

# Thermo Scientific Dionex UltiMate 3000 Series

## Column Compartments TCC-3000SD and TCC-3000RS

### Operating Instructions (Original Operating Instructions)



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## Declaration of Conformity

(Original Declaration of Conformity)

**Product:** Thermo Scientific Dionex UltiMate 3000 - Column Thermostat

**Types:** **TCC-3000SD** and **TCC-3000RS**

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

- Low-Voltage Directive 2006/95/EC
- EMC Directive 2004/108/EC

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

- DIN EN 61010-1:2010  
Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1: General Requirements

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

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

This declaration is issued for the manufacturer

Dionex Softron GmbH  
Part of Thermo Fisher Scientific Inc.  
Dornierstraße 4  
D-82110 Germering

by the Managing Director, Rüdiger Obst and  
den Vice President HPLC, Fraser McLeod.

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# Table of Content

<b>1</b>	<b>Introduction.....</b>	<b>1</b>
1.1	How to Use this Manual .....	1
1.2	Safety .....	3
1.2.1	Symbols on the TCC and in the Manual.....	3
1.2.2	Safety Precautions .....	4
1.2.3	Consignes de Sécurité.....	8
1.3	Intended Use .....	12
1.4	Federal Communications Commission (FCC) Note.....	13
<b>2</b>	<b>Overview.....</b>	<b>15</b>
2.1	Unit Description.....	15
2.2	Operating Principle .....	16
2.3	Configurations .....	17
2.4	Front Panel Elements .....	18
2.5	Rear Panel .....	19
2.5.1	Power Switch.....	20
2.5.2	Fuse Cartridge .....	20
2.5.3	USB Port.....	20
2.5.4	Digital I/O.....	20
2.6	Interior Components .....	21
2.7	Gas and Humidity Sensors.....	22
2.8	Column Switching Valve.....	22
2.9	Column Identification System (Column ID) .....	24
2.10	Pre-Column Heater .....	24
2.11	Post-Column Cooler .....	25
2.12	Operation from Chromeleon.....	26
2.13	System Wellness, Predictive Performance, and Diagnostics.....	27
<b>3</b>	<b>Installation.....</b>	<b>29</b>
3.1	Facility Requirements .....	29
3.2	Unpacking .....	29
3.3	Positioning the TCC in the UltiMate 3000 System .....	31
3.4	Connecting the TCC .....	33
3.4.1	General Information .....	33
3.4.2	Connecting the USB Cable.....	33
3.4.3	Connecting the Power Cord.....	34
3.4.4	Connecting the Digital I/O .....	34
3.5	Setting Up the TCC in Chromeleon.....	35
3.5.1	Loading the USB Driver for the TCC .....	35
3.5.2	Installing the TCC .....	37
3.5.3	Configuring the TCC .....	38
3.6	Setting Up the TCC in DCMSLink.....	44

<b>4</b>	<b>Preparation for Operation (Startup)</b>	<b>45</b>
4.1	Overview	45
4.2	General Precautions for Connecting Capillaries	46
4.3	Opening the Column Chamber	48
4.4	Inspecting the Valve Drainage	49
4.5	Installing a Pre-column Heater	49
4.6	Installing a Separation Column	50
4.7	Installing the Post-Column Cooler Insert	52
4.8	Connecting the Components to the Column Switching Valve	53
4.8.1	Connections on a 2-position, 6-port Column Switching Valve	54
4.8.2	Connections on a 2-position, 10-port Column Switching Valve	55
4.8.3	Connections on a Multi-Position Column Switching Valve	56
4.9	Connecting Drain Tubing	56
4.10	Equilibrating the System	57
<b>5</b>	<b>Operation and Maintenance</b>	<b>59</b>
5.1	Power-Up	59
5.2	Status Screen	60
5.3	Operation from Chromeleon	61
5.3.1	Connecting to Chromeleon	61
5.3.2	Direct Control	62
5.3.3	Automated Control	65
5.4	Display Screens (Function Keys and Menus)	67
5.4.1	Showing the Function Keys	67
5.4.2	TCC Menus	68
5.5	Operational Settings	72
5.5.1	Turning on Column Thermostatting	73
5.5.2	Turning on Post-Column Thermostatting	74
5.5.3	Activating Column Identification (Column ID)	75
5.5.4	Selecting the Column	76
5.5.5	Adjusting the Sensitivity of the Gas and Humidity Sensors	77
5.5.6	Selecting the Status Screen	78
5.5.7	Adjusting the Screen Brightness or Contrast	78
5.5.8	SmartStartup and SmartShutdown	79
5.6	Special Chromeleon Functions	80
5.6.1	Ready Temp Delta and Equilibration Time	80
5.6.2	Predictive Performance	82
5.6.3	TCC Diagnostics	83
5.6.4	Recording the Temperature Signals	83
5.6.5	Operational Qualification and Performance Qualification	83
5.7	Shutting Down the TCC	84
5.8	Routine and Preventive Maintenance	86

<b>6</b>	<b>Troubleshooting</b> .....	<b>87</b>
6.1	Overview .....	87
6.2	Messages on the TCC Display .....	88
6.3	Chromeleon Diagnostics Messages .....	91
6.4	Operating Problems .....	92
<b>7</b>	<b>Service</b> .....	<b>95</b>
7.1	General Notes and Safety Precautions .....	95
7.2	Removing Gases and Humidity from the Column Chamber .....	97
7.3	Column Switching Valve .....	98
7.3.1	Inspecting the Column Switching Valve for Leakage .....	99
7.3.2	Replacing the Valve Pod .....	100
7.3.3	Replacing the Valve Stator .....	105
7.3.4	Rotor Seal and Stator Face Seal .....	107
7.4	Replacing the Main Power Fuses .....	109
7.5	Updating the TCC Firmware .....	110
<b>8</b>	<b>Technical Information</b> .....	<b>113</b>
<b>9</b>	<b>Accessories, Consumables, and Spare Parts</b> .....	<b>115</b>
9.1	Standard Accessories .....	115
9.2	Optional Accessories .....	117
9.3	Consumables and Spare Parts .....	120
<b>10</b>	<b>Appendix - Digital I/O (Pin Assignment)</b> .....	<b>125</b>
<b>11</b>	<b>Index</b> .....	<b>127</b>



# 1 Introduction

## 1.1 How to Use this Manual

The layout of this manual is designed to provide quick reference to the sections of interest to the reader when operating the Thermo Scientific™ Dionex™ TCC-3000 Thermostatted Column Compartment. However, in order to obtain a full understanding of the TCC, Thermo Fisher Scientific recommends that you review the manual thoroughly before beginning operation.

The descriptions in this manual apply to the following column compartments in the UltiMate™ 3000 series:

- TCC-3000SD
- TCC-3000RS

The following conventions apply to the descriptions throughout this manual:

- The term "the TCC" or "the device" is used throughout the manual. If some detail applies to only one model or version, the model (version) is identified by name.
- If not otherwise stated, the descriptions for the Viper™ capillary connections apply also to nanoViper™ and possible other Viper capillary connections.
- The device configuration may vary. Therefore, not all descriptions necessarily apply to your particular TCC.
- The representation of a component in this manual may be slightly different from the real component. However, this does not influence the descriptions.
- The descriptions in this manual refer to firmware version 1.32 and Chromeleon™ 6.80 Service Release 13. If you want to operate the TCC from Chromeleon 7, note the information on page 26.

This manual is provided "as is". Every effort has been made to supply complete and accurate information and all technical specifications have been developed with the utmost care. The information contained in this manual should not be construed as a commitment by Thermo Fisher Scientific. Thermo Fisher Scientific assumes no responsibility for any errors that may appear in this document that is believed to be complete and accurate at the time of publication and, in no event, shall Thermo Fisher Scientific be liable for incidental or consequential damages in connection with or arising from the use of this document. We appreciate your help in eliminating any errors that may appear in this document.

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## 1.2 Safety

The CE Mark label and cTUVus Mark safety label on the instrument indicate that the instrument is compliant with the related standards.

### 1.2.1 Symbols on the TCC and in the Manual

The table shows the symbols that are used on the TCC:

Symbol	Description
	Alternating current—Courant alternatif
	Power supply is on (-)—L'instrument est mis sous tension (-) and Power supply is off (O)—L'instrument est mis hors tension (O)
	Surface becomes hot during operation—La surface devient chaude lors du fonctionnement.
	Refer to the Operating Instructions to prevent risk of harm to the operator and to protect the device against damage. Référez-vous à ce manuel pour éviter tout risque de blessure à l'opérateur et/ou protéger l'instrument contre tout dommage.
	Label according to the "Measures for Administration of the Pollution Control of Electronic Information Products" (China RoHS) guideline Étiquette "Measures for Administration of the Pollution Control of Electronic Information Products" (China RoHS)
	WEEE (Waste Electrical and Electronic Equipment) label—For more information, see the WEEE Information section in the "Installation and Qualification Documents for Chromatography Instruments" binder. Étiquette DEEE (Déchets d'Équipements Électriques et Electroniques)—Pour plus d'informations, référez-vous au chapitre WEEE Information dans le classeur "Installation and Qualification Documents for Chromatography Instruments"

At various points throughout the manual, the following symbols indicate messages of particular importance:

-  **Tip:** Indicates general information, as well as information intended to optimize the performance of the instrument.
-  **Important:** Indicates that failure to take note of the accompanying information could cause wrong results or may result in damage to the instrument.
-  **Important:** Indique que ne pas tenir compte de l'information jointe peut conduire à de faux résultat ou endommager l'instrument.

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

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

## 1.2.2 Safety Precautions

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

 **Tip:** Before operating the TCC for the first time, read this manual once to make yourself familiar with the contents of this manual.

For the safety precautions in French, see section 1.2.3 (→ page 8).

 **Warning:** All users of the device must observe the following safety precautions and all additional safety precautions in this manual to avoid the possibility of personal injury or damage to the device when operating the device or carrying out any maintenance or service procedures.

Observe any warning labels on the TCC and see the related sections in these *Operating Instructions*.

- **Protective equipment**

When performing any work on or near the HPLC system, wear personal protective equipment (protective clothing, safety gloves, safety glasses) as required by the hazard of the mobile phase and sample. For information about the proper handling of a particular substance and for advice on specific hazards, refer to the material safety data sheet for the substance you are using. Observe the guidelines of Good Laboratory Practice (GLP).

An eyewash facility and a sink should be close to the device. If any substance splashes on the eyes or skin, wash the affected area and seek medical attention.

- **Hazardous substances**

Many organic solvents, mobile phases, and samples are harmful to health. Be sure that you know the toxic and infectious properties of all substances that you are using. You may not know the toxic or infectious properties of many substances that you are using. If you have any doubt about a substance, treat it as if it contains a potentially harmful substance. For advice on the proper handling of a particular substance, refer to the Safety Data Sheet (SDS) of the manufacturer. Observe the guidelines of Good Laboratory Practice (GLP).

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

- **Hazardous gases**

Install the HPLC system in a well-ventilated laboratory. If the mobile phase or sample includes volatile or flammable solvents, do not allow them to enter the workspace. If the mobile phase or sample includes volatile or flammable solvents, avoid open flames and sparks.

- **Electrostatic discharge**

Discharge of electrostatic energy may lead to sparking and can constitute a fire hazard. Keep in mind that liquid flowing through capillaries can generate static electricity. This effect is particularly pronounced in insulating capillaries and with non-conductive solvents (for example, pure acetonitrile).

