly acidic or basic mobile phases for long periods.
- If the detector was operated with organic solvents in high concentration that may form peroxides upon evaporation, such as un-stabilized tetrahydrofuran, flush the detector with LC/MS-grade water before shutdown.

AVIS

Afin d'éviter toute détérioration du détecteur d'aérosols chargés, respectez les consignes suivantes :

- Vidangez toujours le détecteur au moyen d'un solvant pur adéquat avant d'interrompre le fonctionnement. Suivez les étapes ci-dessous.
- Évitez de laisser le détecteur exposé à des phases mobiles hautement acides ou alcalines sur de longues périodes.
- Si le détecteur a fonctionné avec des solvants organiques en concentration élevée pouvant former des peroxydes lors de l'évaporation, comme du tétrahydrofuranne non stabilisé, vidangez le détecteur avec de l'eau de qualité LC/MS avant arrêt.

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

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

1. Remove the column.
2. Flush the detector with an appropriate, pure solvent (minimum LC/MS-grade) that does not contain any additives. Make sure that residual sample components, impurities from the column, or buffers are completely removed from the detector.

   Observe the following:

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

   TIP As an intermediate solvent, you can use 100% methanol to flush the charged aerosol detector.

3. Turn off the pump flow and then the gas flow:

   a) Turn off the pump flow to the detector. Wait at least 5 minutes. During the waiting period, the detector drains any remaining mobile phase to waste.

   b) Turn off the gas flow on the detector.

   c) Wait until the system pressure is down to zero before you continue.

   d) Turn off the gas supply to the detector.

4. Turn off the detector with its main power switch.
5. *Detector shall be transported or shipped after shutdown*
   Prepare the detector for transport. Follow the instructions in section 7.12 Removing the Detector from the System Stack, page 200.

Restarting the Detector

To restart the detector, follow these steps:

1. Prepare and restart the other modules in the system, following the instructions in the *Operating Manuals* for the modules.
2. Flush the components in the flow path before the detector before you connect the detector to the system flow path.
3. Turn on the detector with its main power switch.
4. Before starting an analysis, let the detector equilibrate and be sure that it is ready for operation (see section 6.5 Preparing the Detector for Operation, page 121).

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).

Seul le personnel d'entretien certifié par Thermo Fisher Scientific (désigné par la suite par techniciens d'entretien Thermo Fisher Scientific, par souci de concision), est autorisé à réaliser des procédures supplémentaires de maintenance et d'entretien.

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

7.2 Safety Guidelines for Maintenance and Service

- For English version, see below.
- For French version, see page 167.

English Version

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

Observe all warning messages and precautionary statements presented in section 2.3 Safety Precautions, page 23.

WARNING—High Voltage

High voltages are present inside the detector 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.

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—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 solvents lines. Refer to the *Operating Manual* for the pump. Retighten the reservoir caps.

NOTICE—Detector Gas Flow and Pump Flow

Improper handling of detector gas flow and pump flow start and stop can damage the detector. Observe the respective order of steps:

- *To stop pump flow and detector gas flow*
  Turn off the pump flow first, wait at least 5 minutes and only then turn off the detector gas flow. During the waiting period, the drain pump drains any remaining mobile phase to waste.
- *To start detector gas flow and pump flow*
  Turn on the detector gas flow first, wait at least 5 minutes and only then turn on the pump flow.

French Version

Lorsque vous effectuez des procédures de maintenance ou d'entretien, veuillez respecter les consignes de sécurité suivantes :

Respectez tous les messages d'avertissement et mentions de mise en garde présentés dans la section 2.3, page 23.

AVERTISSEMENT—Haute tension

Des tensions élevées sont présentes dans le détecteur et peuvent provoquer des chocs électriques. N'ouvrez pas le boîtier et ne retirez pas les capots de protection, à moins que cela ne soit expressément indiqué dans le présent manuel.

AVERTISSEMENT—Fuite de substances dangereuses provenant des raccordements fluidiques

Les raccordements fluidiques et les capillaires peuvent contenir des substances potentiellement dangereuses pour la santé. Il existe un risque de projection de solvant si des capillaires éclatent, glissent de leurs raccords, ne sont pas suffisamment serrés ou se déconnectent.

- Portez un équipement de protection approprié et suivez les bonnes pratiques de laboratoire.
- Avant d'entamer les procédures de maintenance ou de réparation, nettoyez toutes les substances nocives à l'aide d'un solvant approprié.

ATTENTION—Projection de solvant

Un risque de projection de solvants existe lorsque ceux-ci sont soumis à une pression élevée.

- Arrêtez le débit de la pompe avant ouverture du trajet d'écoulement.
- Patientez jusqu'à ce que la pression du système redescende à zéro.
- Portez un équipement de protection approprié lorsque vous ouvrez le trajet d'écoulement.

ATTENTION—Pression hydrostatique

Il existe un risque de fuite de solvants si vous ouvrez le trajet d'écoulement pendant que la pompe est en service. Cela est dû à la pression hydrostatique présente dans le système lorsque les réservoirs de solvants sont situés au-dessus du refoulement de la pompe.

Avant de desserrer un raccordement dans le trajet d'écoulement de faible pression, arrêtez le débit de la pompe et patientez jusqu'à ce que la pression du système redescende à zéro. Dévissez le bouchon des réservoirs de solvants et retirez la conduite de solvant en même temps que le bouchon des réservoirs. Videz les conduites de solvant : Resserrez le bouchon des réservoirs. Resserrez le bouchon des réservoirs. Consultez le *Manuel d'utilisation* de la pompe. Re-serrez les capots de réservoirs.

AVIS—Débit de gaz du détecteur et débit de la pompe

Toute manipulation incorrecte lors du démarrage ou de l'arrêt du débit de gaz du détecteur et du débit de la pompe peut endommager le détecteur. Respectez l'ordre respectif des étapes :

- *Pour interrompre le débit de la pompe et le débit de gaz du détecteur* Interrompez le débit de la pompe en premier, patientez au moins 5 minutes, puis uniquement après cela, interrompez le débit de gaz du détecteur. Durant la période d'attente, la pompe de vidange évacue toute phase mobile restante vers l'évacuation.
- *Pour démarrer le débit de gaz du détecteur et le débit de la pompe* Démarrez le débit de en premier, patientez au moins 5 minutes, puis uniquement après cela, démarrez le débit de la pompe.

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 detector when instructed to do so.
- Use only the replacement parts specifically authorized and qualified for the detector by Thermo Fisher Scientific. For ordering information, see section 10.4 Consumables and Replacement Parts, page 245.
- 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.
- When disconnecting capillaries, protect open flow connections with plugs.
- If you need to return the detector for depot repair, follow the instructions in section 7.12 Removing the Detector from the System Stack, page 200.

7.4 Routine and Preventive Maintenance

Optimum detector performance, maximum uptime of the detector, and accurate results can be obtained only if the detector 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 detector.

Frequency	What you should do...
Daily	Inspect the flow connections for signs of leakage or blockage.
	When you use buffers or salt solutions, flush the detector thoroughly after use with an appropriate solvent that does not contain buffers or salts.
	The stability of water or highly aqueous (< 5% organic modifier) mobile phase is highly susceptible to microbial growth. Prepare such mobile phases freshly on a daily basis
Regularly	Inspect the flow connections for damage, such as cracks, nicks, cuts, or blockage.
	Check that all warning labels are still present on the detector and clearly legible. If they are not, contact Thermo Fisher Scientific for replacement.
	Check the drain tubes: • Check that the drain tubes properly connect to the drain ports on the bottom right side of the detector. • Make sure that the tubes are unclogged and routed below the level of the drain ports. • Check the volume of the liquid in the waste container. Empty the container as needed.
	Check all electrical connections to ensure that they are properly seated.

Frequency	What you should do...
Annually	Have Thermo Fisher Scientific service personnel perform preventive maintenance once a year. For details on the service interval, see section 7.4.2, page 171.
	Perform the gas filter replacement annually according to the service interval on the display. For details on the service interval, see section 7.4.2, page 171.

TIP The detector is just one component of a chromatographic system. The performance of the detector will reflect the performance of the overall HPLC system. To maintain optimal analytical performance, perform routine maintenance on each of the various HPLC system modules, such as pump, autosampler, etc.

7.4.2 Preventive Maintenance

The preventive maintenance features of the detector provide information about internal parameters and service intervals.

If a date is expired, it appears in red.

Gas filter change date

- Displays the next due date for gas filter replacement
- To set an interval for 12 months after the gas filter replacement, press the **Reset Filter Chg Date** soft key on the **Date & Time Setup** screen.

Preventive maintenance (PM) date

- Displays the next due date for preventive maintenance (PM)
- To set an interval for 12 months after preventive maintenance was performed, press the **Reset next PM Date** soft key on the **Date & Time Setup** screen.

7.4.3 Flushing the Detector between Analyses

Observe the following guidelines to prevent build-up or accumulation of residue from the mobile phase, sample matrix and analytes within the detector between the analyses. This helps maintain consistent response, optimum performance and reduced detector downtime:

- Periodically flush the detector with the detector gas flow being turned on. When using buffer solutions and other additives, it is recommended to flush the detector daily using compatible solvents that do not contain additives.
- Use the solvent with the best solubility characteristics for the sample matrix and analyte(s) of the analytical method in question.
- If flushing is done with a stronger solvent than used for your method, disconnect the detector from the system flow path first and flush the system to waste (for example, with 20 column volumes). Then reconnect the detector to the system flow path, turn on the gas flow and repeat the flushing.
- Use an evaporation temperature setting of 35 °C when flushing the detector.

To continue with an analysis, prepare the detector for operation (see section 6.5, page 121).

7.4.4 Cleaning or Decontaminating the Detector

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.

AVIS Essuyez immédiatement tout liquide renversé sur le système. Si les surfaces sont exposées trop longtemps, ce liquide peut occasionner des dégâts.

Decontamination

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

ATTENTION—Mélanges de gaz explosifs provenant de détergents à base d'alcool

Les détergents contenant de l'alcool peuvent former des mélanges de gaz inflammables et explosifs s'ils sont exposés à l'air.

- Utilisez ces détergents uniquement dans les cas requis et uniquement dans des pièces bien ventilées.
- Évitez la proximité des flammes nues ou toute exposition à une chaleur excessive durant le processus de nettoyage.
- Essuyez les composants nettoyés jusqu'à ce qu'ils soient secs après nettoyage. N'utilisez pas le détecteur tant qu'il n'est pas entièrement sec.

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 detector. Liquids can cause a short circuit when getting in contact with the electronic components.

AVIS Observez les points suivants :

- Utilisez uniquement des détergents qui n'endommagent pas les surfaces du système.
- N'utilisez jamais d'outils tranchants ou de brosses pour nettoyer les surfaces.
- N'utilisez pas de vaporisateurs pour le nettoyage.
- Évitez que du détergent ne pénètre dans le trajet d'écoulement.
- Le chiffon ou l'essuie-tout employé pour le nettoyage ne doit pas être trop mouillé. Évitez que du liquide ne pénètre dans les composants fonctionnels du détecteur. Les liquides peuvent provoquer un court-circuit en entrant en contact avec les composants électroniques.

Preparations

Turn off the power to the detector 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.

7.5 Disconnecting the Gas Inlet and Exhaust Tubes

CAUTION—Escaping Gas

Gas can escape from open gas connections when the detector gas flow and/or the gas supply is turned on. The escaping gas can pose a health and safety risk.

Make sure that the detector gas flow and the gas supply are turned off before you remove the nebulizer, disconnect the gas tubes or remove the gas filter assembly from the detector.

Turn on the gas supply and detector gas flow only when the nebulizer is installed, the components in the gas flow path are properly connected, and the protective cover of the gas filter assembly is installed.

ATTENTION—Fuite de gaz

Du gaz peut s'échapper des raccordements de gaz ouverts lors du démarrage du débit de gaz du détecteur et/ou de l'alimentation de gaz. Cette fuite de gaz peut présenter un risque pour la santé et la sécurité.

Assurez-vous que le débit de gaz du détecteur et l'alimentation de gaz sont éteints avant d'enlever le nébuliseur, de débrancher les tubes à gaz ou d'enlever le bloc de filtration de gaz du détecteur.

Démarrez l'alimentation de gaz et le débit de gaz du détecteur uniquement lorsque le nébuliseur est installé, lorsque les composants dans le trajet d'écoulement de gaz sont correctement raccordés, et lorsque le capot de protection du bloc de filtration de gaz est installé.

Parts required

Only required if gas tubing is to be replaced

- Gas inlet tubing

  – and/or –
- Gas exhaust tubing

Tools required

- Multitool (from the detector ship kit)
- *Only required if gas tubing is to be replaced*
  Tubing cutter (optional)

Preparations

1. Flush the detector with the detector gas flow being turned on. For recommendations on flushing the detector, see section 7.4.3 Flushing the Detector between Analyses, page 172.
2. Turn off the pump flow and then the gas flow:
   a) Turn off the pump flow to the detector. Wait at least 5 minutes. During the waiting period, the detector drains any remaining mobile phase to waste.
   b) Turn off the gas flow on the detector.
   c) Wait until the system pressure is down to zero before you continue.
   d) Turn off the gas supply to the detector.
3. Turn off the detector with the main power switch.

Follow these steps

1. To disconnect gas tubes from the gas ports: Push the connected gas tubing into the fitting and at the same time push the locking ring of the gas port with the multitool. Then pull out the tubing.

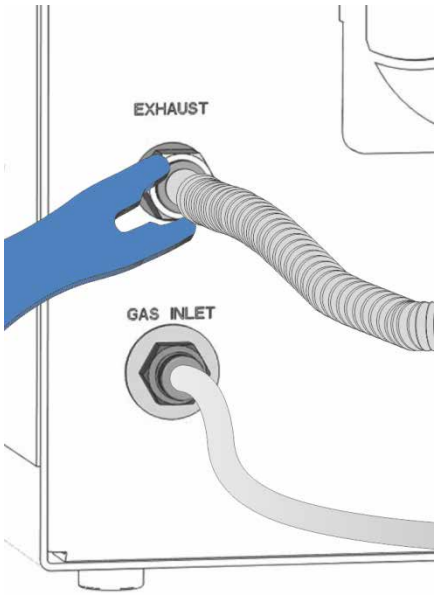


Figure 31: Disconnecting the gas exhaust tubing with the multitool (example)

2. To re-install the gas tubes or install new gas tubes, follow the steps in section 5.5.4 Connecting the Gas Inlet and Exhaust Tubes, page 79.

7.6 Disconnecting the Drain Lines

Parts and tools required

Only if a drain line is to be replaced

- Replacement drain tubing (flexible hose, to be cut for use for both ports)
- Tubing cutter

Preparations

1. Flush the detector with the detector gas flow being turned on. For recommendations on flushing the detector, see section 7.4.3 Flushing the Detector between Analyses, page 172.
2. Turn off the pump flow and then the gas flow:
   a) Turn off the pump flow to the detector. Wait at least 5 minutes. During the waiting period, the detector drains any remaining mobile phase to waste.
   b) Turn off the gas flow on the detector.
   c) Wait until the system pressure is down to zero before you continue.
   d) Turn off the gas supply to the detector.
3. Turn off the detector with the main power switch.

Follow these steps

1. On the leak port and waste port on the right side of the detector, disconnect the two drain lines.
2. *If a drain line is to be replaced*
   Follow the steps in section 5.6.3 Setting Up the Detector Drainage, page 86.

7.7 Removing the Nebulizer

CAUTION—Sharp Tip of Nebulizer Capillary

The capillary inside the nebulizer that protrudes from the nebulizer tip is sharp and may be fragile. Touching the nebulizer capillary can cause personal injury and damage to the capillary. To avoid personal injury, always wear safety glasses when handling the nebulizer. Do not touch the nebulizer tip. Handle the nebulizer with care.

ATTENTION—Pointe acérée du capillaire de nébuliseur

Le capillaire en silice fondue à l'intérieur du nébuliseur fait saillie à partir de l'embout de nébuliseur. Ce capillaire est fragile et acéré ; ceci peut provoquer un risque d'accident corporel et d'endommagement du capillaire. Afin d'éviter de vous blesser, revêtez toujours des lunettes de protection lorsque vous manipulez le nébuliseur. Ne touchez pas l'embout du nébuliseur. Manipulez le nébuliseur avec précaution.

CAUTION—Escaping Gas

Gas can escape from open gas connections when the detector gas flow and/or the gas supply is turned on. The escaping gas can pose a health and safety risk.

Make sure that the detector gas flow and the gas supply are turned off before you remove the nebulizer, disconnect the gas tubes or remove the gas filter assembly from the detector.

Turn on the gas supply and detector gas flow only when the nebulizer is installed, the components in the gas flow path are properly connected, and the protective cover of the gas filter assembly is installed.

ATTENTION—Fuite de gaz

Du gaz peut s'échapper des raccordements de gaz ouverts lors du démarrage du débit de gaz du détecteur et/ou de l'alimentation de gaz. Cette fuite de gaz peut présenter un risque pour la santé et la sécurité.

Assurez-vous que le débit de gaz du détecteur et l'alimentation de gaz sont éteints avant d'enlever le nébuliseur, de débrancher les tubes à gaz ou d'enlever le bloc de filtration de gaz du détecteur.

Démarrez l'alimentation de gaz et le débit de gaz du détecteur uniquement lorsque le nébuliseur est installé, lorsque les composants dans le trajet d'écoulement de gaz sont correctement raccordés, et lorsque le capot de protection du bloc de filtration de gaz est installé.

Parts and additional items required

NOTICE The nebulizer is highly sensitive to contamination. Even minute particles on the nebulizer can lead to contamination and poor detector performance. Always wear clean-room gloves when you install or remove the nebulizer.

AVIS Le nébuliseur présente une sensibilité élevée à la contamination. Même la présence de particules infimes sur le nébuliseur peut provoquer une contamination ou de mauvaises performances du détecteur. Lorsque vous installez ou retirez le nébuliseur, portez des gants pour salle blanche.

- *If the nebulizer is to be transported*
  Nebulizer packaging, including
  - Protective tubing
  - Closing plug
  - Original packaging that the nebulizer was shipped in
- *If no new nebulizer is to be installed*
  Dust-seal plug for the nebulizer opening on the detector

Preparations

1. Flush the detector with the detector gas flow being turned on. For recommendations on flushing the detector, see section 7.4.3 Flushing the Detector between Analyses, page 172.
2. Turn off the pump flow and then the gas flow:
   a) Turn off the pump flow to the detector. Wait at least 5 minutes. During the waiting period, the detector drains any remaining mobile phase to waste.
   b) Turn off the gas flow on the detector.
   c) Wait until the system pressure is down to zero before you continue.
   d) Turn off the gas supply to the detector.
3. Turn off the detector with the main power switch.
4. Disconnect the inlet capillary from the nebulizer.

Follow these steps

1. Turn the nebulizer by 90 degrees counter-clockwise in the opening until it releases from the two locking points.
   Mind the correct orientation of the nebulizer when it is unlocked:

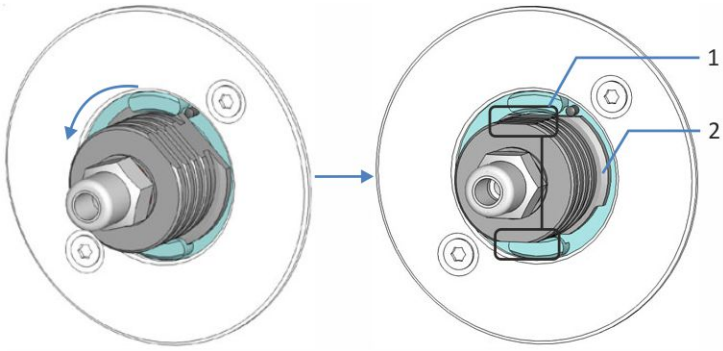


Figure 32: Unlocking the nebulizer

No.	Description
1	Gripping sides of the nebulizer on the top and bottom handle side
2	Protruding attachment locks of the nebulizer on the left and right handle side

2. Pull the nebulizer straight out of the nebulizer opening.

NOTICE Avoid the nebulizer tip from touching the sides of the nebulizer opening, as this can damage the tip.

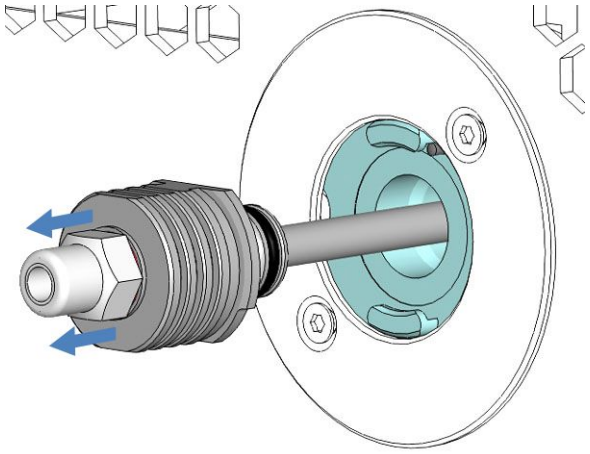


Figure 33: Removing the nebulizer

3. Install the dust seal plug to the opening for the nebulizer.

4. *If the nebulizer is to be transported*
   Pack the nebulizer:

   a) Carefully install the protective tubing to the nebulizer spray pipe. Do not to touch the nebulizer tip with the protective tubing, as it can damage the tip.

   b) Install the plug to the nebulizer flow inlet.

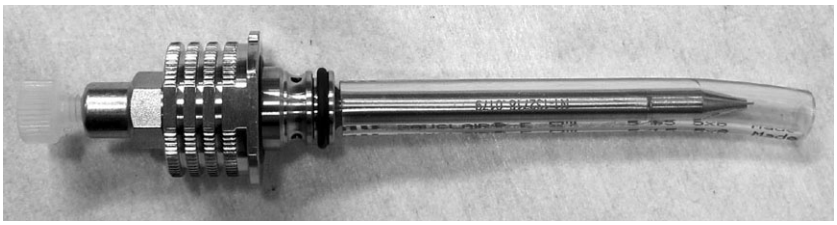


Figure 34: Nebulizer with protective tubing and plug on the flow inlet

   c) Pack the nebulizer in its original packaging that it was shipped in.

To re-install the nebulizer, follow the instructions in the *Installation Guide* that is shipped with the nebulizer.

7.8 Replacing the Gas Filter Assembly

WARNING—High Voltage, Electric Shock

High voltages are present inside the detector that could cause an electric shock. When the side panel is removed, dangerous electrical connections will be exposed.

- Turn off the detector and disconnect the power cord from both detector and the power source before removing the panel.
- Upon completing the procedure, make sure that all panels and covers are properly installed. An electrical safety test must be performed by a qualified person according to national regulations when the procedure is complete.
- Further work in the enclosure must only be performed by Thermo Fisher Scientific service personnel.

AVERTISSEMENT—Haute tension, Choc électrique

- Mettez le détecteur en arrêt et débranchez le cordon d'alimentation du détecteur et de la source d'alimentation, avant de retirer le panneau.
- Une fois vous avez terminé la procédure de maintenance, assurez-vous que tous les panneaux et capots sont réinstallés correctement. Un contrôle de sécurité électrique doit être fait par une personne qualifiée selon les réglementations nationales après que la procédure de maintenance soit terminée.
- Tous travaux supplémentaires dans l'enceinte du détecteur doivent être effectués uniquement par le personnel de service de Thermo Fisher Scientific.

CAUTION—Gas Filter Rupture upon Excessive Gas Supply Pressure

An excessive supply gas pressure can lead to an overpressure in the detector and can cause the gas filters to rupture. This can pose a health and safety risk.

- Turn on the gas supply only when the gas filters are properly connected to the detector and the protective cover is properly installed.
- Observe the gas supply pressure range that is specified for the detector. Do not exceed the maximum gas supply pressure.
- Before you start the replacement of the gas filter assembly, make sure that the gas supply and the detector gas flow are turned off.
- Observe the *Gas Supply Site Requirements* in this manual.

ATTENTION—Rupture de filtre à gaz suite à une pression d'alimentation de gaz excessive

Une pression d'alimentation de gaz excessive peut conduire à une surpression dans le détecteur, ce qui peut provoquer une rupture des filtres à gaz. Ceci peut présenter un risque pour la santé et la sécurité.

- Démarrez l'alimentation de gaz uniquement lorsque les filtres à gaz sont correctement raccordés au détecteur et lorsque le capot de protection est correctement installé.
- Respectez la plage de pressions d'alimentation de gaz spécifiée pour le détecteur. Ne dépassez pas la pression d'alimentation de gaz maximale.
- Assurez-vous que l'alimentation de gaz et le débit de gaz du détecteur sont éteints avant de commencer à remplacer le bloc de filtration de gaz.
- Observez les exigences de lieu relatif à l'alimentation de gaz dans ce manuel.

CAUTION—Escaping Gas

Gas can escape from open gas connections when the detector gas flow and/or the gas supply is turned on. The escaping gas can pose a health and safety risk.

Make sure that the detector gas flow and the gas supply are turned off before you remove the nebulizer, disconnect the gas tubes or remove the gas filter assembly from the detector.

Turn on the gas supply and detector gas flow only when the nebulizer is installed, the components in the gas flow path are properly connected, and the protective cover of the gas filter assembly is installed.

ATTENTION—Fuite de gaz

Du gaz peut s'échapper des raccordements de gaz ouverts lors du démarrage du débit de gaz du détecteur et/ou de l'alimentation de gaz. Cette fuite de gaz peut présenter un risque pour la santé et la sécurité.

Assurez-vous que le débit de gaz du détecteur et l'alimentation de gaz sont éteints avant d'enlever le nébuliseur, de débrancher les tubes à gaz ou d'enlever le bloc de filtration de gaz du détecteur.

Démarrez l'alimentation de gaz et le débit de gaz du détecteur uniquement lorsque le nébuliseur est installé, lorsque les composants dans le trajet d'écoulement de gaz sont correctement raccordés, et lorsque le capot de protection du bloc de filtration de gaz est installé.

When

Interval for gas filter replacement has expired

Parts required

Gas filter assembly, consisting of a charcoal gas filter and a HEPA gas filter

Tools required

- Screwdriver, Torx T10
- Multitool

Preparations

If the detector is not placed in the bottom position in the system stack

Stop the detector operation and remove the detector from the system stack. See section 7.12 Removing the Detector from the System Stack, page 200.

Follow these steps

1. On the right side of the detector, loosen the 3 screws that attach the side panel using the screwdriver.

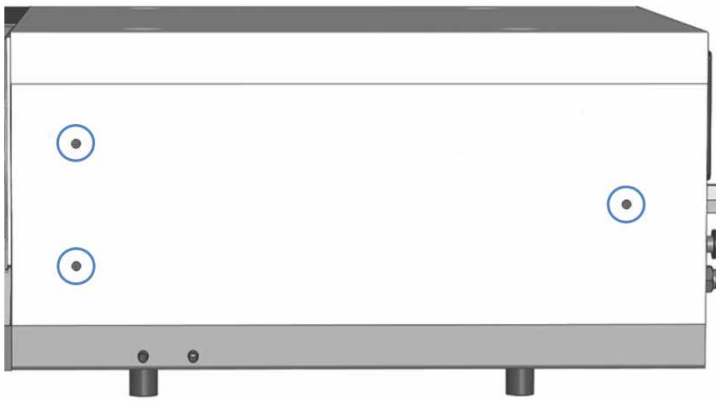


Figure 35: Screws on the right side panel

2. Carefully move the right side panel away from the detector and set it aside. The gas filter assembly is mounted to the interior of the side panel. The gas tubes are long enough to allow the side panel to be set aside.