Take appropriate measures to prevent the generation of static electricity near the HPLC system. For example, make sure that the air humidity level in the laboratory is sufficiently high and provide proper ventilation, wear anti-static clothing or shoes, prevent accumulation of air bubbles in waste lines, and use grounded waste containers. Use only non-conductive capillaries to direct solvents into the waste container. With electrically conductive capillaries make sure that they are properly grounded.

- **Self-ignition of solvents**

Do not use solvents for which the self-ignition temperature is below 150 °C. In case of leakage, these solvents may self-ignite on a hot surface.

- **Capillaries, capillary connections, open connections**

- ◆ Capillaries, especially non-metallic capillaries may burst, slip out of their fittings or may not be screwed in. This may result in substances spraying out of the open connections.
- ◆ In an UltiMate 3000 system, some components are made of PEEK™. This polymer has superb chemical resistance to most organic solvents. However, it tends to swell when in contact with trichloromethane (CHCl<sub>3</sub>), dimethyl sulfoxide (DMSO), or tetrahydrofuran (THF). In addition, it is attacked by concentrated acids, such as, sulfuric acid and nitric acid or a mixture of hexane, ethyl acetate, and methanol. In both cases, capillaries may start leaking or they can burst. Swelling or attack by concentrated acids is not a problem with brief flushing procedures.
- ◆ Do not use tubing that is stressed, bent, kinked, or damaged.
- ◆ Capillary connections can be contaminated by harmful substances or harmful substances can escape from open connections.

- ◆ In an UltiMate 3000 Bio RS system, some system capillaries are made of MP35N<sup>®</sup>, a nickel-cobalt based alloy. Individuals with sensitivity to nickel/cobalt may show an allergic reaction from skin contact.
- ◆ Always wear safety glasses when handling fused silica tubing, for example, during installation or when cutting capillaries to the length.
- **Hot surfaces**

To avoid burns, do not touch any metal or plastic parts inside the column chamber while the temperature is higher than 50 °C. Wait for the chamber to cool down, for example, before changing a column or before performing any maintenance procedures.
- Disconnect the TCC from all power sources before removing the panels. When the panels are removed, dangerous electrical connections will be exposed. The enclosure must be opened only by Thermo Fisher Scientific service personnel.
- Always replace blown fuses with original spare part fuses authorized by Thermo Fisher Scientific.
- Replace faulty communication cables.
- Replace faulty power cords. Never use a power cord other than the power cords provided for the device.
- Use only the original spare parts and accessories authorized for the device by Thermo Fisher Scientific.
- The column switching valves are filled with 2-propanol when they are shipped from the factory. During initial operation, make sure that the solvents used are miscible. Otherwise, use an appropriate intermediate solvent.
- When operating the HPLC system, always set a lower pressure limit for the pump. This prevents damage resulting from leakage or from running the pump dry.
- To prevent damage to the TCC when lifting or moving, always lift the unit by the bottom sides or sides. Do not lift the TCC by the bottom front or front panel door. This may damage the door.
- The open front panel door is not designed to carry weight. Do not place any heavy objects on the open front panel door; this may damage the door.
- After operation, rinse out buffers and solutions that form peroxides.
- Before switching from buffer to organic solution, rinse the analytical system thoroughly with de-ionized or HPLC grade water.
- When switching to another solvent, ensure that the new solvent is miscible with the one contained in the HPLC system. If the solvents are not miscible, the system can be damaged, for example, by flocculation.

- If a leak occurs, turn off the TCC immediately, stop the pump flow, and remedy the situation.
- Use only standard solvents (HPLC grade) and buffers that are compatible with all parts that may be exposed to solvents.
- Before interrupting operation for several days or more or when preparing the TCC for transport, observe the precautions for shutting down the TCC (→ page 84).
- Do not use the TCC in ways other than those described in these *Operating Instructions*.
- Keep the operating instructions near the device to be available for quick reference.

### 1.2.3 Consignes de Sécurité

Si vous utilisez d'instrumentation analytique, vous devez connaître les risques d'utilisation de produit chimiques.

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

 **Avertissement:** Toutes les personnes utilisant l'instrument doivent observer les consignes de sécurité suivantes et dans les autres chapitres de ce manuel pour éviter une mise en danger de sa personne ou de dommage à l'instrument pendant l'utilisation et des opérations de maintenance ou service de l'instrument.

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

- **Equipment de protection**

Pour tous les travaux sur le système HPLC ou à proximité, portez l'équipement de protection personnel (vêtements de protection, gant de sécurité, lunettes de protection) qui correspond aux risque découlant de la phase mobile et/ou de l'échantillon. Pour les informations sur la manipulation correcte des composés et des recommandations pour les situations de risque spécifiques, veuillez consulter la fiche de données de sécurité des substances que vous utilisez. Veuillez respecter des directives des Bonnes Pratiques de Laboratoire (BPL).

Une installation permettant de se laver 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 affectée à l'eau, puis.

- **Substances dangereuses**

De nombreux solvants organiques, phases mobiles et échantillons sont nuisibles à la santé. Informez-vous de propriétés toxicologiques et infectieuses de toutes les substances que vous utilisez. Les propriétés toxicologiques et infectieuses de nombreuses substances peuvent être mal connues. Au moindre doute concernant une substance, traitez-la comme s'il contenait une substance potentiellement dangereuse. Pour des instructions comment utiliser correctement des composés particuliers, veuillez consulter à la fiche de données des sécurités du fabricant respectif. Veuillez respecter des directives des Bonnes Pratiques de Laboratoire (BPL).

Débarassez-vous de tous les déchets de substances de manière écologique, conformément à la réglementation en vigueur au niveau local. Empêchez impérativement l'accumulation de solvants inflammables, toxiques et/ou infectieux. Suivez un programme d'élimination des déchets réglementé et approuvé. Ne jetez jamais de solvants inflammables, toxiques et/ou infectieux dans le système municipal d'évacuation des eaux usées.

- **Gaz dangereux**

Installez le système HPLC dans un laboratoire bien ventilé. Si la phase mobile ou l'échantillon contient des solvants volatils ou inflammables, vous devez assurer qu'ils ne pénètrent dans l'espace de travail. Si la phase mobile ou l'échantillon contient des solvants volatils ou inflammables, évitez les flammes nues et les sources d'étincelles à proximité.

- **Décharge électrostatique**

Décharge électrostatique peut provoquer la formation d'étincelles et peut présenter un risque d'incendie. Veuillez noter que des solvants fluides dans les capillaires peuvent se charger automatiquement. Cet effet se peut produire particulièrement forte dans les capillaires isolants et avec des solvants non-conducteurs (par exemple, l'acetonitrile pur).

Prenez des mesures appropriées pour éviter les charges électrostatiques à proximité du système HPLC. Par exemple, s'assurez qu'il y a une humidité de l'air suffisante et une ventilation adéquate dans le laboratoire, portez des vêtements ou équipement de protection antistatique, évitez l'accumulation de bulles d'air dans les lignes de déchets et utilisez des réservoirs à déchets mis à la terre.

Utilisez uniquement des capillaires non-conducteurs pour diriger solvants au réservoir de déchets. Capillaires électriquement conducteur devrait être mis à la terre.

- **Inflammation spontanée des solvants**

N'utilisez aucun solvants avec une température d'auto-inflammabilité inférieure à 150° C. Si une fuite se produit, ces solvants peuvent s'auto-enflammer au contact d'une surface chaude.

- **Capillaires, connecteur capillaires, connexions ouvertes**

- ◆ Des capillaires, en particulier les capillaires non-métalliques, pourraient fendre ou glisser des connecteurs ou ne peuvent pas être vissés. Ceci peut en résulter aussi que des substances pourraient jaillir des connexions ouvertes.
- ◆ Dans un système UltiMate 3000, certaines composantes sont en PEEK. Bien que ce polymère présente une excellente résistance chimique à la plupart des solvants organiques, il a tendance à gonfler lorsqu'il est en contact prolongé avec du chloroforme (CHCl<sub>3</sub>), du diméthyle sulfoxyde (DMSO) ou du tétrahydrofurane (THF). De plus, il est attaqué par des acides concentrés tels que l'acide sulfurique et l'acide nitrique ou d'un composé du hexane, éthyle acétate et méthanol. Ceci peut causer des capillaires de fuite ou risquer des capillaires d'éclater. Ces acides peuvent cependant être utilisés dans le cadre de procédures de nettoyage, à condition que l'exposition soit brève.
- ◆ N'utilisez pas de capillaires écrasés, pliés, abimés ou endommagés.
- ◆ Les connecteurs capillaires pour pourrait être contaminé par des substances dangereuses ou des substances dangereuses pourrait sortir des connexions ouvertes.

- ◆ Dans un système UltiMate 3000 Bio RS, certains capillaires du système Viper sont faits d'alliage de nickel-cobalt MP35N. Contact avec la peau peut provoquer une réaction chez les personnes qui sont sensibles au nickel/cobalt.
- ◆ Portez des lunettes de protection lorsque vous manipulez des capillaires en silice fondue (pendant l'installation, découpe, etc.).
- **Surface chaude**

Pour éviter tout risque de brûlure, ne touchez à aucune partie en métal ou plastique à l'intérieur du compartiment de colonne tant que la température est supérieure à 50 °C. Attendez que le four refroidisse, par exemple, avant de changer une colonne ou avant de procéder à tous opérations de maintenance.
- Quand les capots de protection de l'appareil sont démontés, vous êtes exposés à des connexions électriques sous haute tension deviennent accessibles. Débranchez l'instrument de toute source d'alimentation électrique avant de retirer les capots. Ne démontez les capots de protection que si cela est explicitement demandé au cours de ces instructions. Les capots de protection devraient être démontés uniquement par le personnel de service de Thermo Fisher Scientific.
- Remplacez toujours les fusibles grillés par des fusibles de rechange autorisés par Thermo Fisher Scientific.
- Remplacez les câbles de communication défectueux.
- Remplacez les cordons d'alimentation électrique défectueux. Utilisez uniquement les cordons d'alimentation électrique spécifique à l'instrument.
- Utilisez seulement des pièces de rechange originales et des accessoires autorisés par Thermo Fisher Scientific.
- Les vannes de colonne sont stockées sous 2-propanol. Au cours démarrage de l'instrument, assurez-vous que les solvants utilisés soient miscibles avec le 2-propanol. Sinon, suivez les étapes intermédiaires appropriées.
- Réglez toujours une limite de pression minimum pour le système HPLC. Ceci prévient les dommages résultant de fuites ou du fonctionnement à sec de la pompe.
- Lorsque vous soulevez ou l'instrument, tenez-le toujours par le dessous ou par les côtés de l'unité. Soulever l'instrument par la partie avant inférieure ou par le panneau avant peut endommager la porte.
- Ne placez aucun objet lourd sur la porte ouverte du panneau avant. Ceci pourrait endommager la porte.
- Après utilisation, purgez le système des tampons et des susceptibles de former des peroxydes.

- Lorsque vous passez d'une solution saline à un solvant organique, effectuez un rinçage intermédiaire du système HPLC à l'eau dé-ionisée ou qualité HPLC.
- Lorsque vous passez à un autre solvant, assurez-vous que le nouveau solvant soit miscible avec celui qui se trouve dans le système HPLC. Dans le cas contraire, le système HPLC peut être endommagé; par exemple, par des floculations!
- Si une fuite se produit, arrêtez immédiatement l'instrument, stoppez le débit de la pompe et remédiez au problème.
- Utilisez uniquement des solvants (qualité HPLC) et des solutions salines compatibles avec les matériaux exposés phase mobiles.
- Avant d'interrompre le fonctionnement pendant plusieurs jours ou plus, observez les précautions figurant en page 84.
- De nombreux solvants organiques et solutions salines sont toxiques. Informez-vous des propriétés toxicologiques de toutes les phases mobiles que vous utilisez.
- N'utilisez pas l'instrument de manière autre que celles décrites dans ce manuel.
- Conservez ce manuel à proximité de l'instrument pour pouvoir le consulter facilement.

### 1.3 Intended Use

For Research Use Only. Not for use in diagnostic procedures.

The device is designed to be operated only by qualified and authorized personnel. All users must know the hazards presented by the device and the used substances.

The TCC is designed for laboratory research use in high-performance liquid chromatography (HPLC) or ultra-high performance liquid chromatography (UHPLC) applications. It is part of the UltiMate 3000 system, but can be used also with other HPLC systems if adequate control inputs and outputs are available. A PC with USB port is required. The TCC is controlled by the Chromeleon CHROMATOGRAPHY MANAGEMENT SYSTEM. Being part of the UltiMate 3000 system, the TCC can also be operated with other data systems, such as

- Xcalibur™, Compass™/HyStar™, or Analyst®  
To do so, installation of the DCMSLink (Dionex Chromatography Mass Spectrometry Link) software is required in addition to the installation of the data system.
- Empower™  
Installation of the Dionex Instrument Integration Software is required in addition to the installation of the data system.

For more information, contact the Thermo Fisher Scientific sales organization for Dionex HPLC Products.

Observe the following:

- Note that the TCC may be operated only with accessories and spare parts recommended by Thermo Fisher Scientific (→ page 115) and within its technical specifications (→ page 113).
- Use only standard solvents (HPLC grade or LC-MS grade: 0.2 µm filtered) and buffers that are compatible with components in the flow path of the TCC. Note the special properties of the solvents, such as the viscosity, boiling point, UV absorption (UV/VIS detector), and refractive index (refractive index detector).
- pH range  
Depends on the pre-column heater (→ section 2.10, page 24), post-column cooler (→ section 2.11, page 25), and column switching valve (→ section 7.3.4, page 107).
- Buffer concentration  
Depends on the pre-column heater, post-column cooler and/or column switching valve  
SST: Typically up to 1 mol/L (< 0.1 mol/L chloride ions)  
Ti/PEEK: Typically up to 1 mol/L (< 1 mol/L chloride ions)
- Also observe the information about the solvent compatibility of the other UltiMate 3000 system modules. For more information, refer to the *Operating Instructions* for the modules.

If there is any question regarding appropriate usage, contact Thermo Fisher Scientific before proceeding. Thermo Fisher Scientific cannot be held liable for any damage, material or otherwise, resulting from inappropriate or improper use of the TCC.

 **Warning:** If the device is used in a manner not specified by Thermo Fisher Scientific, the protection provided by the device could be impaired. Thermo Fisher Scientific assumes no responsibility and will not be liable for operator injury and/or instrument damage. Whenever it is likely that the protection is impaired, the instrument must be disconnected from all power sources and be secured against any intended operation.

 **Avertissement:** Si l'instrument est utilisé de façon non spécifiée par Thermo Fisher Scientific, la protection prévue par l'instrument pourrait être altérée. Thermo Fisher Scientific n'assume aucune responsabilité et ne sera pas responsable des blessures de l'opérateur et/ou des dommages de l'instrument. Si la protection de l'instrument n'est pas garanti à tout moment, débranchez l'instrument de toutes les sources d'alimentation électrique et assurez-vous que l'instrument n'est pas utilisé involontairement.

## 1.4 Federal Communications Commission (FCC) Note

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



## 2 Overview

### 2.1 Unit Description

The TCC is a modern high-quality instrument designed for HPLC analysis, especially as part of the UltiMate 3000 system. The design has been optimized for minimum dead volume and maximum efficiency.

- Column thermostating in a temperature range from +5 °C up to +110 °C (TCC-3000RS) or +5 °C up to +80 °C (TCC-3000SD) and the wide range of supported column switching valves make the TCC the appropriate choice for almost all applications in HPLC and UHPLC.
- Thermoelectric elements heat or actively cool the column chamber and all internal components to the desired temperature (settable in 0.1 °C increments). Using a heat exchanger, they allow fast temperature changes and ensure independence from the ambient temperature, even if the temperature set point is below the ambient temperature.
- The TCC allows compartment cooling by max. 18 °C from the ambient temperature. The lower temperature limit is +5 °C. At an ambient temperature of 25 °C, a decrease in temperature from 50 °C to 20 °C is typically realized in 15 minutes.
- In addition, the columns can be warmed up to max. +110 °C (TCC-3000RS) or +80 °C (TCC-3000SD). At an ambient temperature of 25 °C, an increase in temperature from 20 °C to 50 °C is typically realized in 12 minutes.
- Temperature control allows keeping the column temperature constant. If the ambient temperature changes during the analysis, the increased heating or cooling ensures that the column temperature remains constant. The maximum deviation is  $\pm 0.1$  °C.
- The column chamber provides room for up to 12 columns. The maximum column length is 300 mm.
- An electronic column identification module allows GLP-compliant documentation of the column type and all important column parameters (→ page 24).
- The TCC can be equipped with one or two column switching valves (→ page 17), for example, for applications that require different columns at frequent intervals at similar temperatures (→ page 22).

- If required, the following components can be installed in the TCC:
  - ◆ Pre-column heater (→ page 24)  
The pre-column heater brings the solvent and the sample to the column temperature before they enter the column. This avoids temperature gradients in the column.
  - ◆ Post-column cooler (→ page 25) (*only TCC-3000RS*)  
The post-column cooler cools the column eluate to a temperature that is appropriate for the subsequent detection. Post-column cooling minimizes the noise values and thus leads to optimal detection results.
- Various monitoring and diagnostic features are provided for optimum system performance and reliability (→ page 27).
- The TCC can be fully controlled by the Chromeleon Chromatography Management System, providing a high degree of system integration.
- All surfaces in the column chamber are made of materials that provide maximum resistance to the most commonly used HPLC solvents.

## 2.2 Operating Principle

The fundamental requirement for a column compartment for liquid chromatography applications is the ability to maintain the preset temperature as precisely as possible. However, for temperature equalization, temperature stability is more important than the absolute precision of the setting. The TCC contains advanced electronic circuitry that maintains the temperature with a precision of  $\pm 0.1$  °C.

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

Thermoelectric elements in the TCC heat up and cool down the columns. The heat exchanger inside the column chamber helps to bring the air and all of the components installed in the chamber to the desired temperature. If required, a pre-column heater can be installed in the column chamber.

All this ensures that

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

Under these conditions, the analytical separation is performed at the nominal temperature. This minimizes fronting and tailing of peaks, as well as retention time variations.

In addition, a post-column cooler insert can be installed under the column chamber of the TCC-3000RS. Post-column cooling ensures that the temperature of the column eluate is reduced to a temperature appropriate for the subsequent detection. Post-column cooling minimizes the noise values and thus leads to optimal detection results.

## 2.3 Configurations

The TCC is available in the following configurations:

Column Compartment	Part No.
TCC-3000RS Column Compartment <i>with</i> post-column thermostating Basic version without column switching valves	5730.0000
TCC-3000SD Column Compartment <i>without</i> post-column thermostating Basic version without column switching valves	5730.0010

The TCC can be fitted with two column switching valves. Depending on whether you want to install the valve to the right or left side of the enclosure, the appropriate installation kit (see table) and the desired pod is required.

The shipment includes the valve drive (actuator), all parts required for the installation, and detailed installation instructions. For information about the available pods, see page 100.

Installation kit for	Part No.
<i>TitanHT™ column switching valves, suitable for pressures &lt; 125 MPa (18130 psi)</i>	
Installation kit for Right-side installation	6730.0001
Left-side installation	6730.0002
<i>TitanHP™ column switching valve, suitable for pressures &lt; 41 MPa (6000 psi)</i>	
Installation kit for Right-side installation	6730.0003
Left-side installation	6730.0004

## 2.4 Front Panel Elements



Fig. 1: Front panel view (example)

No.	Element	Function
1	Display	Shows information about the TCC, for example: <ul style="list-style-type: none"> <li>- General information upon power-up (→ page 59)</li> <li>- Status screen (→ page 60)</li> <li>- Functions and menus (→ pages 67 and 68)</li> <li>- Messages (→ page 88)</li> </ul>
2	Standby button	Switches the TCC to Standby mode (the LED is lighted). To cancel Standby mode and resume operation, press the Standby button again (the LED is not lighted). <b>Note:</b> To allow the TCC to change the mode, press and hold the Standby button for at least one second.
3	<b>Status LEDs</b>	
	Power	The LED is blue when the TCC is on.
	Connected	The LED is green when the TCC is connected in Chromeleon.
	Status	The LED is green when the TCC has reached the target temperature. The LED is orange when the TCC has not yet reached the target temperature or when the door is open. The LED is red when an error has been detected, for example, a leak.

## 2.5 Rear Panel

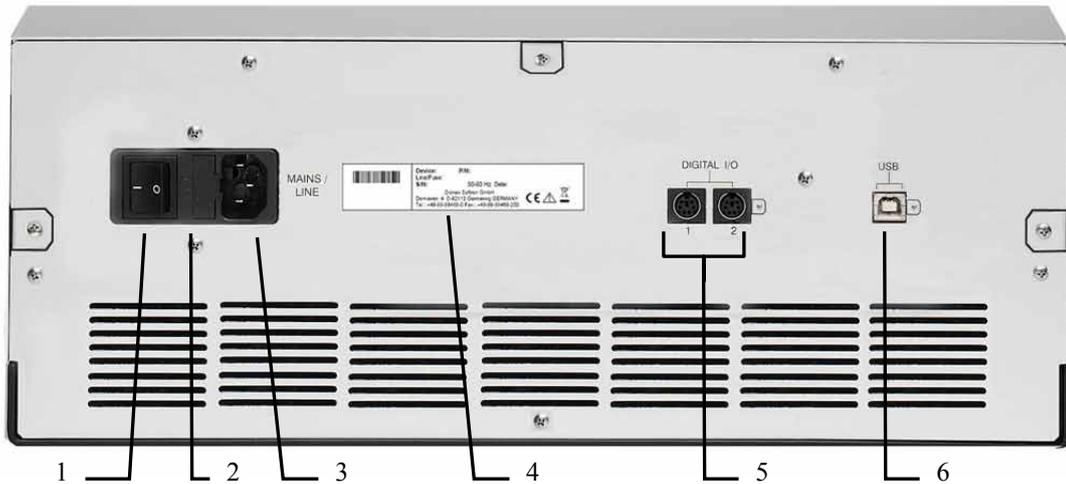


Fig. 2: Rear panel view

No.	Description
1	Power switch (→ page 20)
2	Fuse cartridge (→ page 20)
3	Main power receptacle (→ page 34)
4	Type label
5	Digital I/O ports for communication with external devices (→ page 20)
6	USB (Universal Serial Bus) port for connection to the Chromeleon computer (→ page 20)

### **2.5.1 Power Switch**

The main power switch is on the rear panel. The main power switch is used to turn the TCC on or off.

### **2.5.2 Fuse Cartridge**

The fuse cartridge contains two slow-blow fuses rated at 2 A. For information about how to change the fuses, see page 108.

### **2.5.3 USB Port**

The Chromeleon Chromatography Management System can use a USB (= Universal Serial Bus) connection to control the TCC. Data is transferred digitally by means of the appropriate USB cable (→ page 33).

For information about how to connect the TCC to the Chromeleon computer, see sections 3.4.1 and 3.4.2 (→ page 33).