NOTICE Improper gas tube connections to and from the gas filter assembly will damage the detector. Review the gas tube connections and mind the direction arrows on the gas filters before you continue. The incoming gas enters the bottom charcoal filter, then the top HEPA filter and exits off to the gas cycle inside the detector.

AVIS Les raccordements de tubes de gaz vers et depuis le bloc de filtration de gaz inadéquatement installés endommagent le détecteur. Vérifiez les raccordements de tubes de gaz et observez les flèches d'orientation sur les filtres de gaz avant de procéder à des travaux. Le flux de gaz entrant passe en premier par le filtre en charbon du bas, entre ensuite dans le filtre HEPA tout du haut et puis passe dans le cycle de gaz à l'intérieur du détecteur.

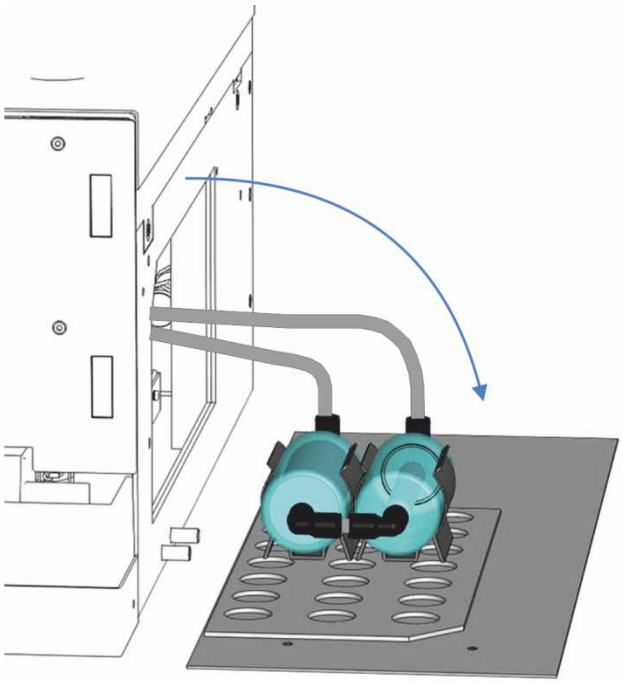


Figure 36: Side panel opened

3. Disconnect the gas tubes from the gas filter assembly:

   a) On the two (push-in) elbow fittings on the gas filter assembly, push in the locking ring on each elbow fitting with the multitool (no. 1 in Figure 37). Leave the elbow fittings connected to the gas filter assembly.

   b) Carefully pull the gas tubes off from the elbow fittings (no. 2 in Figure 37).

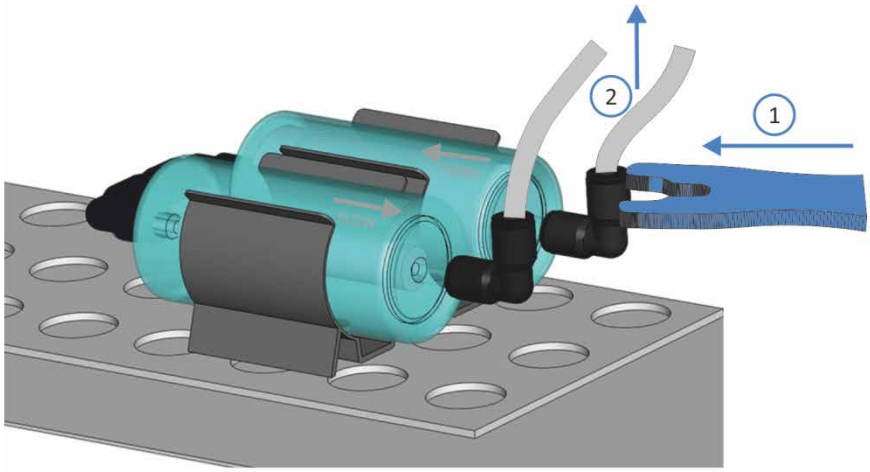


Figure 37: Unlocking an elbow fitting with the multitool

4. Pull the gas filter assembly out of the clamps carefully.

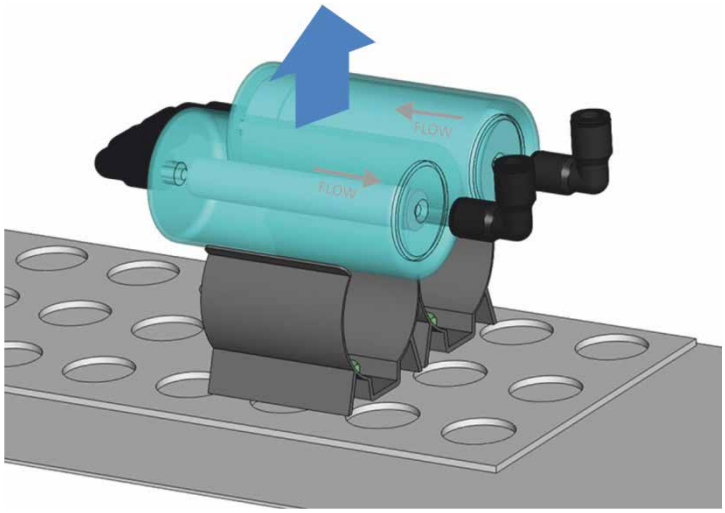


Figure 38: Removing the gas filter assembly

5. With the new gas filter assembly, mind the correct orientation for the gas flow for installation. Observe the flow direction signs on the filters.

   - The bottom or inner gas filter must be the charcoal gas filter (thick black inner filter cylinder; no. 1 in Figure 39).
   - The top or outer gas filter must be the HEPA gas filter (thin white inner filter cylinder; no. 3 in Figure 39).

6. Push the new gas filter assembly into the clamps observing the orientation signs for the gas flow on the gas filters.

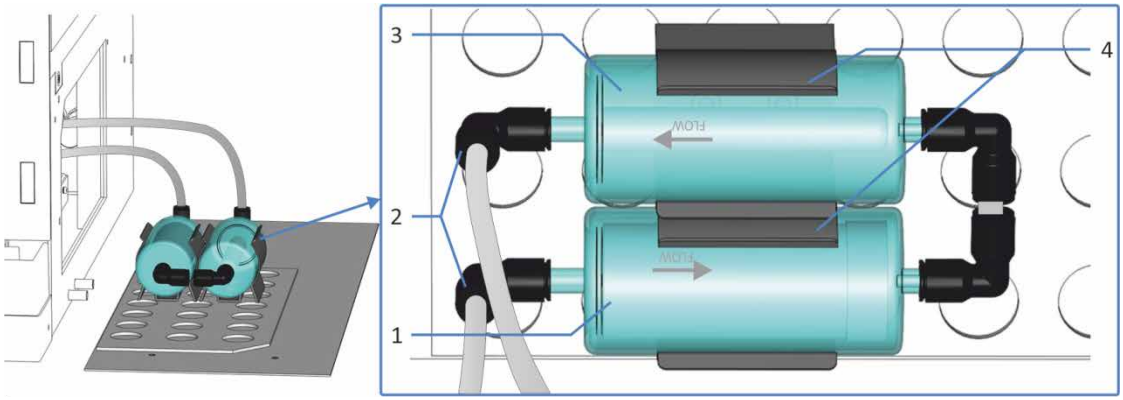


Figure 39: Correct installation of the gas filter assembly

No.	Description	No.	Description
1	Charcoal gas filter	3	HEPA gas filter
2	Elbow fittings	4	Gas filter clamps

7. Connect the gas tubes and observe the **In** and **Out** labelling on the gas tubes:

   - On the bottom charcoal gas filter, push the inlet gas tubing into the (push-in) elbow fitting.
   - On the top HEPA gas filter, push the outlet gas tubing into the (push-in) elbow fitting.

   Check that the connections are secure: Slightly pull on the tubes in the fittings. If a tubing slides out, repeat this step.

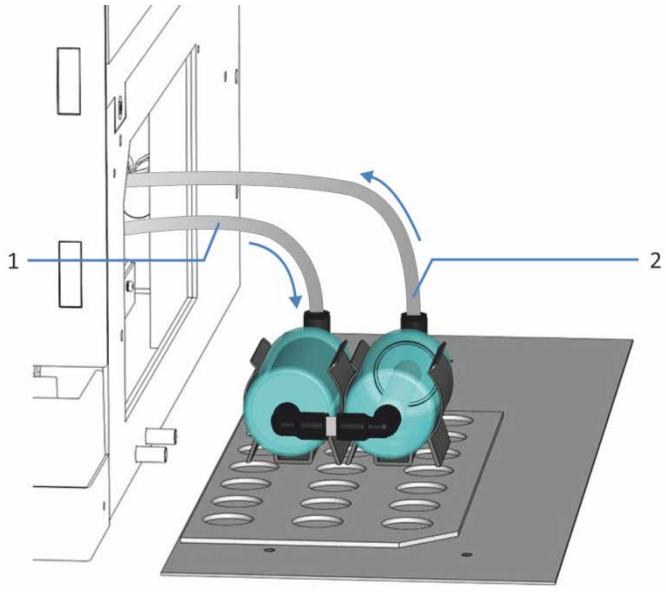


Figure 40: Installed gas filter assembly

No.	Description
1	Inlet gas tubing to the charcoal gas filter (thick black inner filter cylinder)
2	Outlet gas tubing to the HEPA gas filter (thin white inner filter cylinder)

8. Install the right side panel: Position the side panel on the right of the detector. Make sure that the screws match the recesses.
9. With the screwdriver, tighten the 3 attachment screws.
10. Have an electrical safety test performed according to national regulations by a qualified person.
11. *If the detector is not placed in the bottom position in the system stack*
    Set up the detector in the system stack again and reinstall the detector. See chapter 5 Installation, page 51.
12. Reconnect the power cord to the detector and power source.

13. Turn on the detector with its main power switch. Observe the notes in section 5.7, page 98.

14. On the **Date & Time Setup** screen of the detector display, press the **Reset Filter Chg Date** softkey to reset the gas filter replacement interval for 12 months.

15. Turn on the gas flow to check for proper functioning of the gas filters. See section 6.5.4.1 Turning On the Detector Gas Flow, page 135.

    If no warning or error occurs, the gas filter replacement is completed.

    Before starting an analysis, let the detector equilibrate and be sure that it is ready for operation (see section 6.5 Preparing the Detector for Operation, page 121).

7.9 Stream-Switching Valve (Corona Veo RS only)

This section applies only for Corona Veo RS detectors.

7.9.1 Disassembling and Inspecting the Valve

Tools required

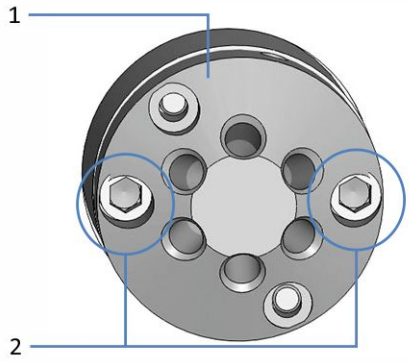
Hexagon socket-head wrench, size 9/64"

Preparations

1. Flush the detector with the detector gas flow being turned on. For recommendations on flushing the detector, see section 7.4.3 Flushing the Detector between Analyses, page 172.
2. Turn off the pump flow and then the gas flow:
   a) Turn off the pump flow to the detector. Wait at least 5 minutes. During the waiting period, the detector drains any remaining mobile phase to waste.
   b) Turn off the gas flow on the detector.
   c) Wait until the system pressure is down to zero before you continue.
   d) Turn off the gas supply to the detector.
3. Turn off the detector with the main power switch.
4. Disconnect the capillaries from the stream-switching valve.

Follow these steps

1. On the stream-switching valve, loosen the 2 screws that attach the stator with the wrench. Loosen the screws in an alternating pattern, by only half a turn at a time to avoid that the stator gets jammed.

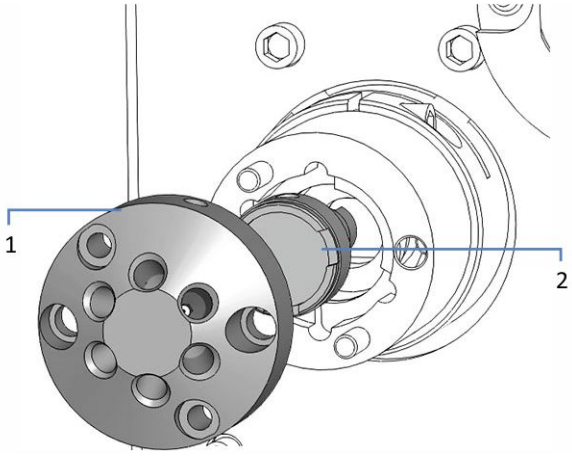


No.	Description
1	Stator
2	Attachment screws for stator

Figure 41: Stream-switching valve (view from front)

2. Remove the stator from the valve body. To ensure that the sealing surface of the stator cap is not damaged, place the stator on its outer face.

3. Carefully remove the rotor seal with your hand or a small screwdriver.



No.	Description
1	Stator
2	Rotor

Figure 42: Disassembled valve

4. Inspect the rotor and stator surfaces for scratches:

   - If there are no signs of scratches, clean all parts thoroughly. See section 7.9.2, page 194.
   - If there are signs of scratches, replace the rotor and/or stator and reassemble the valve. See section 7.9.3, page 194.

7.9.2 Cleaning Stator and Rotor

Items required

- Deionized water
- Microfiber cloth

Preparations

Disassemble and inspect the valve. See section 7.9.1, page 192.