### **2.5.4 Digital I/O**

With Chromeleon, you can use the 6-pin digital I/O ports to exchange digital signals with external devices. For more information, see page 34.

For information about the functions of the connector pins and pin assignment, see page 125.

## 2.6 Interior Components

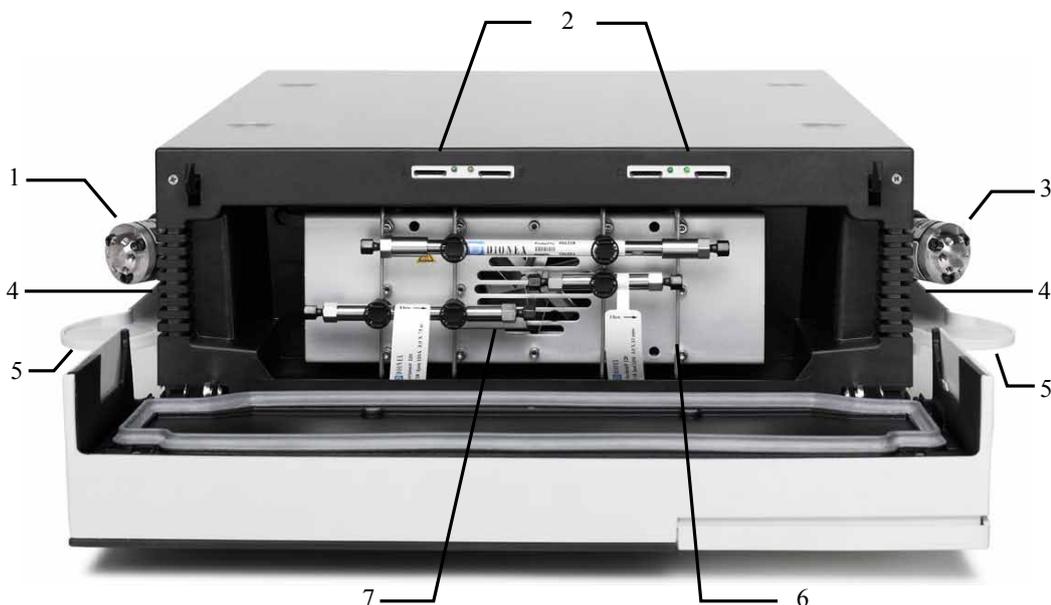


Fig. 3: TCC interior view

No.	Description
1	Column switching valve It depends on the TCC configuration whether a valve is installed in this position (→ page 17).
2	Slots for the column ID chip cards (→ page 75)
3	Column switching valve It depends on the TCC configuration whether a valve is installed in this position (→ page 17).
4	Capillary guides The capillaries from and to the column switching valve are routed through these guides.
5	Drip tray for valve drainage (→ page 49)
6	Column brackets (→ page 50)
7	Temperature sensor

## 2.7 Gas and Humidity Sensors

A gas sensor and a humidity sensor are installed inside the TCC. The sensors detect any gas or humidity that may accumulate in the column chamber.

When a certain concentration of gas or humidity is reached inside the TCC (while the door of the column chamber is closed), the **Status** LED on the front panel door changes to red and a message appears on the TCC display and in the Chromeleon Audit Trail. It depends on the sensor settings whether a beep sounds in addition to alert you (→ page 77).

When a sensor reports excessive gas or humidity, find and eliminate the source for the leakage (→ page 97).

## 2.8 Column Switching Valve

A wide range of column switching valves is available from Thermo Fisher Scientific for the TCC (→ page 17). They allow you to realize most applications in HPLC and UHPLC. Fig. 4 through Fig. 6 show example flow schematics for the different valve types.

- A 2-position, 6-port valve is the appropriate choice for applications that require two different columns at frequent intervals at similar temperatures.

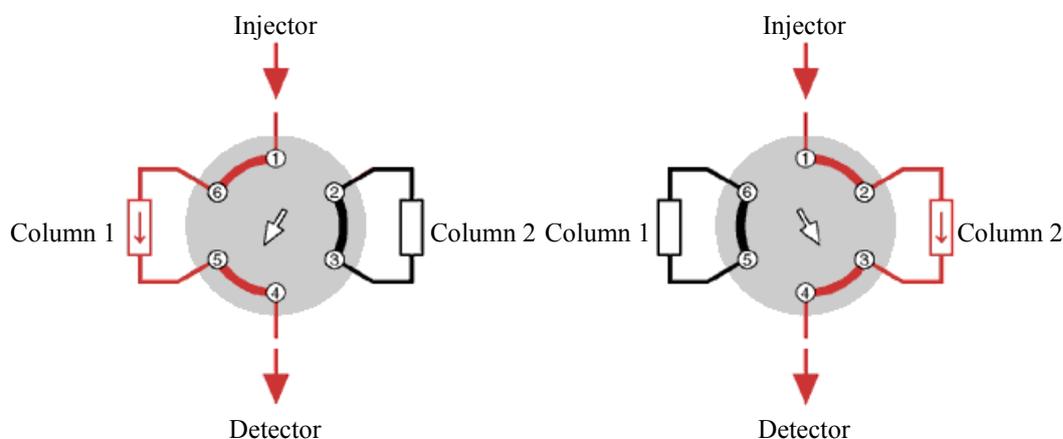


Fig. 4: Typical example for column switching with a 2-position, 6-port column switching valve

- A 2-position, 10-port valve is used for applications that require overlapping injections with offline re-equilibration of the column.

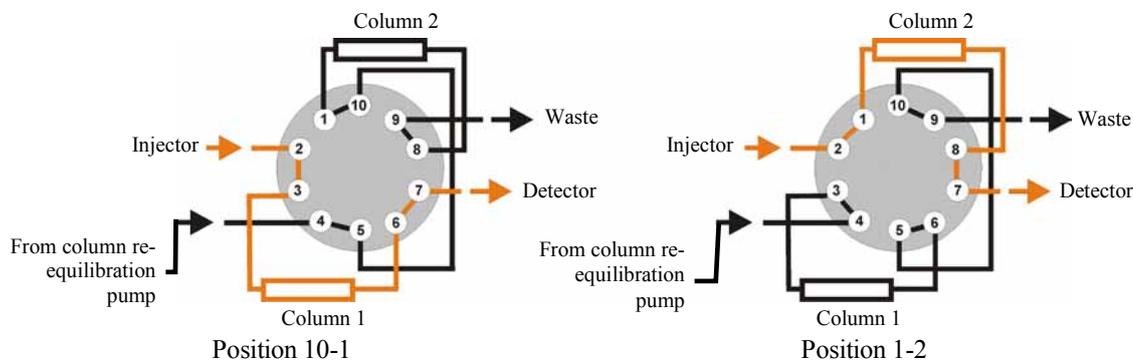


Fig. 5: Example for column switching with a 2-position, 10-port column switching valve

In position 10-1, column 1 analyzes while column 2 re-equilibrates. In position 1-2, column 2 analyzes while column 1 re-equilibrates.

- Two multi-position valves are the appropriate choice for applications with several columns, for example, for method scouting.

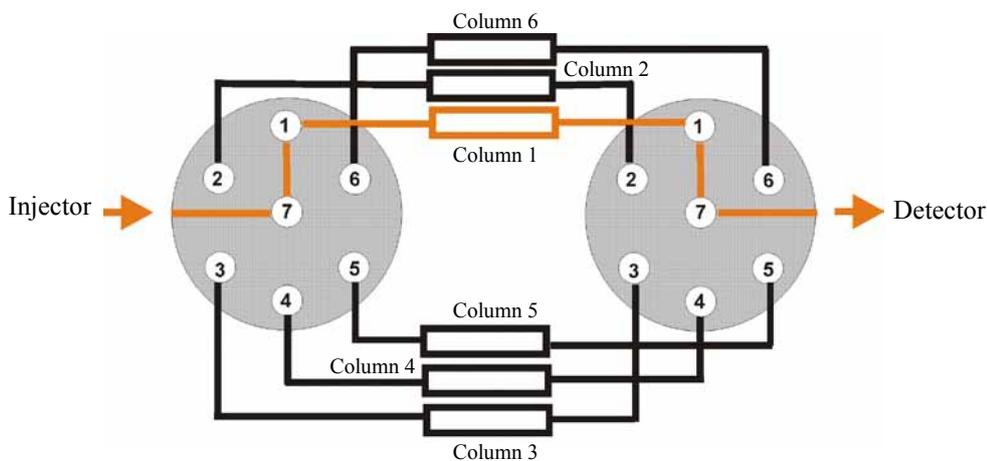


Fig. 6: Example flow schematic for column connection on two multi-position valves (here 6-position, 7-port valves)

For information about how to connect the capillaries to the column switching valves, see section 4.2 (→ page 46).

## 2.9 Column Identification System (Column ID)

The TCC is fitted with an electronic column identification system (column ID) that lets you store column-specific information on a column-ID chip card. This information provides a GLP-compliant overview of the column status. The chip card is connected to the column for the column life cycle. Column identification is supported for four columns simultaneously.

The information on the column ID chip card is continuously updated and can be reviewed at any time in Chromeleon, as long as the column and chip card are installed in the TCC. For more information about the column ID, see page 75.

## 2.10 Pre-Column Heater

The pre-column heater brings the solvent and sample to the column temperature before they enter the column. This avoids temperature gradients in the column.



Fig. 7: Pre-column heater, here with Viper connectors

The following pre-column heaters are available for the TCC:

Description	Part No.
1 $\mu$ L pre-column heater: SST, with Viper connectors <sup>1</sup>	6722.0510
2 $\mu$ L pre-column heater: SST <sup>2</sup> , with Viper connectors <sup>1</sup> Biocompatible <sup>3</sup>	6722.0530 6723.0232
7 $\mu$ L pre-column heater: SST, with Viper connectors <sup>1</sup> Biocompatible <sup>3</sup>	6722.0540 6723.0242
11 $\mu$ L pre-column heater: SST, with Viper connectors <sup>1</sup> Biocompatible <sup>3</sup>	6722.0550 6723.0252

<sup>1</sup> These pre-column heaters can be used with pressures up to 125 MPa.

<sup>2</sup> Included in the accessories kit of the TCC-3000RS

<sup>3</sup> These pre-column heaters can be used within the pH range 2-10 and with pressures up to 34 MPa.

The decision which pre-column heater is appropriate for the respective application depends on various factors, such as the flow rate and the temperature difference between the ambient temperature and the column temperature. For applications in analytical HPLC and UHPLC, the 2  $\mu\text{L}$  pre-column heater usually provides the best performance. The 1  $\mu\text{L}$  pre-column heater is used, for example, with applications for which an especially low extra-column volume is important. When using system capillaries with an inner diameter of  $> 180 \mu\text{m}$  and large-volume separation columns (semipreparative HPLC), Thermo Fisher Scientific recommends installing a pre-column heater with a volume of 7  $\mu\text{L}$  or 11  $\mu\text{L}$ .

## 2.11 Post-Column Cooler

### *Only TCC-3000RS*

The TCC-3000RS supports post-column cooling of the eluent. A post-column cooler insert (SST) with a thermally effective volume of 2  $\mu\text{L}$  (total volume: 5  $\mu\text{L}$ ) is shipped in the accessories kit of the TCC-3000RS.

The post-column cooler can reduce the temperature of the column eluate to a temperature that is appropriate for the subsequent detection (ideally the flow cell temperature), and thus minimize the noise values. In this way, optimal detection results will be achieved.

With a column temperature of 100  $^{\circ}\text{C}$  and water used as eluent at a flow rate of 3 mL/min, the column eluate can be cooled by at least 40  $^{\circ}\text{C}$ . The lower temperature limit for post-column cooling is 5  $^{\circ}\text{C}$ . The upper temperature limit is 110  $^{\circ}\text{C}$ . The maximum heat dissipation of the cooler is limited.

The post-column cooler can be used in the pH range 1-13. For information about how to install the post-column cooler insert, see page 52. For information about how to operate the TCC with post-column thermostating, see page 74.

## 2.12 Operation from Chromeleon

The TCC can be controlled by the Chromeleon Chromatography Management System. To do so, an appropriate Chromeleon version and a Timebase Class 1 Chromeleon license are required.

Two modes of software control are available for the TCC:

- *Direct Control*  
With direct control, you select operating parameters and commands in the Commands (F8) dialog box or on a control panel. Direct commands are executed as soon as they are entered. For routine operation, most parameters and commands are available also on a control panel. For more information about direct control, see page 62.
- *Automated Control*  
With automated control, you create a program (or PGM File). This is a list of control commands, executed in chronological order, for automated operation of the TCC. You can create programs automatically with the software wizard or manually by editing an existing program. For more information about automatic control, see page 65.

**i** **Tip:** All software details in this manual refer to Chromeleon 6.80.

If you want to operate the TCC from *Chromeleon 7*, refer to the following documents for information about how to perform the related processes in Chromeleon 7 (all documents are included in the Chromeleon 7 shipment):

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

Note the following:

- Chromeleon 7 terminology is different from the terminology used in Chromeleon 6.80. For details, refer to the 'Glossary - Chromeleon 7,' which is available in the Documents folder of your Chromeleon 7 installation.
- Chromeleon 7 may not yet support all functions supported in Chromeleon 6.80.

## 2.13 System Wellness, Predictive Performance, and Diagnostics

System Wellness monitors the health of the TCC. Therefore, the TCC supports several performance and reliability features that can help you detect small problems before they turn into big ones:

- Internal monitoring of all mechanical operations
- Automatic self test upon power up
- Gas and humidity sensors (→ page 22)
- Electronic column identification system (column ID; → page 24)

When an error is detected, the **Status** LED on the front panel door is red and a message appears on the TCC display (→ page 88).

When the TCC is operated from Chromeleon, additional functions for estimating the lifetime of consumables and monitoring and recording service and (re)qualification information (= predictive performance; → page 82) are available. In addition, a diagnostics test is available to check the gas sensor performance (→ page 83).



## 3 Installation

### 3.1 Facility Requirements

The installation site must meet the following requirements:

- The main power switch and the main power receptacle are on the rear panel. Make sure that
  - ◆ Free and unrestricted access to the main power switch is ensured at all times.
  - ◆ The power cord of the device can be easily reached and disconnected from the power line at all times. Provide sufficient space behind the device to unplug the cable.
- Make sure that the installation site meets the power and environmental specifications listed in the Technical Information section (→ page 113).
- Install the TCC in the laboratory on a stable surface that is free of vibrations.
- Make sure that the surface is resistant to solvents.
- The ambient temperature should be kept as constant as possible.
- Avoid direct sunlight and high humidity.
- Allow sufficient clearance behind and to the sides of the TCC for ventilation and do not place any objects between the TCC and the module located below the TCC in the system stack.

### 3.2 Unpacking

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

**i** **Tips:** Immediately report any shipping damage to both, the incoming carrier and Thermo Fisher Scientific. Shipping insurance will compensate for the damage only if reported immediately.

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

1. Place the shipping container on the floor and remove the accessories kit and the power cord. When unpacking a TCC-3000RS, also remove the box containing the pre-column heater and post-column cooler
2. Grasp the TCC by the sides. Slowly and carefully, pull the instrument out of the shipping container and place it on a stable surface.

 **Important:** To prevent the TCC from falling, grasp the TCC by the sides, and then lift the TCC together with the foam spacers out of the shipping container. Do not lift the TCC by the foam spacers or the front panel door.

 **Important:** Afin d'empêcher l'instrument de tomber, saisissez-la par les côtés. Ne soulevez l'instrument à l'aide du matériau d'emballage ou par la porte du panneau avant.

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

 **Important:** To prevent damage to the TCC when lifting or moving, always lift the unit by the bottom sides or sides. Do not lift the TCC by the bottom front or front panel door. This may damage the door.

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

### 3.3 Positioning the TCC in the UltiMate 3000 System

If the TCC is part of an UltiMate 3000 system, stack the individual modules (→ Fig. 8) and interconnect them on the rear panel (→ Fig. 9). The arrangement of the system modules depends on the application.

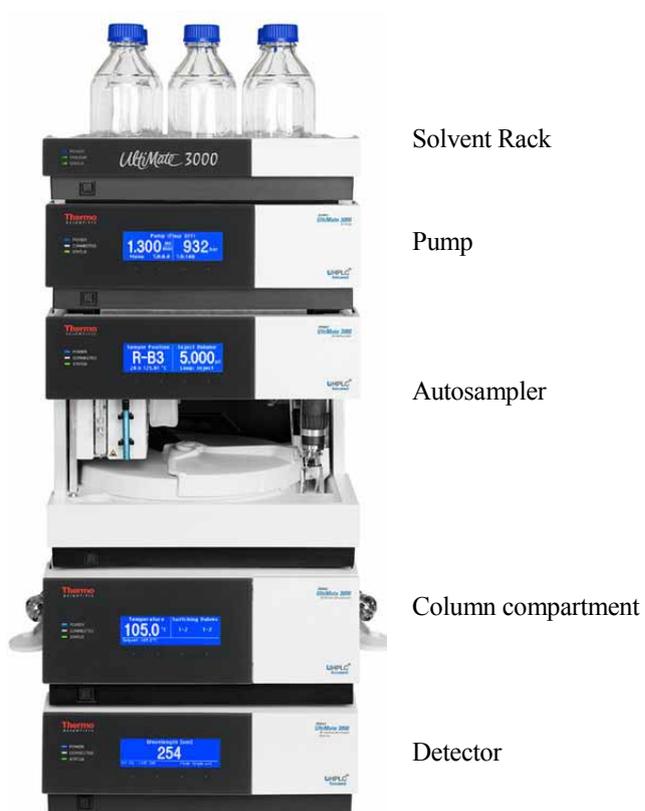


Fig. 8: Module arrangement for an UltiMate 3000 system (example)

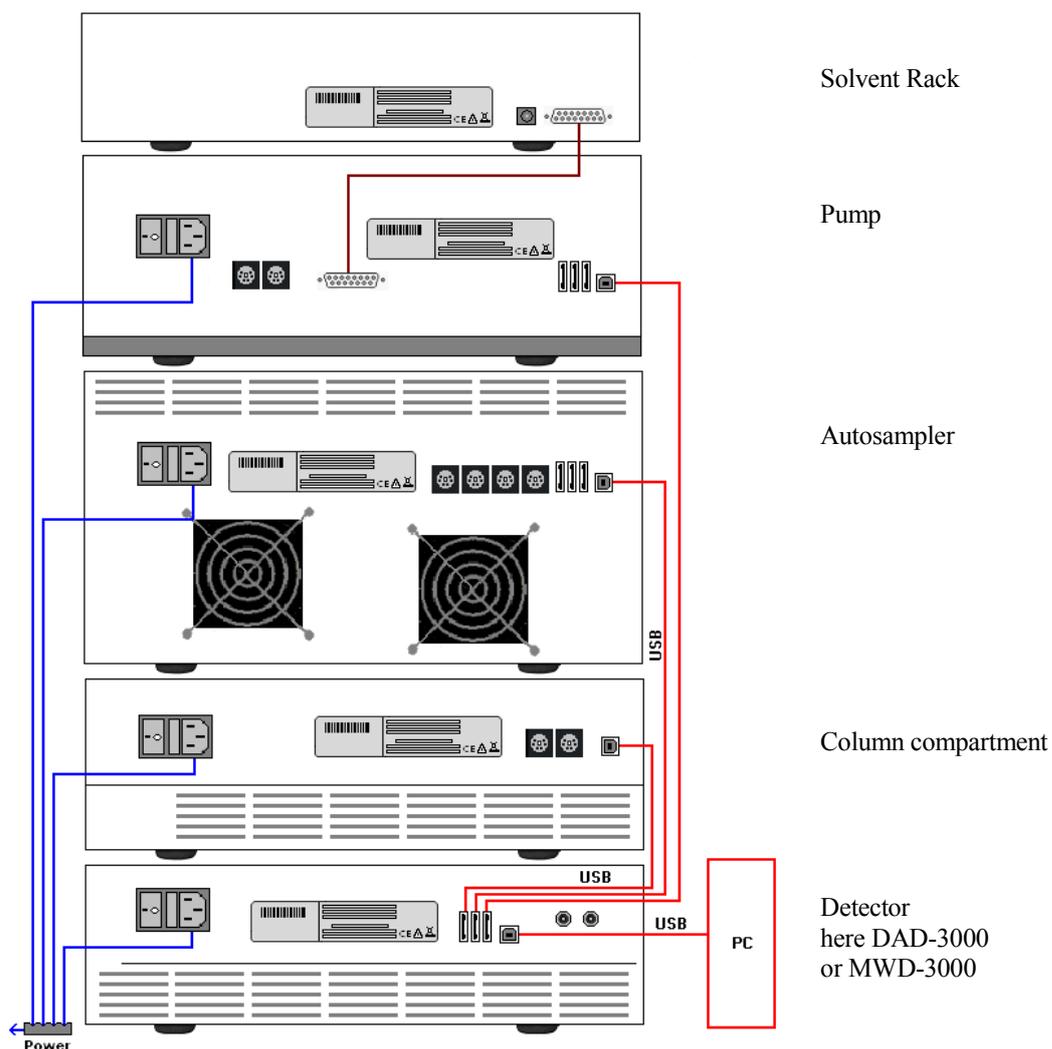


Fig. 9: Example for the rear panel connections on an UltiMate 3000 system

Apart from the Solvent Rack, all modules of the UltiMate 3000 system can be connected separately to the Chromeleon computer by using the USB port on the rear panel of the instrument. However, Thermo Fisher Scientific recommends interconnecting all modules, and then connecting the system to the Chromeleon computer with only one connection.

For systems with a DAD-3000(RS) or MWD-3000(RS), you can use *only* the hub on the detector for the connection.

For systems with a VWD-3x00(RS), use only the hub on the pump.

## 3.4 Connecting the TCC

### 3.4.1 General Information

*If you want to operate the TCC from Chromeleon*

Before you connect the TCC to the USB port on the Chromeleon computer and turn on the TCC power, verify that Chromeleon is installed on the computer and that the license code is entered. Only if you install Chromeleon first, the USB driver for the TCC is automatically loaded and the Windows® operating system can detect the TCC when the power is turned on.

### 3.4.2 Connecting the USB Cable

Connect the TCC to the Chromeleon computer via the USB ports on the rear panel (→ Fig. 2, page 19). Select one of the following alternatives:

- Connect the TCC directly to the USB port on the Chromeleon computer.
- Connect the TCC to the internal USB port on another module in the UltiMate 3000 system that is connected to the Chromeleon computer (→ page 32).