Follow these steps

1. Dampen the microfiber cloth with deionized water.
2. Clean stator, rotor and the valve thoroughly with the microfiber cloth. Take care that no surfaces are scratched while you are cleaning the components.
   After cleaning, it is not necessary to dry the rotor.
3. Reassemble the valve. See section 7.9.3, page 194.

7.9.3 Reassembling the Valve

Parts required

- *If the stator is to be replaced:* Stator
- *If the rotor is to be replaced:* Rotor

Tools required

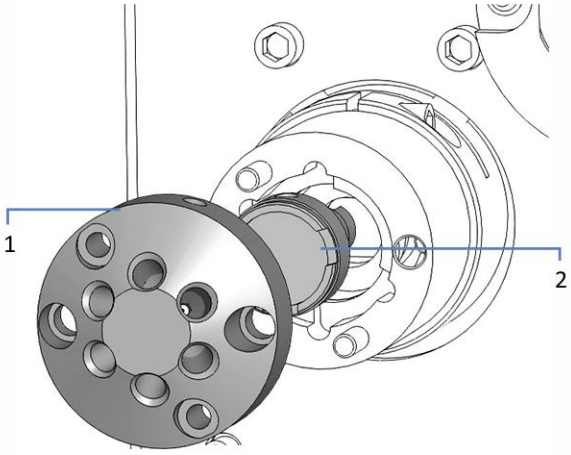
Hexagon socket-head wrench, size 9/64"

Preparations

1. Disassemble and inspect the valve. See section 7.9.1, page 192.
2. *If the stator and/or rotor is to be replaced*
   Unpack the replacement stator and/or rotor.

Follow these steps

1. Insert the rotor in the valve body. Mind the orientation of the rotor:
   - The sealing surface of the rotor with its engraved flow passages must face away from the valve body.
   - The smooth side of the rotor must face to the valve.
   - The pattern of the rotor is asymmetrical to prevent improper placement.



No.	Description
1	Stator
2	Rotor

Figure 43: Reassembling rotor and stator

2. Position the stator on the valve body. Make sure that the stator is in correct orientation.
3. Tighten the 2 screws that attach the stator to the valve gently with the wrench. Do not overtighten the screws. They only hold the assembly together and do not affect the sealing force, which automatically set as the screws close the gap against the valve body.
4. Reconnect the capillaries to the stream-switching valve. See section 5.6.6, page 96.
5. Turn on the detector with its main power switch. Observe the notes in section 5.7, page 98.

7.10 Replacing the Main Power Fuses

When

Blown fuses

Parts required

Replacement fuses (2 fuses, slow-blow, 1 A, 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 detector that could cause an electric shock or damage to the device.

Turn off the detector 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 detector by Thermo Fisher Scientific. Do not use repaired fuses and do not short-circuit the fuse holders.

AVERTISSEMENT—Décharge électrique

Des tensions élevées sont présentes dans le détecteur et peuvent causer des chocs électriques ou endommager l'appareil.

Arrêtez le détecteur au moyen de son interrupteur d'alimentation principal. Déconnectez le cordon d'alimentation de la source d'alimentation et de l'appareil.

Utilisez uniquement les fusibles du type et de courant nominal tels que spécifié par Thermo Fisher Scientific pour le détecteur. N'utilisez pas des fusibles réparés et ne court-circuitez pas les porte-fusibles.

Follow these steps

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

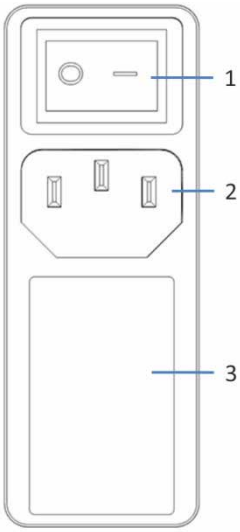


Figure 44: Fuse holder

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

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 detector.
5. Turn on the detector with the main power switch.

7.11 Updating the Detector Firmware

The detector is shipped with the most recent firmware version.

To update the detector firmware, a chromatography data system, such as the Chromeleon Chromatography Management System, is required. The following update description refers to the Chromeleon software.

When

Updating the detector 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 Service Release as appropriate

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

Preparations

- Read the release notes provided with the firmware and/or Chromeleon Service release.
- Verify the following:
  - The detector is connected in Chromeleon.
  - All operations on the instrument (Chromeleon 7) or timebase (Chromeleon 6.8) that includes the detector have been stopped. The instrument or timebase is idle.
- Check the currently installed firmware version in the detector:
  - On the **Main Menu** of the detector display

  –or–

  - On the **General** tab page in the Chromeleon 7 Instrument Configuration Manager or the Chromeleon 6.8 Server Configuration program

Follow these steps

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

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

AVIS Une mise à niveau vers une version antérieure ou une mise à jour incomplète du microprogramme peut donner lieu à une perte de fonctionnalité ou à un dysfonctionnement du détecteur.

- N'interrompez pas la communication entre le logiciel Chromeleon et le détecteur pendant la procédure.
- Au début de la procédure de mise à jour, un message affiche la version du microprogramme installée sur le détecteur et la version à transférer depuis le logiciel Chromeleon. Si la version du microprogramme installée sur le détecteur est plus récente que la version affichée sous Chromeleon, annulez le téléchargement.

1. Start the Chromeleon 7 Instrument Configuration Manager or the Chromeleon 6.8 Server Configuration program.
2. Perform a firmware update from the **General** tab page in the configuration dialog box for the detector. For details, refer to the *Chromeleon Help*.

   The firmware update may take several minutes.

   - Monitor the Audit Trail of the Chromeleon Instrument Configuration Manager (or Server Configuration 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.
3. After a successful firmware update, requalification of the detector may be required. See the release notes for a recommendation.

7.12 Removing the Detector from the System Stack

CAUTION—Heavy Load, Bulky Device

The detector is too heavy or bulky for one person alone to handle safely. To avoid personal injury or damage to the detector, observe the following guidelines:

- Physical handling of the detector, including lifting or moving, requires a team effort of two persons.
- A team effort is in particular required when lifting the detector into the system stack or when removing it.
- To lift or move the detector, grasp the detector by the sides. Do not move or lift the detector by the front bezel or white cover. This will damage the bezel or the detector.

ATTENTION—Charge lourde, instrument encombrant

Le détecteur est trop lourd ou encombrant pour être soulevé en toute sécurité par une seule personne. Afin d'éviter toute blessure corporelle ou détérioration du détecteur, veuillez respecter les consignes suivantes :

- Le maniement physique du détecteur, notamment son soulèvement ou son déplacement, requiert la présence d'au moins deux personnes.
- La présence de plusieurs personnes est requise en particulier pour placer le détecteur dans le système empilé ou pour l'en retirer.
- Pour lever ou transporter le détecteur, saisissez-le par les côtés. Ne déplacez pas ou ne levez pas le détecteur par le panneau avant. Cela risque d'endommager le panneau avant ou le détecteur.

NOTICE Make sure that you do not pull on any tubes, capillaries or cables of the other system modules when you remove the detector from the stack.

AVIS Assurez-vous de ne pas tirez sur des tubes, des capillaires ou de câbles des autres modules du système, lorsque vous retirez le détecteur du système empilé.

Preparations

1. Flush the detector with the detector gas flow being turned on. For recommendations on flushing the detector, see section 7.4.3 Flushing the Detector between Analyses, page 172.
2. Turn off the pump flow and then the gas flow:
   a) Turn off the pump flow to the detector. Wait at least 5 minutes. During the waiting period, the detector drains any remaining mobile phase to waste.
   b) Turn off the gas flow on the detector.
   c) Wait until the system pressure is down to zero before you continue.
   d) Turn off the gas supply to the detector.
3. Turn off the detector and *all* other system modules with their main power switches.
4. Disconnect the power cord from the detector and power source.
5. Disconnect all cables and capillaries to other devices.
6. Disconnect the gas and drain tubes:
   a) Disconnect the gas inlet and exhaust tubes from the detector: On the push-in fittings on the tubes, push in the locking ring of the fitting with the multitool. Pull the fittings off from the gas connectors on the detector.
   b) Disconnect the leak tubing and the waste tubing from the drain ports on the right side of the detector.

Follow these steps

1. *If applicable*
   Remove any modules that stand on top of the detector in the system stack.
2. Remove the detector from the system stack.
   The following steps require a team effort:
   a) Take the detector on both sides and lift it slightly.
   b) Grasp the detector from below and lift it from the stack.
   c) Place the detector on a clean and stable surface.

To restack the detector in the system stack, see section 5.5.1, page 67.

7.13 Transporting or Shipping the Detector

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

Observe the following safety guidelines:

CAUTION—Heavy Load, Bulky Device

The detector is too heavy or bulky for one person alone to handle safely. To avoid personal injury or damage to the detector, observe the following guidelines:

- Physical handling of the detector, including lifting or moving, requires a team effort of two persons.
- A team effort is in particular required when lifting the detector into the system stack or when removing it.
- To lift or move the detector, grasp the detector by the sides. Do not move or lift the detector by the front bezel or white cover. This will damage the bezel or the detector.

ATTENTION—Charge lourde, instrument encombrant

Le détecteur est trop lourd ou encombrant pour être soulevé en toute sécurité par une seule personne. Afin d'éviter toute blessure corporelle ou détérioration du détecteur, veuillez respecter les consignes suivantes :

- Le maniement physique du détecteur, notamment son soulèvement ou son déplacement, requiert la présence d'au moins deux personnes.
- La présence de plusieurs personnes est requise en particulier pour placer le détecteur dans le système empilé ou pour l'en retirer.
- Pour lever ou transporter le détecteur, saisissez-le par les côtés. Ne déplacez pas ou ne levez pas le détecteur par le panneau avant. Cela risque d'endommager le panneau avant ou le détecteur.

Follow these steps

1. Prepare the detector for transport. See the section 7.13.1, page 203.
2. The step depends as follows:
   - To transport the detector to a new location, follow the instructions in section 7.13.2, page 203.
   - To ship the detector, follow the instructions in section 7.13.3, page 204.

7.13.1 Preparing the Detector for Transport

To prepare the detector for transport, follow these steps:

1. Perform a long-term shut down of the detector. See section 6.8.3, page 156.
2. Turn off the detector with its main power switch and disconnect the power cord.
3. Remove all cables and flow connections to other devices.
4. Remove the detector from the system stack. See section 7.12 Removing the Detector from the System Stack, page 200.
5. Remove the nebulizer. See section 7.7, page 179.

7.13.2 Transporting the Detector to a New Location

To transport the detector to a new location, follow these steps:

1. Observe the notes for handling and lifting the detector safely.
2. Transport the detector to the new location.
3. Install and set up the detector in the system stack. Follow the instructions on mounting the system stack in section 5.5.1, page 67.
4. Set up the detector:
   a) To connect the detector and to set up flow connections, follow the instructions in the *Installation chapter* in this operating manual.

b) To prepare the detector for first-time operation, follow the instructions in the *Preparing the Detector for Operation section* in this operating manual.

5. Before starting an analysis, let the detector equilibrate and be sure that it is ready for operation.

7.13.3 Shipping the Detector

To ship the detector, follow these steps:

1. Follow the unpacking instructions in this manual in the reverse order.
   Alternatively, observe the packing instructions, which is part of the *Service Return Form* section in the manual binder.

   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 detector 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 Decontamination Certificate, which is part of the Service Return Form. Sign the certificate to confirm that the device has been properly decontaminated and that it is free of hazardous substances.
- Thermo Fisher Scientific refuses to accept devices for repair if the Decontamination Certificate is missing.

ATTENTION—Contamination possible

Des substances dangereuses peuvent contaminer l'instrument durant l'utilisation et peuvent causer des blessures corporelles au personnel d'entretien.

- Décontaminez toutes les pièces de l'instrument que vous souhaitez renvoyer pour réparation.
- Remplissez et signez le certificat de décontamination qui fait partie du formulaire de retour du service technique. Signez le certificat afin de confirmer que l'instrument a bien été décontaminé et qu'il ne contient désormais plus de substances dangereuses
- Thermo Fisher refuse d'accepter des instruments pour la réparation dont le certificat de décontamination n'est pas fourni avec l'instrument.

Restarting the Detector after Shipping

To restart the detector after shipping, follow these steps:

1. Follow the unpacking instruction in this operating manual.
2. Install and set up the detector in the system stack. Follow the instructions on mounting the system stack in section 5.5.1, page 67.
3. Set up the detector:
   a) To connect the detector and to set up flow connections, follow the instructions in the *Installation chapter* in this operating manual.
   b) To prepare the detector for first-time operation, follow the instructions in the *Preparing the Detector for Operation section* in this operating manual.
4. Before starting an analysis, let the detector 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 detector.

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 detector.

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 Indicator on the Detector Display

The detector display provides an overview of the detector status. If no errors or warnings are active, the **Status** is **Normal**.

Troubleshooting Check

If a problem occurs with the detector, performing a troubleshooting check helps identifying and isolating the cause of the problem.

Self-Test Error Codes

If a problem is detected during self-test diagnostics upon power-up, a self-test error dialog appears on the detector display. The detector is not ready for analysis. View the self-test results and resolve the problem before you continue.

For self-test error codes and recommended remedial actions, see section 8.3, page 212.

Warning and Error Codes

If a problem occurs during operation of the detector, beeping starts to alert you in addition to the warning or error code and a message on the detector display. Certain soft key functions become available. Depending on the severity of the code, a running sequence is continued or interrupted.

For warning and error codes and related remedial actions, see section 8.4, page 214.

TIP If you operate the detector from a chromatography data system, the problem is also reported to the software and a message appears in the audit trail of the software. In case of Chromeleon, a related message for the problem appears in the Chromeleon Audit Trail.