To ensure trouble-free operation, use only these cables for the connection (the cables are provided in the accessories kit for the TCC):

USB Cable	Part No.
USB cable, type A to type B, high speed USB 2.0 (cable length: 1 m)	6035.9035
USB cable, type A to type B, high speed USB 2.0 (cable length: 0.5 m)	6720.8910

 **Tip:** Each USB device can be separated from the computer or next USB hub by no more than 5 meters.

### 3.4.3 Connecting the Power Cord

Use the power cord shipped with the pump to connect the instrument to the main power source. Connect the power cord from the main power receptacle on the rear panel (→ Fig. 2, page 19) to a grounded power source. No manual adjustment is required to adapt the line voltage to local voltage requirements.



**Warning:** Never use a power cord other than the power cords provided for the device.

Do not use multiple sockets or extension cords. Using defective multiple sockets or extension cords may cause personal injury or damage to the device.



**Avertissement:** Utilisez uniquement les cordons d'alimentation électrique spécifique à l'instrument.

N'utilisez pas des blocs multiprise ou des câbles prolongateurs. Cela pourrait entraîner des blessures corporelles ou endommager l'instrument.

### 3.4.4 Connecting the Digital I/O

To connect an external device to a digital I/O port, use the appropriate 6-pin mini-DIN cable (part no. 6000.1004).

1. Plug the 6-pin connector of the mini-DIN cable into the Digital I/O port **1** (or **2**). For information about the functions of the connector pins and pin assignment, see page 125.
2. For each relay output or digital input to be used, connect the appropriate signal wire and ground wire to the corresponding connectors on the external device (→ *documentation provided with the external device*).
3. When configuring the TCC in the Chromeleon **Server Configuration** program, make the following settings:
  - On the **Relays** page, select the corresponding relay output (→ page 43).
  - On the **Inputs** page, select the corresponding digital input (→ page 43).

## 3.5 Setting Up the TCC in Chromeleon

This section provides brief instructions for setting up the TCC in Chromeleon. For details, see the *Chromeleon Help*. For information about how to set up the TCC in DCMSLink, see section 3.6 (→ page 44).

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

### 3.5.1 Loading the USB Driver for the TCC

1. Turn on the computer power, if it is not already on.
2. Under Windows Vista<sup>®</sup> (Windows<sup>®</sup> XP, Windows<sup>®</sup> 7, or Windows<sup>®</sup> Server 2008) log on as a
  - Local administrator if the computer is a local computer.
  - User with local computer administrator privileges if the computer is a network computer.

3. Open the **Chromeleon Server Monitor** program by double-clicking the Chromeleon Server Monitor icon  on the Windows taskbar.

If the Server Monitor icon is not on the taskbar, click **Start** on the taskbar, point to **Programs** (or **All Programs**, depending on the operating system), point to **Chromeleon**, and then click Server Monitor.

4. Click **Start** to start the server.
5. Click **Close** to close the Server Monitor window. The Server Monitor icon  appears on the taskbar.

**i** **Tip:** Clicking the Quit Monitor button quits (exits) the Server Monitor program, but does not stop the server. To stop the server, click **Stop**.

6. Turn on the main power switch on the rear panel of the TCC.
7. *Windows Vista, Windows 7, and Windows Server 2008* will automatically detect the new TCC and perform the USB installation.

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

- a) Click Cancel to exit the wizard.
- b) Turn off the TCC.

- c) Install Chromeleon.
- d) Turn on the power to the TCC. Windows will now detect the TCC and install the USB software for the TCC automatically.

*Windows XP*

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

- a) If asked whether Windows can connect to Windows Update to search for software, select **No, not this time**.
- b) Accept the default option (**Install the software automatically**) and click **Next>**.
- c) Click **Finish** when the wizard reports that the software for the TCC has been installed.

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

- a) Click **Cancel** in the Windows message box.
- b) Turn off the TCC.
- c) Install Chromeleon.
- d) Turn on the power to the TCC. Windows will now automatically detect the TCC and launch the **Found New Hardware Wizard**.

### 3.5.2 Installing the TCC

After the USB software for the TCC has been installed (→ page 35), install and configure the TCC in Chromeleon:

1. Start the Chromeleon **Server Monitor** (→ page 35) and the Chromeleon server if they are not yet running.
2. Start the Chromeleon **Server Configuration** program by clicking **Start** on the taskbar. Point to **Programs** (or **All Programs**, depending on the operating system), point to **Chromeleon**, and then click **Server Configuration**.
3. If necessary, click the plus sign next to the server name to display the items underneath.
4. Select the timebase to which the TCC will be assigned, or create a new timebase (on the **Edit** menu, click **Add Timebase**).
5. Open the **Add device to timebase** dialog box. To do so, click **Add Device** on the **Edit** menu or right-click the timebase and click **Add Device** on the menu.
6. On the Manufacturers list, click Dionex HPLC: UltiMate 3000 and on the Devices list, click TCC-3x00(RS) Column Compartment.
7. A wizard guides you through the installation. Chromeleon connects to the TCC and transfers the settings from the instrument firmware to Chromeleon, setting the options on the pages accordingly. Click OK to confirm the message.
8. On each page, verify that the settings are correct and select additional settings if needed. For a description of the pages, see section 3.5.3.1 (→ page 38).
9. Click **Finish** to complete the installation of the TCC.
10. On the **File** menu, click **Save Installation** and then close the Server Configuration program.

### 3.5.3 Configuring the TCC

#### 3.5.3.1 Initial Installation

During the installation, Chromeleon connects to the TCC and transfers the settings from the instrument firmware to Chromeleon, setting the options on the wizard pages accordingly. Verify that the standard settings are correct and make additional settings if needed. You may reopen the configuration pages later again to change the settings (→ page 41).

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

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

#### General Page

The **General** page shows the general instrument parameters.

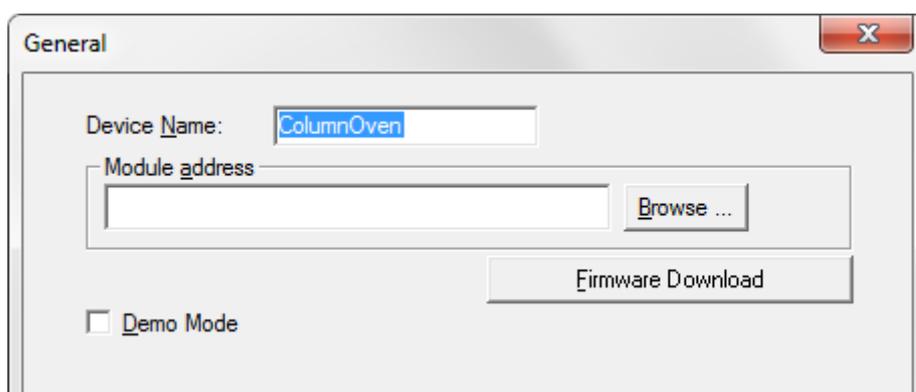


Fig. 10: General page

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

- **Module address**

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

- **Firmware Download**

Click this button to update the TCC firmware with the version available in Chromeleon. The button appears dimmed if the Demo Mode is enabled.

The TCC is shipped with the most recent firmware version. If a firmware update is ever required, follow the steps in section 7.5 (→ page 110).

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

### Components Page

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

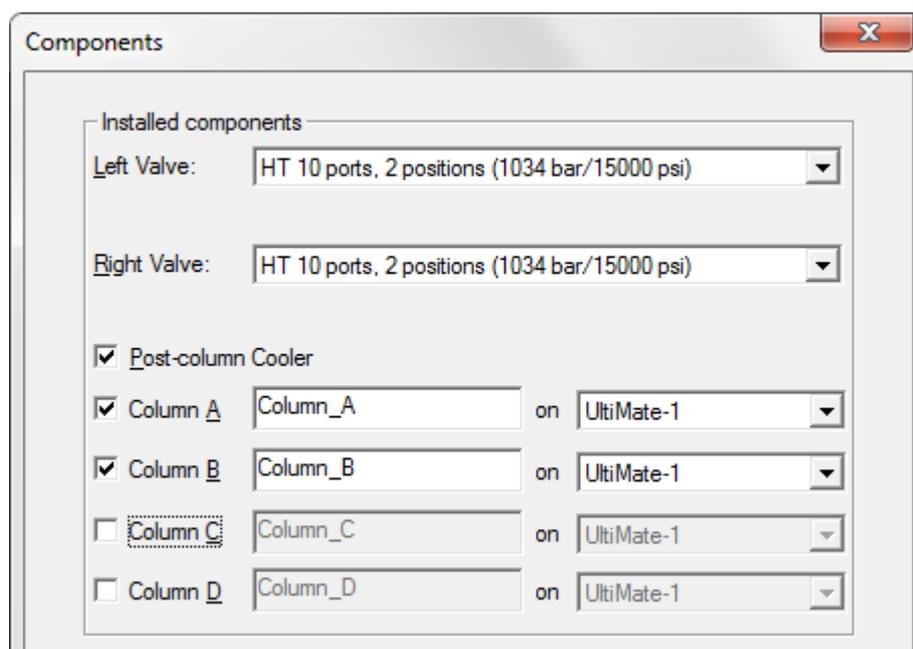


Fig. 11: Components page (here TCC-3000RS)

- **Left Valve and Right Valve**

Indicate which type of column switching valve is installed. Check and change the settings if necessary.

 **Tip:** For the TitanHT multi-position valve (pressure < 125 MPa) the entry is 'HT 7 ports, 6 positions (1034 bar/15000 psi)' or 'HT 7 ports, 6 positions (1034 bar; 1250 bar)', depending on the Chromeleon version.

- **Post-column Cooler**

The TCC-3000RS supports post-column cooling of the eluent (→ page 25). If the check box is selected, you can set the temperature for post-column thermostating and turn thermostating on and off in the Chromeleon client program (→ page 74).

- **Column A through Column D**

The TCC supports column identification (→ page 24). Select the columns for which you want to use column identification by the check box in the Enabled column. The text box behind the column displays the name used to identify the column in the installation environment and in the Chromeleon client. To use existing control panels, accept the default name. If you enter a different name, you may have to re-link the controls on the control panels and edit the column name in the program files.

The information about the column is continuously updated and can be reviewed at any time in Chromeleon (→ page 75).

- **On**

Select the timebase to which the related column is assigned. The standard setting is the timebase in which the column compartment is installed. To change the setting, click the arrow next to the **on** box and select a different timebase from the list. The list shows all timebases for that server.

### 3.5.3.2 Changing the Basic Configuration or Selecting Advanced Settings

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

1. Start the **Server Configuration** program (→ page 37).
2. Right-click the TCC in the timebase and click Properties on the menu.
3. In addition to the pages of the installation wizard (→ page 38), configuration pages for the advanced settings are available (→ page 42). Select the additional settings or change the settings as needed.

Besides, Chromeleon provides two more buttons on the **General** page. They allow you to match the configuration of the TCC with the settings in Chromeleon:

Button	Description
<b>Retrieve configuration from module</b>	Click this button to transfer the current valve configuration to Chromeleon. The settings on the <b>Components</b> page are updated. This is necessary only if you install different column switching valves or connect a different TCC, or if automatic matching was not performed correctly when the wizard was started.
<b>Send configuration to module</b>	Click this button to transfer the valve configuration settings from the Chromeleon <b>Components</b> page to the TCC.

4. To save the configuration, click Save Installation on the File menu and then close the Server Configuration program.

## Configuration Page

Use this page to determine whether Chromeleon shall record the temperature signals as separate channels and select the pressure unit.