Operating Issues

Leaks are a potential safety issue. Therefore, if a leak sensor detects leakage, beeping starts to alert you in addition to the warning code and a message on the display. Follow the instructions in this manual to find and eliminate the source for the leakage.

TIP The **Diagnostics** screen provides helpful information for troubleshooting if a problem occurs in the charged aerosol detector.

For information on all operating issues that may occur and affect detector performance, see section 8.5 Operating Issues, page 220.

8.2 Troubleshooting Check

If a problem occurs with the detector, the following troubleshooting check helps identifying and isolating the cause of the problem. Subsequent troubleshooting sections cover the problems in greater detail.

1. Turn on the detector and check the self-test results.

   - If the self-test was successful and no warning or error code appears, continue with step 2.
   - If the self-test failed, the results appear in red on the display. Follow the steps in section 8.3 Self-Test Error Codes, page 212.
   - If a warning or error code appears on the display, follow the steps in section 8.4 Warning and Error Codes, page 214.
   - If the detector does not power up:

     a) Check the power cord and make sure that it is properly connected to the power inlet on the detector and the power source.

     b) Replace the fuses. See section 7.10, page 196.

     c) Repeat step 1.

2. Perform the following checks and, if applicable, resolve accordingly:

   - *Gas connections*
     Check the gas inlet tubing, gas exhaust tubing and gas filter assembly for signs of gas leakage and proper connection to the detector. The lines must be free of kinks, blockages or loops. The ventilation must be free from blockages.
   - *Gas supply to the detector*
     Verify that gas is supplied to the detector. Check that the gas supply pressure is within the allowed range. For gas specifications, see section 9.1, page 236.
   - *Liquid flow connections*
     Make sure that the liquid flow connections in the system are properly installed. Check that there are no visible signs of leakage.

- *Electrical connections*
  Check that the electrical connections, including the Digital I/O connections, are installed properly and function correctly.
- *Other components in the system*
  Check that the other components in the system are connected properly and operate properly, according to the instructions for each component.
- *Routine and preventive maintenance during operation*
  Verify that any recent routine and preventive maintenance procedures during operation were performed properly. For the routine and preventive maintenance for the detector, see section 7.4, page 170.

8.3 Self-Test Error Codes

If a problem is detected during self-test diagnostics upon power-up of the detector, a self-test error dialog appears on the detector display. The detector is not ready for analysis.

Follow these steps

1. View the self-test results:
   a) In the self-test error dialog on the detector display, select the **Review** soft key. The first entry for the self-test review appears.
   b) Select the **(Test Name)** to review the results of the entry. Write down failed self-tests and their error codes.
   Navigate through the self-test review using the **Next** or **Last** soft keys.
   c) To exit the self-test review, select the **Continue** soft key. Pressing the soft key bypasses the self-test results and displays the **Main Menu**.
2. Follow the remedial actions for the respective self-test error code. After each remedial action, turn the detector off and on to perform self-test diagnostics and check if the remedial action was successful.

Self-test error codes and remedial actions

The table lists the self-test error codes for the detector and provides troubleshooting assistance. Each code consists of a code number and the letter **F** to denote a failure. The code number is the unique identifier for the problem.

If you are unable to resolve a problem following the instructions in this manual, contact Thermo Fisher Scientific Technical Support for assistance.

Self-test code	Description	Remedial Action
1	The detector failed to reach the maximum charger test voltage.	Contact Technical Support.
2	An error occurred with the charger voltage output when the voltage of the corona charger was turned off.	
4	An error occurred with the corona charger current at maximum charger test voltage.	

Self-test code	Description	Remedial Action
8	An error occurred with the corona charger current when the voltage of the corona charger was turned off.	Contact Technical Support.
10	An error occurred with the reading of the flow ratio transducer at zero pressure.	
20	An error occurred with the reading of the pressure transducer at zero pressure.	
40	An error occurred with the reading of the total flow transducer at zero pressure.	
80	An error occurred with the ion trap supply upon power-up.	• Liquid is present in the ion trap, indicating a flooding in the detector. Turn off the pump flow. Check that the waste and drain lines are free from loops, kinks or blockages that may cause the liquid to flow back into the detector. Resolve the flooding. See section 8.5.3, page 224. • Repeat the self-test. If the problem persists, contact Technical Support.
100	An error occurred with the ion trap supply when the ion trap voltage was turned off.	• Liquid is present in the ion trap, indicating a flooding in the detector. Turn off the pump flow. Check that the waste and drain lines are free from loops, kinks or blockages that may cause the liquid to flow back into the detector. Resolve the flooding. See section 8.5.3, page 224. • Repeat the self-test. If the problem persists, contact Technical Support.
200	The detector failed to reach a steady-state internal temperature of the electrometer amplifier.	• The detector requires additional warm-up time before the self-test. Repeat the self-test. • If the error still appears, contact Technical Support.
400	The clock in the detector is not set.	Contact Technical Support.
800	The clock is not running.	
1000	The clock battery is low.	

8.4 Warning and Error Codes

The tables list the most frequently observed warning and error codes for the detector and provide troubleshooting assistance. Each code consists of a code number and a message. The code number is the unique identifier for the problem while the wording may change.

If you are unable to resolve a problem following the instructions in this manual or if you encounter a code or message that is not listed in the table, contact Thermo Fisher Scientific Technical Support for assistance.

8.4.1 Warning Codes

If a warning code appears, the following sequence of actions occurs:

- A warning code appears on the display, starting with *1*.
- The detector does not stop the running data acquisition.
- The **Status** on the detector display indicates that a warning is active.
- Certain soft key functions become available:
  - Pressing the **Mute Beep** soft key turns off the beep for the current alarm.
  - Pressing the **Continue** soft key before the problem is resolved bypasses the error/warning dialog and shows the **Main Menu**.
- *If the detector is operated from a chromatography data system, such as Chromeleon*
  The detector does not interfere with running sequences or batches.

  Nevertheless, Thermo Fisher Scientific recommends taking appropriate remedial action to resolve the problem.

Code and Messages	Description and Remedial Action
If a warning appears, turn off the detector. Wait for 5 seconds and turn on the detector again. Check the self-test results. Allow the detector to come to thermal stabilization. If the message still appears, follow the instructions for the respective warning code below.	
15000 Charger voltage failed	The voltage of the charger approaches the maximum level. Turn the detector off and on (see top line of the table). If the voltage still fails, contact Technical Support.

Code and Messages	Description and Remedial Action
15008 Stream-switching valve (SSV) failure	*Corona Veo RS only* The stream-switching valve has failed to rotate. *To resolve the problem:* • In the **System Setup Menu** of the display, actuate the valve manually. • If the valve still fails to rotate, disassemble and inspect the valve. See section 7.9.1, page 192. • Replace the rotor and the stator. See section 7.9.3, page 194. • If the warning code persists, the stream-switching valve may be defect. Contact Technical Support.
15010 Leak sensor fault detected	The leak sensor reports a leakage. Find and eliminate the source for the leakage (see section 8.5.1, page 220).
15011 High engine temperature	The internal temperature of the engine is too high. Turn the detector off and on (see top line of the table). If the voltage still fails, contact Technical Support.
15012 Low engine temperature	The internal temperature of the engine heater is too low. Turn the detector off and on (see top line of the table). If the voltage still fails, contact Technical Support.
15013 High evaporation temperature	The internal temperature of the evaporation tube is too high. Set a lower evaporation temperature. See section 6.7.4 Evaporation Temperature, page 142.
15014 Evaporation heater fault	The evaporation heater has failed to apply the selected temperature. Turn the detector off and on (see top line of the table). Allow the detector to come to thermal stabilization. If the warning persists, contact Technical Support.

8.4.2 Error Codes

If an error code appears, the following sequence of actions occurs:

- An error code appears on the display, starting with *2*.
- The detector stops the **Run Mode** and the running data acquisition.
- If not already turned on, the drain pump is turned on automatically.
- Certain soft key functions become available:
  - Pressing the **Mute Beep** soft key turns off the beep for the current alarm.
  - Pressing the **Continue** soft key before the problem is resolved bypasses the error/warning dialog and shows the **Main Menu**.
- *If the detector is operated from a chromatography data system, such as Chromeleon*
  The detector stops any running sequences or batches immediately.

NOTICE Unresolved error code problems may result in permanent damage to the detector. Take appropriate remedial action to resolve the problem before you continue operation.

AVIS Des issues de code d'erreurs non-résolus peuvent aboutir à des dommages permanents du détecteur. Prenez des mesures correctives appropriées pour résoudre le problème avant de procéder à l'utilisation.

Code and Messages	Description and Remedial Action
29000 Low ion trap voltage	The ion trap voltage is too low. Liquid may be present in the ion trap. The voltage may have been shorted due to detector flooding. *The following actions occur:* • The contact closure is sent to the Digital I/O terminal of the detector. If the pump is connected to the Digital I/O terminal, the pump flow is stopped. • If the drain pump is not yet turned on, it is turned on automatically. • *Corona Veo RS only:* The stream-switching valve automatically diverts liquid flow away from the nebulizer to prevent detector flooding. *To resolve the problem:* Make sure that the gas flow and drain pump are turned on. Check that liquid flows out of the waste line. Keep in mind that liquid may not be seen leaving the detector for certain mobile phases with high volatility or with low flow rates. Resolve the flooding. See section 8.5.3, page 224.
29002 Low flow ratio	The gas flow ratio is below the specified range for more than 60 seconds. *The following actions occur:* • The contact closure is sent to the Digital I/O terminal of the detector. If the pump is connected to the Digital I/O terminal, the pump flow is stopped. • If the drain pump is not yet turned on, it is turned on automatically. • *Corona Veo RS only:* The stream-switching valve automatically diverts liquid flow away from the nebulizer to prevent detector flooding. *To resolve the problem:* • Make sure that gas is still supplied to the detector. Check that the gas supply pressure is within the allowed range. Observe the gas specifications for the detector. • Check that the nebulizer pressure is set as specified on the nebulizer gas pressure certificate. • Turn the detector off and on. Check the self-test results. • Check the **Gas Flow Ratio**. The value should be within the allowed range. **TIP** The **Gas Flow Ratio** parameter is available on the **Diagnostics** screen. If the error persists, contact Technical Support.

Code and Messages	Description and Remedial Action
29003 High flow ratio	The gas flow ratio is above the specified range for more than 60 seconds. *The following actions occur:* • The contact closure is sent to the Digital I/O terminal of the detector. If the pump is connected to the Digital I/O terminal, the pump flow is stopped. • If the drain pump is not yet turned on, it is turned on automatically. • *Corona Veo RS only:* The stream-switching valve automatically diverts liquid flow away from the nebulizer to prevent detector flooding. *To resolve the problem:* • Make sure that gas is still supplied to the detector. Check that the gas supply pressure is within the allowed range. Observe the gas specifications for the detector. • Check that the nebulizer pressure is set as specified on the certificate that was shipped with the nebulizer. • Turn the detector off and on. Check the self-test results. • Check the **Gas Flow Ratio**. The value should be within the allowed range. **TIP** The **Gas Flow Ratio** parameter is available on the **Diagnostics** screen. If the error persists, contact Technical Support.
29004 High gas pressure	The nebulizer gas pressure has exceeded the maximum limit. *The following actions occur:* • The contact closure is sent to the Digital I/O terminal of the detector. If the pump is connected to the Digital I/O terminal, the pump flow is stopped. • If the drain pump is not yet turned on, it is turned on automatically. • *Corona Veo RS only:* The stream-switching valve automatically diverts liquid flow away from the nebulizer to prevent detector flooding. *To resolve the problem:* • Make sure that gas is still supplied to the detector. Check that the gas supply pressure is within the allowed range. Observe the gas specifications for the detector. • If the gas supply pressure exceeds 620 kPa (6.2 bar, 90 psi), the overpressure relief valve will open. This creates a loud hissing sound. To remedy the gas supply overpressure, see the *Resolving Gas Supply Overpressure* section in this manual. • Check that the nebulizer gas pressure is set as specified on the nebulizer gas pressure certificate. • Check the gas inlet tubing and gas filter assembly for proper connection to the detector. • Turn the detector off and on. Check the self-test results. If the error persists, contact Technical Support.

Code and Messages	Description and Remedial Action
29006 Low gas pressure	The nebulizer gas pressure has dropped below the minimum limit. This can be caused by an incorrect gas pressure setting, a gas leak (internally or externally), or an incorrect gas supply pressure. *The following actions occur:* • The contact closure is sent to the Digital I/O terminal of the detector. If the pump is connected to the Digital I/O terminal, the pump flow is stopped. • If the drain pump is not yet turned on, it is turned on automatically. • *Corona Veo RS only:* The stream-switching valve automatically diverts liquid flow away from the nebulizer to prevent detector flooding. *To resolve the problem:* • Make sure that gas is still supplied to the detector. Check that the gas supply pressure is within the allowed range. Observe the gas specifications for the detector. • Check that the nebulizer gas pressure is set as specified on the nebulizer gas pressure certificate. • Check the gas inlet tubing and gas filter assembly for signs of gas leakage and proper connection to the detector. Turn on gas flow and check for any unusual noise. • Turn the detector off and on. Check the self-test results. • Most LC pumps are programmed to send out a general contact closure in the event of a low pump pressure alarm as determined in the configuration. Make sure that this setting is compatible with the analytical method. If the error persists, contact Technical Support.
29009 Liquid sensor fault detected	Excess liquid is present inside the detector. *The following actions occur:* • The contact closure is sent to the Digital I/O terminal of the detector. If the pump is connected to the Digital I/O terminal, the pump flow is stopped. • If the drain pump is not yet turned on, it is turned on automatically. • *Corona Veo RS only:* The stream-switching valve automatically diverts liquid flow away from the nebulizer to prevent detector flooding. *To resolve the problem:* Make sure that the gas flow and drain pump are turned on. Check that liquid flows out of the waste line. Keep in mind that liquid may not be seen leaving the detector for certain mobile phases with high volatility or with low flow rates. Resolve the flooding. See section 8.5.3, page 224.

8.5 Operating Issues

8.5.1 Resolving Leakage

When

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

Liquid may have collected in the leak tray under the flow connections.

Parts required

Replacement part as required

Additional items required

Cloth or tissue

Preparations

When resolving leakage, observe the safety guidelines and general rules for maintenance and service as presented in chapter 7 Maintenance and Service, page 163.

Follow these steps

1. Turn off the pump flow and then the gas flow:
   a) Turn off the pump flow to the detector. Wait at least 5 minutes. During the waiting period, the detector drains any remaining mobile phase to waste.
   b) Turn off the gas flow on the detector.
   c) Wait until the system pressure is down to zero before you continue.
   d) Turn off the gas supply to the detector.
2. If you operate the detector from the chromatography data system, disconnect the detector from the software.
3. Turn off the detector with the main power switch.

4. Locate the source of the leak.
   As leakage usually occurs at a connection, visually inspect all components and connections in the flow path.

   The following can help you to identify the source:

   Nebulizer

   If liquid is visible on the nebulizer, leakage may have occurred in the nebulizer. Remove the nebulizer from the detector (see section 7.7, page 179). Inspect the nebulizer for signs of leakage.

   - If no signs for leakage are present, re-install the nebulizer (see section 5.5.3, page 77).
   - If signs of leakage are present, proceed with the steps below.

   Corona Veo RS only: Stream-switching valve

   If liquid is visible on the stream-switching valve, leakage may have occurred on the capillary connections on one of the ports. Inspect the capillaries for signs of leakage.
5. Tighten or replace the connection or component as required.
6. 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.
7. Allow the sensor to adjust to the ambient temperature for a few minutes.
8. Turn on the detector with its main power switch.
9. If you operated the detector from the chromatography data system, reconnect the detector from the software.
10. If leakage is no longer reported, you can resume operation.

8.5.2 Resolving Gas Supply Overpressure

CAUTION—Excessive Gas Supply Pressure

An improper or excessive gas supply pressure can lead to an overpressure in the detector that can cause the safety valve in the detector to release gas. In extreme cases, the excessive pressure can cause the gas filters to rupture. This can pose a health and safety risk.

- Observe the gas supply pressure range that is specified for the detector. Do not exceed the maximum gas supply pressure.
- If you use high-pressure gas cylinders as gas supply, double-check the regulator outlet pressure to ensure that it is within the gas supply specifications of the detector. This is especially important when attaching the gas bottle for the first time and when changing gas bottles.
- If the overpressure relief valve is releasing gas as a result of an overpressure in the detector during operation, turn off the detector immediately. Remedy the situation as described in the *Resolving Gas Supply Overpressure* section in this manual.

ATTENTION—Pression d'alimentation de gaz excessive

Une pression d'alimentation de gaz inappropriée ou excessive peut conduire à une surpression dans le détecteur, ce qui peut amener la soupape de sécurité dans le détecteur à libérer du gaz. Dans des cas extrêmes, la pression excessive peut conduire à une rupture des filtres de gaz. Ceci peut présenter un risque pour la santé et la sécurité.

- Respectez la plage de pressions d'alimentation de gaz spécifiée pour le détecteur. Ne dépassez pas la pression d'alimentation de gaz maximale.
- Si vous utilisez des cylindrés de gaz de haute pression comme alimentation de gaz, contrevérifiez le régulateur de pression de sortie afin d'assurer qu'il se trouve dans les limites de la plage autorisée de le l'alimentation en gaz du détecteur. Ceci est particulièrement important lorsque vous raccordez des bouteilles de gaz pour la première fois et lors du remplacement des bouteilles de gaz.
- Si la soupape de surpression libère du gaz suite à une surpression dans le détecteur lors de l'utilisation, mettez immédiatement le détecteur hors tension. Remédiez à la situation comme décrit dans la section 8.5.3, page 224 de ce manuel.

When

The gas supply pressure has exceeded 620 kPa (6.2 bar, 90 psi). The detector cannot pressurize properly.

The following actions occur:

- The overpressure relief valve on the gas inlet inside the detector will open and release gas pressure to prevent damage to the detector. This creates a loud hissing sound.
- If the detector is in **Run Mode**, the detector will fail to pressurize. An error code will appear on the detector display and beeping starts to alert you.

Follow these steps

To remedy the situation, follow these steps:

1. Turn off the pump flow and then the gas flow:
   a) Turn off the pump flow to the detector. Wait at least 5 minutes. During the waiting period, the detector drains any remaining mobile phase to waste.
   b) Turn off the gas flow on the detector.
   c) Wait until the system pressure is down to zero before you continue.
   d) Turn off the gas supply to the detector.
2. On the detector display, clear the error code and return to the **Main Menu**.
3. Check that the gas supply pressure is within the allowed range. See the *Gas specifications* in section 9.1, page 236.
4. On the gas supply, turn on the gas flow to the detector.
   If the gas supply pressure has fallen within the allowed range, the overpressure relief valve will remain closed.
5. Turn on the gas flow in the detector. See section 6.5.4.1, page 135.
6. On the **Gas Regulator** screen on the detector display, check that the nebulizer gas pressure reading has returned to the allowed range. See section 6.4.3.1 Gas Regulator Screen, page 116.
   If the pressure reading is normal, return to the **Main Menu**.

If the problem persists, contact Thermo Fisher Scientific Technical Support for assistance.

8.5.3 Resolving Flooding In the Detector

When

The liquid sensor inside the detector detected a build-up of excess liquid (flooding) inside the detector.

The following actions occur:

- A critical error code appears on the detector display and beeping starts to alert you. See section 8.4.2 Error Codes, page 216.

> **TIP** If you operate the detector from a chromatography data system, an error message will also be documented in the audit trail of the software.

- The detector exits the **Run Mode**. If you operate the detector from a chromatography software, the running sequence (or batch) is aborted.
- If not already turned on, the drain pump is turned on automatically.
- If the detector is connected to a LC pump using the **Pump Off** output on the I/O connection terminal, the pump will stop the pump flow.
- *Corona Veo RS only:* The stream-switching valve will divert the liquid flow away from the detector.

Follow these steps

1. Turn off the pump flow to the detector if not already automatically done by the **Pump Off** I/O connection.
2. Leave the detector gas flow turned on to dry the excess liquid. If there is only a small amount of liquid present inside the detector, the liquid may evaporate when leaving on gas flow overnight.

> **TIP** The period for leaving the gas flow turned on depends on the severity of the excess liquid that built up.

3. On the detector display, clear the error code and return to the **Main Menu**.
   If the error code does not reappear, turn the detector gas flow off and on. Check the display:
   - *If the error code no longer appears*
     The excess liquid build-up is removed.
   - *If the error code still appears*
     Write down the code and wording of the message, and contact Thermo Fisher Scientific Technical Support for assistance.

8.5.4 Additional Operating Issues

This section provides additional issues that may arise during operation of the Corona Veo (RS) detector in an HPLC system. Locate the table for the type of symptom you have, find the possible cause, and use the description of the solution to help you solve your problem quickly.

Also check the detector display for a related warning or error code if an operating problem occurs. The code and message may provide additional information.

Note that this section provides information on symptoms and causes directly related to the charged aerosol detector or the HPLC system. For information about troubleshooting for the other system modules, refer to the operating manuals for the other system modules.

TIP 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.

8.5.4.1 Baseline, Background Current or Charger Current

Symptom	Possible Cause	Remedial Action
Baseline noise and/or poor precision	Unstable evaporation temperature or evaporation temperature is too low	If the evaporation tube temperature is unstable, this can lead to higher baseline noise and/or poor precision.
	Unstable gas regulator pressure	If the gas regulator pressure shows instability in the nebulizer gas pressure, this can lead to baseline noise and/or poor precision. Check that the gas supply pressure is stable. If the instability remains, contact Technical Support.
Baseline noise/high background current	Non-volatile impurities in the mobile phase, contaminants from the system or from column bleed	Observe the Mobile Phase Guidelines for the Detector in section 6.5.1, page 123. Isolate the source of high background and noise by testing individual components. For example, with and without column, with and without additive and so forth.
	Incomplete eluent evaporation	This may occur if a high liquid flow rate, a low evaporation temperature and/or less volatile solvent such as 100% water is used. Operate the detector only within the allowed flow rate range. If using a post-column make-up flow, make sure that the combined rate from both flow paths are within the allowed range. Observe the Mobile Phase Guidelines for the Detector in section 6.5.1, page 123. Optimize the evaporation temperature. See section 6.7.4, page 142.
	Detector flooding	This may occur if the detector is turned off. Resolve the flooding. See section 8.5.3 Resolving Flooding In the Detector, page 224.
	Highly retained compounds being eluted from the column	This may occur if a new mobile phase or column is used. Observe the Mobile Phase Guidelines for the Detector in section 6.5.1, page 123. Allow the system to equilibrate for an hour with the new mobile phase or until the baseline is stable. Check the signal again. Disconnect the column from the flow path and re-establish flow. If the signal drops, clean or replace the column.
	Leaking connections in the system	Check the system flow path for leaks. Tighten all fitting connections if necessary.
Charger current / charger voltage outside of range	Malfunctioning of the charger inside the detector	Check the display for self-test errors. See section 8.3 Self-Test Error Codes, page 212. If the problem persists, contact Technical Support.

Symptom	Possible Cause	Remedial Action
High baseline drift	Column contaminated	Clean or replace the column.
	Eluents are contaminated or not homogeneous	• Use freshly prepared solvent. • Observe the Mobile Phase Guidelines for the Detector in section 6.5.1, page 123. • Before you start analysis, homogenize eluents already in their reservoir. • Check the eluent filter frits.
	Mobile phase is contaminated	• Use freshly prepared solvent. • Observe the Mobile Phase Guidelines for the Detector in section 6.5.1, page 123.
	System not sufficiently equilibrated	Flush the system until equilibration. Usually, a volume of 5–10 times the column volume will be sufficient.
	Unstable environmental conditions	Make sure that the temperature and the humidity are constant. You can determine temperature fluctuations by recording the temperature channels.
Non-periodic baseline fluctuation, high noise	Air trapped in the system	Purge the system as necessary (refer to *Pump Operating Manual*).
	Ambient temperature fluctuations	Check the thermostat in the laboratory. If possible, note the temperature fluctuations in the system log.
	Contamination eluting from the column	Trace levels of organic compounds may be tightly retained by the column. Remove the column and check if the problem persists. Clean the column. If the problem still occurs, replace the column
	Contamination of the mobile phase, or insufficient purity of the eluent	Use freshly prepared solvent. Use HPLC-grade eluents only. Observe the Mobile Phase Guidelines for the Detector in section 6.5.1, page 123.
	Gas content of the eluent too high	Degas the solvent.
	Inconstant column temperature	Check the thermostatted column compartment.
	Leaking connections in the system	Check the system flow path for leaks. Tighten all fitting connections if necessary.
	Mobile phase not properly mixed	Check the mixing function of the pump.
	Pressure fluctuations from pump	Purge the pump; check general function (refer to *Pump Operating Manual*).
	System not grounded	Verify that all system components are grounded.

8.5.4.2 Backpressure

Symptom	Possible Cause	Remedial Action
High backpressure	Accumulated particulates from eluent, column or samples	• Check that the mobile phase and/or samples are filtered sufficiently before use, for example using an in-line filter. • Use freshly prepared mobile phase. • Use a mobile phase with a substantial fraction of an organic solvent to prevent growth of microorganisms. Observe the Mobile Phase Guidelines for the Detector (see section 6.5.1, page 123).
	Analyte solubility in the mobile phase exceeded	• Isolate the pressure spike from the autosampler up to the detector. • Replace the in-line filter elements. • Flush the system using an appropriate solvent. • Make sure that the standard or sample is soluble in the mobile phase. Use diluted sample or standard if necessary.
	Nebulizer nozzle/capillary clogged	Poor solubility of analyte during nebulization/analyte build-up. Check the backpressure of the nebulizer: 1. Remove the nebulizer from the detector (see section 7.7, page 179). 2. Set up a direct flow connection from the pump to the nebulizer. Make sure no other module is connected in between. 3. Carefully flow liquid through the nebulizer capillary from the pump. The backpressure of the nebulizer is typically below 10 bars. Liquid should exit the capillary in drops. If the backpressure rises in the pump, then a blockage is present in the nebulizer capillary. Contact Technical Support. To avoid blockage in the nebulizer, always use the detector with an appropriate mobile-phase composition to maintain solubility.
	System capillaries clogged	Check each capillary in the system flow path from the detector to the pump. Remove any blockage or replace the capillaries.

8.5.4.3 Peak Shape and Response

Symptom	Possible Cause	Remedial Action
Inability to autozero the signal	Autozero on a peak or void signal	The Autozero occurred on a relatively flat section of the chromatogram.
	Autozero on a very noisy signal	Reduce the noise or increase the current range.
	High background signal on a very sensitive current range (background >10x gain)	• Use a mobile phase that provides a lower background (lower concentration of impurities). Observe the Mobile Phase Guidelines for the Detector in section 6.5.1, page 123. • Increase the current range.
Peak broadening	Clogging of capillaries, solvent line filter frits or sample loop	• Replace the capillaries. • Check the solvent line filter for permeability. Replace the filter frit if necessary. • Replace the sample loop.
	Column overloaded or contaminated	Clean or replace the column. Reduce the injection volume or injection mass.
	Eluent has changed	Use freshly prepared solvent. Use HPLC-grade eluents only.
	Extra-column volume too large	• If early peaks are broader than later eluting ones, check the capillary I.D. and length, sample loop size, flow cell, for example. • Use a capillary with a smaller volume for the connection between column compartment and detector.
Peak fronting	Sample or solvent is stronger than eluent at time of injection	Match sample-solvent strength to the eluent strength at time of injection.
Peak tailing	Extra column volume too large	Use short capillary connections with a suitable inner diameter.
	Improper capillary connections	Check capillary fittings for correct placement. Loosen and retighten fittings. If you use Viper capillaries and fittings, refer to the *Viper Installation and Operation Guide*.
Periodic baseline fluctuation, pulsation	Air trapped in the system	Purge the system (refer to *Pump Operating Manual*).
	Pressure fluctuations from pump	Purge the pump; check general function (refer to *Pump Operating Manual*).