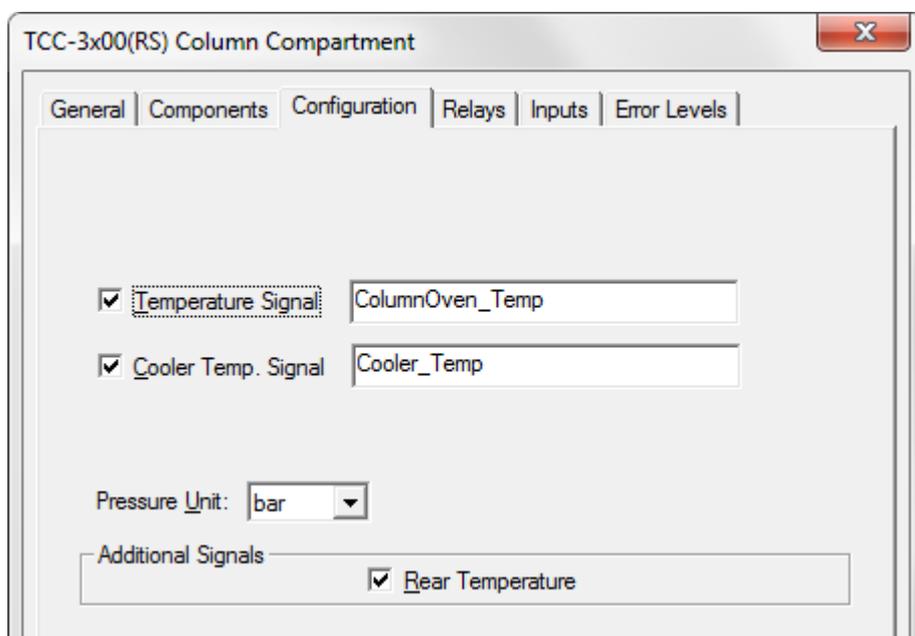


Fig. 12: Configuration page (here TCC-3000RS)

- **Temperature Signal**  
The check box is selected by default. Accept this setting if you want to record the temperature of the TCC as a separate channel (→ page 83).  
The name under which temperature signal is identified in the installation environment and in the Chromeleon client is ColumnOven\_Temp. Accept the default name. If you enter a different name, you may have to re-link the controls on the control panels.
- **Cooler Temp. Signal** (only TCC-3000RS)  
The check box is selected by default. Accept this setting if you want to record the temperature of the post-column cooler as a separate channel (→ page 83). The signal will be recorded only if you have also selected the post-column cooler check box on the **Components** page (→ page 39). Accept the default name (**Cooler\_Temp**) under which this temperature signal is identified in the installation environment and in the Chromeleon client. If you change the default name, you may have to re-link the corresponding controls of the related control panels.
- **Pressure Unit**  
Select the pressure unit to be used for storing the pressure values on the column ID chip card.
- **Rear Temperature**  
The check box is selected by default. Accept this setting. The signal will be recorded as a separate channel. If a problem occurs, the channels can provide helpful information to identify and eliminate the source for the problem.

### **Relays Page**

The **Relays** page lists all available relays. Select a check box to enable the relay. If a check box is cleared, the relay will not be available in Chromeleon. You can change the name and timebase assignment for a relay. To do so, double-click the relay name and make the changes in the **Device Configuration** dialog box.

### **Inputs Page**

The **Inputs** page lists all available remote inputs. Select a check box to enable the remote input. If a check box is cleared, the input will not be available in Chromeleon. You can change the name and timebase assignment for an input. To do so, double-click the input name and make the changes in the **Device Configuration** dialog box.

### **Error Levels Page**

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

### 3.6 Setting Up the TCC in DCMSLink

1. Install and configure the DCMSLink-Software (→ *DCMSLink Installation Guide*). The Guide is provided on the DCMSLink DVD in the *Additional Documents\DCMSLink User Documents* folder.
2. Open the Chromeleon **Server Configuration** program (→ *DCMSLink Installation Guide*).
3. Add the TCC to a timebase. The steps in section 3.5.2 apply equally (→ page 37).
4. Configure the TCC. The steps in section 3.5.3 apply equally (→ page 38).

For more information about DCMSLink, refer to *DCMSLink Help* and the *DCMSLink Quick Start Guide*. The Quick Start Guide is also provided on the DCMSLink DVD.

## 4 Preparation for Operation (Startup)

### 4.1 Overview

After you have unpacked, positioned and connected the TCC (→ sections 3.1 through 3.4, page 29 and following pages), prepare the TCC for operation. When connecting the capillaries, observe the precautions on page 46.

1. *If one or two column switching valves are installed in the TCC*  
Verify that the drain tubing for discharging possible liquid leaks from the valves is properly connected (→ page 49).
2. *Optional*  
Install a pre-column heater (→ page 49).
3. Install the separation columns (→ page 50).
4. *Optional (only TCC-3000RS)*  
Install the post-column cooler insert (→ page 52).
5. Establish the fluid connections between the columns and switching valves, as required by your application (→ page 53).
6. Connect the TCC to the other components of your UltiMate 3000 system, as required by your application.
7. Connect drain tubing (→ page 56).
8. *If you want to operate the TCC from Chromeleon*  
Set up the TCC in Chromeleon if it is not already set up (→ page 35).
9. Turn on the TCC power (→ page 59).
10. Turn on and set the temperature for column thermostating if applicable (→ page 73).
11. Activate column identification if applicable (→ page 75).
12. Turn on and set the temperature for post-column thermostating if applicable (→ page 74).
13. Check and change the sensitivity settings for the gas and humidity sensors if necessary (→ page 77).
14. Adjust the brightness and contrast of the front panel display if necessary (→ page 78).
15. Before starting sample analysis, equilibrate the entire system (→ page 57).

## 4.2 General Precautions for Connecting Capillaries

When connecting capillaries, observe the following general precautions:

- Observe the precautionary statements for capillaries and capillary connections in section 1.2.2 (→ page 4).
- When connecting the capillaries, make sure that the connectors are free from contaminants. Even minute particles may cause damage to the system, for example, to the column.
- Different fitting systems are used in an UltiMate 3000 system. Install the capillaries and fittings only at the positions for which they are intended.
- Thermo Fisher Scientific recommends using Viper capillary connections whenever possible. When using Viper capillaries, observe the information in the instructions shipped with the capillary.
- Depending on the fitting connection, also observe the following:

- ◆ *Viper fitting connections*

Loosen and tighten Viper fitting connections only by the knurled screw and only with your hand (do not use tools).

First, tighten the screw hand-tight. If the connection leaks, tighten the screw a little more. If leakage continues, remove the capillary, clean the capillary ends carefully by using a cloth or tissue wetted with isopropanol, and reinstall the capillary. If the connection continues to leak, replace the Viper capillary.

**i** **Tips:** You can reuse capillaries with Viper fitting connections also for a different connection.

If the knurled screw is a black screw (as shown in Fig. 13), you can remove it from the capillary and reattach it later again.



Fig. 13: Viper fitting connection (example)

- ◆ *Conventional fitting connections (non-Viper)*

Do not over-tighten these fitting connections. If you observe leakage on the connection, tighten a little further.

If leakage still exists, clean the connection port with a cleaning swab (part no. 6040.0006). Replace the capillary and/or fitting if this does not eliminate the problem.

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

- *TCC with column switching valves*
  - ◆ To connect the capillaries to the column switching valve, install *only* Viper fitting connections and/or the ferrules and fitting nuts provided in the accessories kit or original Dionex spare parts. When you connect capillaries to the biocompatible switching valve, observe the precautions on page 53.
  - ◆ Guide the capillaries from and to the column switching valves through the guides provided on the right and on the left of the column chamber (→ Fig. 14, page 47 ). This is a must.

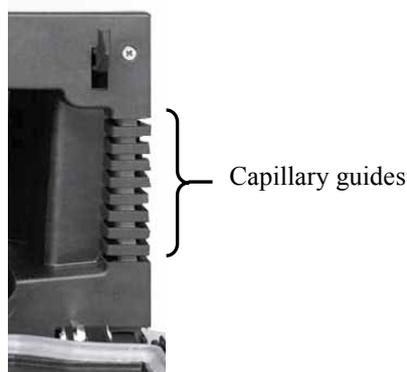
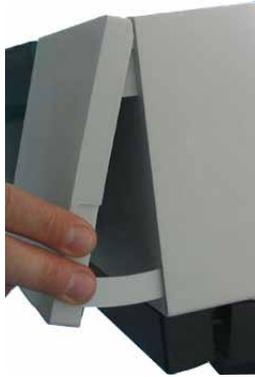


Fig. 14: Capillary guides (here on the right of the column chamber)

- Capillaries *not* connected to column switching valves  
You are free to route them out of the interior
  - ◆ At the right or left side of the column chamber. In this case, you have to route them through the guides provided on the right and on the left of the column chamber.
  - ◆ At any position between the top or bottom of the enclosure and the front panel door to ensure that the connections are as short as possible.  
Place the capillaries in such a manner that they do not open a small path for ambient air into the column chamber (that is, place the capillaries preferably in a 90-degree angle related to the door seal). When cooling, an improper seal may lead to a considerable amount of condensation water.

### 4.3 Opening the Column Chamber

The column chamber in the TCC is easily accessible. The front panel tilts downward when you unlock the door as shown in the picture.



*Fig. 15: Unlocking the front panel door*

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

To prevent damage to the TCC when lifting or moving, always lift the unit by the bottom sides. Lifting the TCC by front panel or bottom front may damage the door.

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

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

To close the column chamber, tilt the front panel upward (push forcefully if necessary). The door locks automatically.

## 4.4 Inspecting the Valve Drainage

The column switching valves are fitted with a drip tray for valve drainage. Liquid leaks from the valves are discharged to waste, together with liquid leaks that might have accumulated in the interior of the unit.

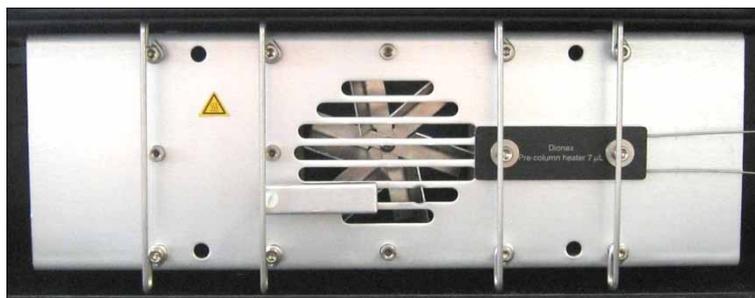


*Fig. 16: Drip tray with drain tubing connected to the left valve and to the right valve*

Verify that the drain tubing is properly connected to the drain port. Liquid leaks are discharged to waste through the drain system of the UltiMate 3000 system (→ page 56).

## 4.5 Installing a Pre-column Heater

Pre-column heaters can be installed at different positions in the column chamber. A maximum of six pre-column heaters can be installed at the same time.



*Fig. 17: Pre-column heater installed in the column chamber (example)*

Install the pre-column heater as described in the installation instructions shipped with the heater.

## 4.6 Installing a Separation Column

**STOP Warning:** Before carrying out any work in the column chamber, wait for the column chamber to cool down. Do not touch any metal or plastic parts inside the column chamber while the temperature is higher than 50 °C.

**STOP Avertissement:** Ne touchez à aucune partie en métal ou plastique à l'intérieur du compartiment de colonne tant que le point de réglage de température est > 50 °C. Attendez que le four refroidisse, par exemple, avant de changer une colonne ou avant de procéder à tous travaux de maintenance.