8.5.4.4 Loss of Response

Symptom	Possible Cause	Remedial Action
Loss of response	Analytes of interest not sufficiently stable	Some compounds will decompose as a function of time. Check the stability regularly. Prepare fresh standards. If necessary, change conditions.
	Change in parameters	Check that the detector is turned on and the **Run Mode** is enabled. Check the parameter settings.
	Clogged autosampler components	Check that the sample and mobile phase are clean. Flush the autosampler (refer to *Autosampler Operating Manual*).
	Drain pump failed	Check that the drain pump is turned on. If there is excessive gas venting from the waste port (see Figure 11 on page 86), contact Technical Support.
	Gas flow turned off	Check that the gas flow is turned on in the detector and the gas supply.
	Gas leaking	Check the gas connections and the gas inlet and exhaust tubes. Remedy the gas leak and/or replace the gas tubes (see section 7.5, page 176).
	Leaking liquid at the detector inlet	Check the capillary connections. Check the tubing that is connected to the waste port of the detector. If internal liquid leak is observed, contact Technical Support.
	Not enough sample in the vial	Check that enough sample is available in the vial for analysis.
	pH of the solvent or mobile phase has changed	Check the mobile phase. Use freshly prepared solvent. Observe the Mobile Phase Guidelines for the Detector in section 6.5.1, page 123.
	Reduced gas flow	• Make sure that the gas is flowing into the detector. • Check the nebulizer gas pressure and the gas supply pressure. • Check gas filter assembly. If necessary, replace the gas filter assembly (see section 7.8, page 183).
	Retention times changed	Maintain the column at constant temperature. Air may be present in the pump, or an incorrect flow rate is set. Purge the pump (refer to *Pump Operating Manual*). Check the flow rate. Consider the mobile phase.
	Stream-switching valve in **Divert** position	*Corona Veo RS only* Check that the stream-switching valve is actuated so that it directs liquid to the nebulizer.

8.5.4.5 Peak Area Precision

Symptom	Possible Cause	Remedial Action
Capillary problems	Capillary connections not installed properly or not tight, dead volumes in capillary connections	Properly install the capillary connections. Tighten the capillary connections. Replace capillary.
Contamination or carry-over	Autosampler carry-over	Refer to the *Autosampler Operating Manual*.
	Contamination or carry-over in the system	Flush the system using an appropriate solvent.
Environmental conditions	Unstable and decomposing sample	Use new sample. Change the conditions. Cool the sample in the autosampler if possible.
	Unstable environmental conditions	Make sure that the temperature and air humidity are constant. Use column thermostatting. Avoid draft.
Injection volume variation	Operating issues with the autosampler	Operating issues with the autosampler may include: • Air trapped in autosampler flow path • Autosampler draws air from vial • Draw speed too high • Gas content of sample too high or saturated • Injector needle clogged or needle tip deformed • Injection valve or other autosampler components leaking • Needle seat worn out Refer to the *Autosampler Operating Manual*.
Pump problems	Operating issues with the pump	Operating issues with the pump may include: • Piston seals in pump leaking • Air trapped in pump head • Baseline fluctuations • Pump pulsation or flow fluctuations • Irreproducible gradient Refer to the *Pump Operating Manual*.

8.5.4.6 Ghost Peaks, Negative Peaks and Spikes

Symptom	Possible Cause	Remedial Action
Ghost peaks	Contamination (typically injector or column)	Flush the system using an appropriate solvent.
	Degassing channels contaminated	Purge the pump (all channels) to rinse the degassing channels (refer to *Pump Operating Manual*).
	Late eluting peak from previous analysis	Extend the run time. Increase the elution strength of the gradient (higher organic content). At the end of the run, flush the column with strong eluent.
	Solvents are degraded, dirty or their purity is insufficient	• Use freshly prepared solvent. • Observe the Mobile Phase Guidelines for the Detector in section 6.5.1, page 123.
Negative peaks	Sample and mobile phase differ in composition	Make sure that the sample dissolves in the mobile phase.
	Wrong polarization of the analog output	Contact Technical Support.
Spikes	Column temperature significantly above boiling point of mobile phase	Reduce the column temperature or install a post-column cooler.
	Electrical interferences from other instruments	Avoid operation of equipment generating strong electric or magnetic fields in close proximity. Do not connect equipment that may cause power disturbances to the same power network used to supply the system. Ground the detector using heavy gauge wire from the thumbscrew ground terminal that is located on the power supply module to the main power ground.

8.5.4.7 Liquid Flow

Symptom	Possible Cause	Remedial Action
Flow fluctuations	Pump flow path	For operating issues with the pump, refer to the *Operating Manual* for the pump.
No flow	Column temperature too high – eluent evaporating	Select a lower column temperature (refer to *Column Compartment Operating Manual*).
	Leak in the system	Find and eliminate the leak.
	Pump flow path	For operating issues with the pump, refer to the *Operating Manual* for the pump.

8.5.4.8 Gas Flow Ratio and Flooding

Symptom	Possible Cause	Remedial Action
High gas flow ratio	Clogging in the detector	Contact Technical Support.
Liquid in the gas exhaust	Flooding inside the detector (pump flow turned on while no gas flow present)	Flooding can occur if the detector is turned off while liquid is still flowing into the detector. See section 8.5.3 Resolving Flooding In the Detector, page 224.
Low gas flow ratio	Gas leak	Check the detector display for the respective error code. See section 8.4 Warning and Error Codes, page 214.

8.5.4.9 Display

Symptom	Possible Cause	Remedial Action
No information on the display	Brightness on the screen not adjusted	Adjust the display brightness. See section 6.4.1, page 109.
	Error in electronic system	Contact Technical Support.
	Fuse has blown	Replace the fuses. See section 7.10, page 196. If the replacement fuses fail, there is a fault with the power supply. Contact Technical Support.
	Module not connected to the mains	Connect the power cord.
	Module power turned off	Turn on the module with its main power switch.

9 Specifications

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

9.1 Performance Specifications

The detector performance is specified as follows:

Type			Specification
Detection type			Charged aerosol detection
Nebulization			FocusJet, concentric flow design
Pump flow rate			
	Corona Veo RS		0.01 – 2.0 mL/min
	Corona Veo		0.2 – 2.0 mL/min
Evaporation temperature			
	Corona Veo RS		Adjustable range: ambient +5 to +100 °C
	Corona Veo		Selectable temperatures: +35 °C or +50 °C
Data collection rate			
	Corona Veo RS		Max. 200 Hz with Chromeleon 7 (max. 100 Hz with Chromeleon 6.8)
	Corona Veo		Max. 100 Hz
Filter time constants			Selectable in numerical sequence (1-2-5 increments): 0.1, 0.2, 0.5, 1.0, 2.0, 3.6, 5.0 10.0 seconds
Digital noise filtering			4th order low-pass Bessel filter
Warm-up time			< 30 minutes to 35 °C evaporation temperature
Integrated stream-switching valve			*Corona Veo RS only:* 6-port, 2-position valve (TTL controlled)
Gas supply specifications			
	Inlet gas supply		Compressed air or nitrogen
	Gas supply pressure		482 - 551 kPa (4.8 - 5.5 bar, 70 - 80 psi)
Gas pressure control			
	Corona Veo RS		Electronic
	Corona Veo		Manual
Rear interface			AC plug, power switch, and the following connectors:
	USB		1 USB port (USB 2.0, "B" type connector)
	Digital I/O interface		4 TTL inputs, 3 relay outputs
	Analog output		Installable option; 1 BNC-type analog output connector
		Full-scale analog output range	1 pA to 500 pA in 1-2-5 sequence
		Analog signal output	0 – 1 V DC
Standalone control interface			Integrated color liquid-crystal display (LCD) touch screen

Type	Specification
Software control	Available detector functions controllable via USB (1.1 or 2.0) through Chromeleon data system with the cable provided (Chromeleon 7, Chromeleon 6.8) The detector can be operated also with other data systems. For details, contact the Thermo Fisher Scientific sales organization.
Materials in the flow path	Stainless steel (type 316), Nitronic™ 60 stainless steel, PEEK, SimRiz™, aluminum *In addition for Corona Veo RS only:* PTFE (Valcon H) **NOTICE** For information about the chemical resistance of materials refer to the technical literature.
Solvent and additive information	See section 2.4, page 37.
Safety features	• Overpressure relief valve on gas inlet • Liquid detection inside the detector and safe leak handling • Detection of high evaporation temperatures • Pump flow shutdown • Leak detection and safe leak handling
Good Laboratory Practice (GLP) features	Preventive maintenance functions for scheduling maintenance procedures based on the actual operating and usage conditions of the detector. This includes monitoring of the replacement interval for the gas filter assembly and the service interval.

9.2 Physical Specifications

The physical conditions of the detector are specified as follows:

Type	Specification
Range of use	Indoor use only
Ambient temperature	15 – 35 °C
Ambient humidity	12 - 80% relative humidity (non-condensing)
Operating altitude	Maximum 2000 m above sea level
Pollution degree	2
Power requirements	100 – 120 V AC, 220 – 240 V AC, ± 10%; 50 – 60 Hz; 100 VA
Overvoltage category	II
Emission sound pressure level	<70 dB(A), typically 54 dB(A)
Dimensions (height x width x depth)	22.9 x 44.5 x 55.9 cm (9 x 17.5 x 22 in.)
Weight	Approx. 14.3 kg (31.5 lbs.)

10 Accessories, Consumables and Replacement Parts

This chapter describes the standard accessories that are shipped with the detector 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 detector 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 detector is shipped.

For reordering information, see section 10.4 Consumables and Replacement Parts, page 245.

10.2.1 Corona Veo RS Detector

Item	Quantity in shipment
Detector drainage components for leak port and waste port:	
Tee pieces	2
L pieces	4
Flexible hose, 11.4 mm x 8.3 mm O.D. x I.D., 2 m length	1
Tubing kit, including:	1
Gas inlet tubing, 1/8" x 1/4" I.D. x O.D., 2.5 m length	1
Gas exhaust tubing, consisting of • Exhaust hose, 1/2" x 11/16" I.D. x O.D., 2.5 m length • Barb stem fitting, 1/2" x 3/8" I.D. x O.D. (pre-installed)	1
Capillary, PEEK, 0.005" x 1/16" I.D. x O.D., red, 2 m length	1
RheFlex fittings, PEEK, 1/16", finger-tight	4
Gas exhaust tubing adapter, inch to metric, 1/4" O.D.	1
Filter frits, stainless steel, porosity 0.5 µm	10
Tubing cutter	1
Digital I/O cable, 2-conductor	1
USB cable, type A to type B, 3 m	1
Tool kit, including: • Multitool • Offset screwdrivers, Torx T10 and T20 • Hexagon socket wrench (1/2" x 9/16") • Slotted screwdriver (2.5 x 50 mm)	1

Item	Quantity in shipment
Capillary, Viper, 0.13 mm I.D., 350 mm length For connection to an optical detector, for example in an UltiMate 3000 system.	1
Capillary, Viper, 0.13 mm I.D., 100 mm length For connection between stream-switching valve and nebulizer.	1
Capillary, PEEK, 0.0015" x 1/16" I.D. x O.D., gray, 1.5 m length	
In-line filter, stainless steel, with filter frit included	1
Fuses kit with 2 fuses (1A, 250 V AC, slow-blow, 5 x 20 mm)	1
Nut and ferrule set, stainless steel, 1/4"	1
Signal synchronization cable for connection to LPG-3400XRS pump	1
Signal cable, 6-pin miniDIN, length 5 m	1

10.2.2 Corona Veo Detector

Item	Quantity in shipment
Detector drainage components for leak port and waste port:	
Tee pieces	2
L pieces	4
Flexible hose, 11.4 mm x 8.3 mm O.D. x I.D., 2 m length	1
Tubing kit, including:	1
Gas inlet tubing, 1/8" x 1/4" I.D. x O.D., 2.5 m length	1
Gas exhaust tubing, consisting of • Exhaust hose, 1/2" x 11/16" I.D. x O.D., 2.5 m length • Barb stem fitting, 1/2" x 3/8" I.D. x O.D. (pre-installed)	1
Capillary, PEEK, 0.005" x 1/16" I.D. x O.D., red, 2 m length	1
RheFlex fittings, PEEK, 1/16", finger-tight	4
Gas exhaust tubing adapter, inch to metric, 1/4" O.D.	1
Filter frits, stainless steel, porosity 0.5 µm	10
Tubing cutter	1
Digital I/O cable, 2-conductor	1

Item	Quantity in shipment
USB cable, type A to type B, 3 m	1
Tool kit, including: • Multitool • Offset screwdrivers, Torx T10 and T20 • Hexagon socket wrench (1/2" x 9/16") • Slotted screwdriver (2.5 x 50 mm)	1
Capillary, Viper, 0.13 mm I.D., 350 mm length For connection to an optical detector, for example in an UltiMate 3000 system.	1
In-line filter, stainless steel, with filter frit included	1
Fuses kit with 2 fuses (1A, 250 V AC, slow-blow, 5 x 20 mm)	1
Nut and ferrule set, stainless steel, 1/4"	1
Signal synchronization cable for connection to LPG-3400XRS pump	1
Signal cable, 6-pin miniDIN, length 5 m	1

10.3 Optional Accessories

Item	Part No.	Remarks
Analog signal output kit	6081.0010	Includes all components required for installation of an analog signal output with a BNC-type connector to the detector, as well as installation instructions.
Corona air compressor 110 V	6295.0350	Supplies the required amount of air pressure for operation of the detector.
Corona air compressor 230 V	6295.0300	Supplies the required amount of air pressure for operation of the detector.
Corona nitrogen generator 1010	6295.0200	Provides on-demand, uninterrupted supply of dry nitrogen from a compressed air source.
Flow splitter	70-6337	Adjusts liquid flow in the range from 1:1 to 20:1.
Viper inverse gradient capillary kit for UltiMate 3000 RS system	6040.2820	Includes all components required for connections in an UltiMate 3000 RS system as well as instructions.
Viper inverse gradient capillary kit for UltiMate 3000 SD system	6040.2819	Includes all components required for connections in an UltiMate 3000 SD system as well as instructions.

10.4 Consumables and Replacement Parts

Capillaries, tubes and other liquid flow components

Description	Part No.
Capillary, PEEK, 0.0015" x 1/16" I.D. x O.D., gray, 1.5 m length	6081.1420
Capillary, PEEK, 0.005" x 1/16" I.D. x O.D., red, 2 m length Inlet capillary for connection to the nebulizer.	6081.1410
Capillary, Viper, 0.13 mm I.D., 100 mm length For connection between stream-switching valve and nebulizer in Corona Veo RS detectors.	6040.2322
Capillary, Viper, 0.13 mm I.D., 350 mm length	6040.2335
Filter frits for in-line filter, stainless steel, porosity 0.5 µm, 10 frits	70-4539
Fitting, one-piece, hand-tight, 10 fittings	2200.5503
In-line filter, stainless steel, with filter frit included	70-4538
RheFlex fittings, PEEK, 1/16", finger-tight	6000.0012
Viper union	6040.2304

Gas filter and gas flow components

Description	Part No.
Gas exhaust tubing, consisting of • Exhaust hose, 1/2" x 11/16" I.D. x O.D., 2.5 m length • Barb stem fitting, 1/2" x 3/8" I.D. x O.D. (pre-installed)	70-6261
Gas filter assembly kit, consisting of charcoal gas filter and HEPA gas filter	6081.7062
Gas inlet tubing, 1/8" x 1/4" I.D. x O.D., 2.5 m length	6081.1070
Nebulizer, stainless steel	6081.1247

Interface cables

Description	Part No.
Digital I/O cable, 2-conductor	70-4850
Signal cable, 6-pin miniDIN, length 5 m	6000.1004
Signal synchronization cable for connection to LPG-3400XRS pump	6043.0003
USB cable, type A to type B, length 3 m	70-5713

Miscellaneous

Description	Part No.
Fuses kit with 2 fuses (1A, 250 V AC, slow-blow, 5 x 20 mm)	70-6666
Multitool	40-0288
Tool kit, including: • Multitool • Offset screwdrivers, Torx T10 and T20 • Hexagon socket wrench (1/2" x 9/16") • Slotted screwdriver (2.5 x 50 mm)	6081.9190
Tubing cutter (1/8" x 3/4")	70-7112

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

Stream-switching valve components (Corona Veo RS detector only)

Description	Part No.
Rotor for stream-switching valve	6820.0014
Stator for stream-switching valve	6820.0012

11 Appendix

This chapter provides additional information about compliance, the use of the digital I/O ports and internal gas flow paths.

11.1 Compliance Information

11.1.1 Declarations of Conformity

- For English version, see below.
- For French version, see page 249.

English Version

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

  The CE mark on the device indicates that the product is compliant with the directive.

- *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:

	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 mark 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

French Version

Déclaration de conformité à la norme CE

L'appareil a satisfait aux exigences requises pour le et respecte les exigences en vigueur.

Conformité à la certification cTUVus

Le label cTUVus apposé sur l'appareil indique que l'instrument a satisfait aux exigences requises pour le marquage cTUVus. La conformité aux normes en vigueur a été évaluée par le TÜV Rheinland de North America Inc.

Conformité aux directives RoHS

Ce produit est conforme aux exigences des directives RoHS (Restrictions of Hazardous Substances) :

- *Directive RoHS européenne*
  Directive portant sur l'utilisation limitée de certaines substances dangereuses dans les équipements électriques et électroniques
  Le marquage CE apposé sur l'appareil atteste de la conformité du produit à la directive.

- *Réglementation RoHS chinoise*
  Mesures de contrôle de la pollution provenant de produits d'information électroniques
  S'il y a lieu, un des logos suivants peut être apposé sur l'appareil :

	Le logo vert est apposé sur les dispositifs qui ne comportent pas les substances dangereuses répertoriées par la réglementation.
	Le logo orange, qui encercle une valeur à un ou deux chiffres, est apposé sur les dispositifs qui comportent des substances dangereuses répertoriées par la réglementation. Le nombre indique la durée d'utilisation sans risques pour l'environnement (environment-friendly use period, EFUP) du dispositif. Pendant cette période, le dispositif (si employé conformément à son utilisation prévue) ne présente pas de risques graves pour la santé humaine ou l'environnement. Pour en savoir plus, rendez-vous sur http://www.thermofisher.com/us/en/home/technical-resources/rohs-certificates.html

11.1.2 WEEE Compliance

English Version

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:

Figure 45: 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.

French Version

Ce produit doit être conforme à la directive 2002/96/CE de l'Union Européenne relative aux déchets d'équipements électriques et électroniques. Il porte le symbole suivant :

Thermo Fisher Scientific a conclu des contrats avec une ou plusieurs entreprises de collecte et de recyclage des déchets dans chaque État membre de l'Union Européenne (UE), et ces entreprises sont tenues de collecter ou de recycler ce produit. Pour obtenir plus d'informations, veuillez contacter Thermo Fisher Scientific.

11.1.3 FCC Compliance

English Version

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.

French Version

Cet équipement a été testé et déclaré conforme aux limites pour un appareil numérique de classe A, conformément à la partie 15 du règlement de la FCC (Commission fédérale des communications) aux États-Unis.

Ces spécifications sont destinées à fournir une protection raisonnable contre les interférences nuisibles, lorsque l'équipement est utilisé dans un environnement commercial. Cet appareil génère, utilise et peut émettre de l'énergie par radiofréquence et, s'il n'est pas installé et employé conformément aux instructions, peut causer des interférences nocives avec les communications radio. L'utilisation de cet appareil dans une zone d'habitation est susceptible de causer des interférences nocives ; le cas échéant, l'utilisateur est contraint de corriger les interférences à ses frais.

11.1.4 Manual Release History

Revision	Released	Covering
2.1	October 2019	Corona Veo, Corona Veo RS
2.0	June 2017	Corona Veo, Corona Veo RS
1.0	July 2013	Corona Veo, Corona Veo RS

11.2 Digital I/O Terminals Pin Assignment

The detector is equipped with two I/O terminals that include 7 connection ports (4 TTL inputs and 3 relay outputs):

Digital I/O Terminal A

Pin	Signal Name	Signal Level	Remark
1	CC1+	Relay output	Positive polarity
2	CC1-	Relay output	Negative polarity
3	GND	Ground	
4	CC2+	Relay output	Positive polarity
5	CC2-	Relay output	Negative polarity
6	GND	Ground	
7	Divert+	TTL input	Positive polarity
8	Divert-	TTL input	Negative polarity
9	GND	Ground	

Digital I/O Terminal B

Pin	Signal Name	Signal Level	Remark
1	Pump Off+	Relay output	Positive polarity
2	Pump Off-	Relay output	Negative polarity
3	GND	Ground	
4	Gas Off+	Relay output	Positive polarity
5	Gas Off-	Relay output	Negative polarity
6	GND	Ground	
7	Autozero+	TTL input	Positive polarity
8	Autozero-	TTL input	Negative polarity
9	GND	Ground	
10	Start+	TTL input	Positive polarity
11	Start-	TTL input	Negative polarity
12	GND	Ground	

NOTICE When you connect TTL inputs, the potential across the pins must be set to 5 V DC ±0.25 V. When you connect a relay output, the potential across the pins must be less than 30 V DC and the current must must be less than 0.5 A.

AVIS Lorsque vous connectez des entrées TTL, le potentiel à travers les broches doit être réglé à 5 V DC ±0.25 V. Lorsque vous connectez la sortie relais, le potentiel à travers les broches doit être inférieur à 30 V DC et le courant doit être inférieur à 0.5 A.

11.2.1 TTL Inputs

The 4 inputs on the I/O terminals are TTL compatible. Use a true contact closure or relay output for connection to the inputs. The positive polarity is the top polarity in each group, and the negative polarity is immediately below it, followed by ground.

If a TTL-level change is used, observe the following:

- Voltage must be between 0 V and 5 V.
- The polarity sense of the device must match that of the detector: The **+** (positive) and **–** (negative) polarities of the device must be connected to the corresponding **+** (positive) and **–** (negative) polarities of the detector, respectively.

Start

The **Start** input is available for use with a chromatography data system that requires triggering event synchronization for data collection from an external device, such as an autosampler. The detector requires a contact closure or shorting of the terminals (a signal of at least 0.5 seconds) from the external device.

For more information, refer to the user documentation of the external device.

Gas Off

The **Gas Off** input can be used to turn off the internal gas inlet valve and stop the gas supply to the nebulizer. It is recommended to use this input only when the gas supply is limited.

If the **Gas Off** input is activated, the detector will shut down internal gas supply. This will result in an alarm condition. Stop the alarm condition using the detector display or the chromatography data system.

Autozero

The **Autozero** input can be used to set the signal of a channel to a zero point, regardless of the current that is being measured.

Allow sufficient time after you performed the autozero and before injection to ensure that the autozero command is completed. Alternatively, an autozero may be performed during a run. In this case, make sure that autozero occurs at a point in the chromatogram where the response curve is expected to be reasonably flat, that is, 15 seconds prior to the elution of a peak.

Divert

The **Divert** input can be used to control the stream-switching valve with a third-party driver.

11.2.2 Relay Outputs

To use output contact closures, connect the outputs according to theirs **+** or **–** polarity. Connect the third wire of the I/O cable to the ground below the polarity of the output to which it belongs.

Pump Off

The **Pump Off** output contact is used to send a signal to the pump or other external device to stop the flow of mobile phase and turn off the pump. This signal may be used to turn off the pump to prevent the detector from being flooded with mobile phase if the gas pressure falls below 50% of the required gas volume for more than 60 seconds.

To use the **Pump Off** contact closure, the HPLC system must be able to accept an input from the detector that can be programmed to turn off liquid flow. In some cases, a special cable is required.

CC1 and CC2

The **CC1** and **CC2** contact closures can be used to start an external device, for example an autosampler, or can be used to change a valve position. The two ports act in similar fashion to the **Pump Off** output.

TIP If you use the Chromeleon software, relay output **CC1** corresponds to the relay signal **CAD_Relay_1** (default name), and relay output **CC2** corresponds to the relay signal **CAD_Relay_2** (default name). The **Pump Off** relay output is not available in the Chromeleon software.

11.3 Internal Gas Flow Path Diagram

The following diagram shows the gas and aerosol flow paths inside the detector.

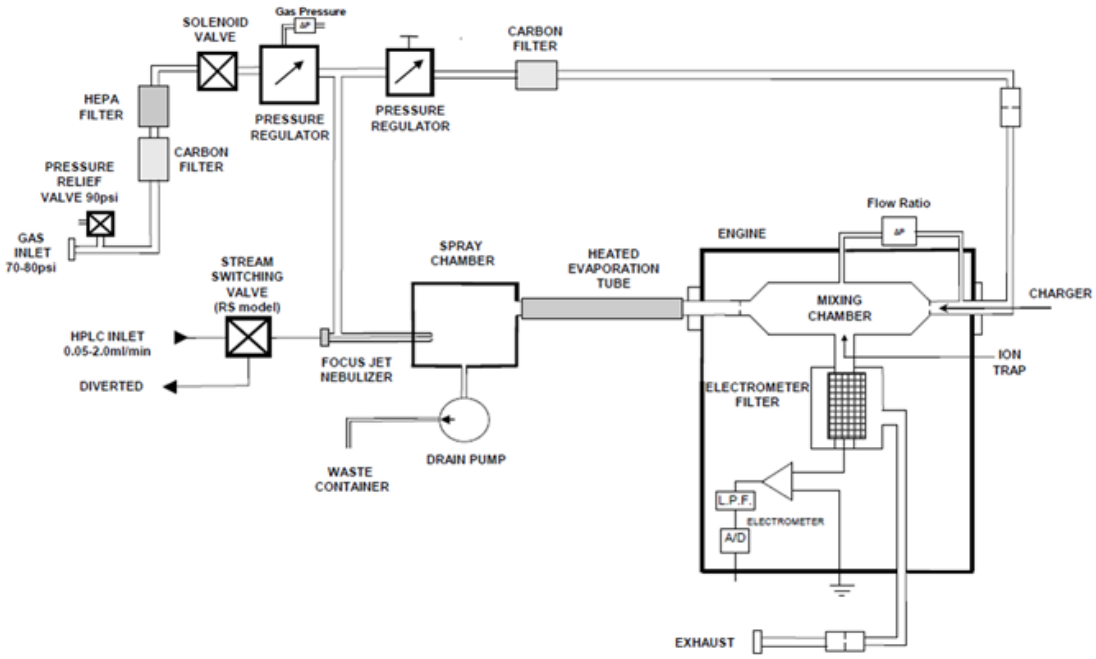


Figure 46: Gas flow path diagram

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