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

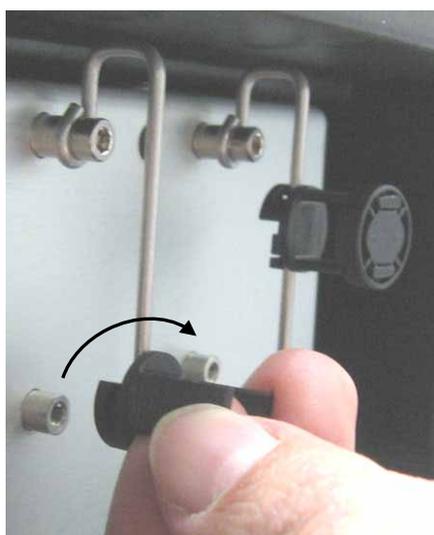
1. The column clip consists of two pieces. To remove the ring from the bottom part, slightly press the ring in the direction of the arrows.



Press the ring in the direction of the arrows. (The arrows on the ring are printed in black.)

*Fig. 18: Two-piece column clip*

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



*Fig. 19: Installing the bottom part*

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



*Fig. 20: Attaching the column ID to the column*

4. Press the column into the bottom part of the clip and reinstall the ring.



*Fig. 21: Installing a column in the clip*

5. Connect the capillaries to column. Observe the precautions on page 46.
6. Establish the fluid connections between the columns and the column switching valves. For information about how to connect the capillaries to the valve, see section 4.8 (→ page 53).
7. Activate column identification if applicable (→ page 75).

## 4.7 Installing the Post-Column Cooler Insert

Only TCC-3000RS

The post-column cooler insert is installed under the column chamber. A removable panel on the front of the instrument provides easy access to the installation section.

1. Remove the panel.

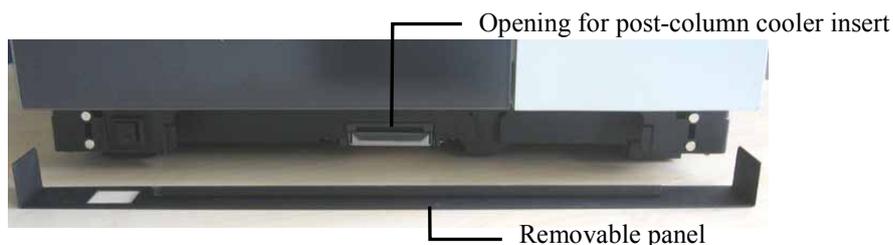


Fig. 22: Removable panel for post-column cooler

2. Open the post-column cooler by pressing the clip down, and then push the insert, with the label facing down, into the opening.

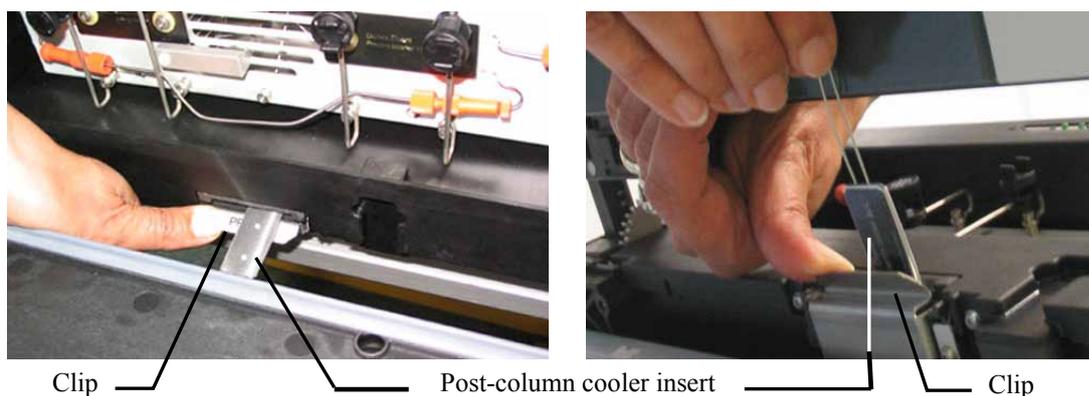


Fig. 23: Inserting the cooler insert (left: view from the top, right: bottom view)

3. Establish the capillaries connections to the post-column cooler insert (depending on your application, from the outlet of the column or from the column switching valve) and from the insert to the detector.

Two capillaries are connected to the post-column cooler. For a system stack as shown in Fig. 8 (→ page 31), the long capillary should be guided to the detector because the length of the capillary has been optimized for this connection.

For information about how to operate the TCC with post-column thermostating, see page 74.

## 4.8 Connecting the Components to the Column Switching Valve

**STOP** **Warning:** Before carrying out any work in the column chamber, wait for the column chamber to cool down. Do not touch any metal or plastic parts inside the column chamber while the temperature is higher than 50 °C.

**STOP** **Avertissement:** Ne touchez à aucune partie en métal ou plastique à l'intérieur du compartiment de colonne tant que le point de réglage de température est > 50 °C. Attendez que le four refroidisse, par exemple, avant de changer une colonne ou avant de procéder à tous travaux de maintenance.

1. For easier access to the connection ports on the switching valve, you may unhook the drip tray of the valve.



Fig. 24: Unhooking the drip tray

2. Connect the capillaries to the column switching valve, by using an appropriate tool. For example configurations for the different valve types, see sections 4.8.1 and 4.8.3. When connecting the capillaries, also observe the general precautions on page 46.

### *Only biocompatible column switching valve (TitanHP, PEEK)*

To connect the capillaries to the biocompatible column switching valve, install *only* PEEK fitting connections and/or the ferrules provided in the accessories kit for the valve or original Dionex spare parts. Do *not* use metal fittings and ferrules for the connection. They can cause damage to the valve.

- a) Slide the fitting nut and ferrule onto the capillary.
- b) Insert the assembly into the valve port.
- c) Push the capillary all the way into the port, and then tighten the connection until the ferrule grabs the capillary.

To ensure proper connection, a short part of the capillary must stick out of the ferrule. Therefore, remove the capillary from the valve to verify this. In addition, check that the ferrule grabbed the capillary. When pulling the ferrule gently, you should not be able to move the ferrule on the capillary.



Fig. 25: Capillary with fitting screw and ferrule for connection to the biocompatible valve pod

3. Route the capillaries through the capillary guides that are provided on the left and right of the column chamber (→ Fig. 3, page 21) into the column chamber. The connections should be as short as possible.
4. Reinstall the drip tray of the valve if applicable.

#### 4.8.1 Connections on a 2-position, 6-port Column Switching Valve

Fig. 26 shows a typical example for the connections on a 2-position, 6-port column switching valve.



Port	Connect the capillary ...
1	from the autosampler or pump
2	to column B or to the pre-column heater
3	from the outlet of column B
4	to the post-column cooler or to the detector
5	from the outlet of column A
6	to column A or to the pre-column heater

Fig. 26: Example for the connections on a 2-position, 6-port column switching valve

If you have connected the inlet capillary of a column to position 6 of a 2-position, 6-port switching valve, you must use position 5 for the outlet capillary of this column. The same applies to valve ports 2 and 3.

### 4.8.2 Connections on a 2-position, 10-port Column Switching Valve

Fig. 27 shows the connections on a 2-position, 10-port column switching valve for tandem operation.

For tandem mode, the UltiMate 3000 system must include one dual gradient pump or two single gradient pumps with identical flow rates, two columns, and one 10-port column switching valve. Running the UltiMate 3000 system in this configuration allows increasing the sample throughput considerably, typically by 50 to 100%. For more information about tandem operation, see the *Chromeleon Help*.



Port	Connect the capillary ...
1	to the post-column cooler or to the detector
2	from the outlet of column B
3	to the waste
4	to port 9 on the column switching valve
5	to column B
6	to the autosampler or to the right pump of a DGP-3600
7	to column A
8	to the left pump of a DGP-3600
9	to port 4 on the column switching valve
10	from the outlet of column A

Fig. 27: Example for the connections on a 2-position, 10-port column switching valve

To realize the setup shown in Fig. 26 with a 10-port column switching valve, follow these steps:

1. Connect the capillaries to the same ports as on the 6-port valve (identical port numbers).
2. The 6-port valve has a direct fluid connection between ports 1 and 6. To achieve this fluidic connection for the 10-port valve, install an additional capillary between ports 7 and 10 (inner diameter of the capillary: 0.13 mm for micro setups; 0.25 mm for analytical setups).
3. Ports 8 and 9 are not used for this setup. Thermo Fisher Scientific recommends connecting these ports with an additional capillary or closing them with a plug.

### 4.8.3 Connections on a Multi-Position Column Switching Valve

Fig. 28 shows the connections on a multi-position column switching valve (here as an example, on a 6-position, 7-port valve).

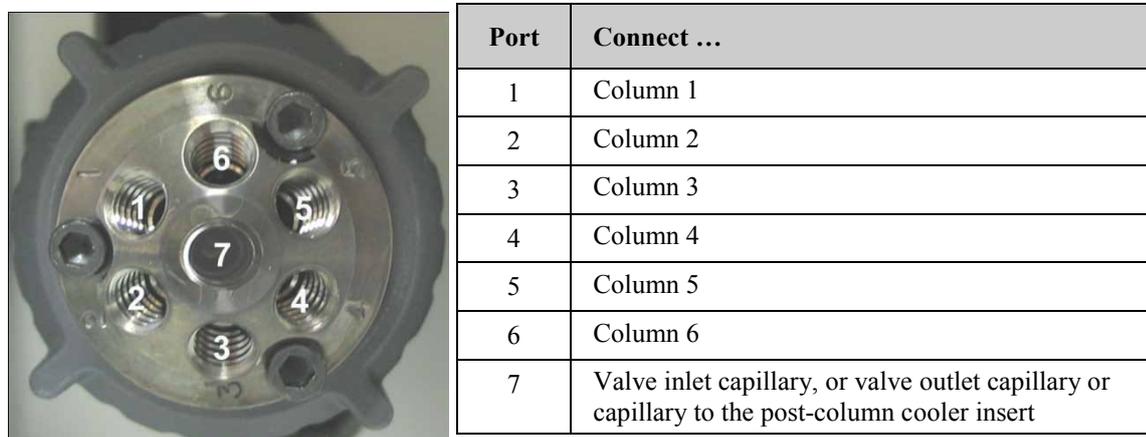


Fig. 28: Example for the connections on a multi-position valve (here on a 6-position, 7-port valve)

## 4.9 Connecting Drain Tubing

To discharge liquid leaks that might have accumulated in the interior, the TCC has a drain port at the bottom right of the instrument.



Fig. 29: Drain port

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

## 4.10 Equilibrating the System

Before using the TCC for sample analysis, equilibrate the UltiMate 3000 system:

1. Pump the starting solvent through the entire system until the system is free of any other liquid composition.
2. Heat or cool all temperature-controlled devices to the temperature required for the application.
3. Set the detector wavelengths and turn on the lamps.
4. Monitor the pump pressure. Verify that the reading is correct for the application and is stable.
5. Monitor the detector signal and verify that the baseline signal is at the expected reading for your application and is stable.

Perform system equilibration in Chromeleon or select the required commands and parameters on the front panel menus of the instruments.

### To equilibrate the system from Chromeleon

- Select and perform the operating commands and parameters from the **Commands** dialog box (→ page 62).
- Create and run an equilibration program to automate the process (→ page 65).
- Use the SmartStartup Wizard to create and run the equilibration program (see the next section).

### To create the equilibration program with the SmartStartup Wizard

1. To open the wizard, select **SmartStartup** on the **Batch** menu.
2. Follow the instructions as they appear on each page of the wizard. For additional information about a page, click **Help**.
3. After you finish the wizard, Chromeleon
  - ◆ Generates an equilibration program and sequence.
  - ◆ Opens the equilibration control panel for the instruments in the timebase (→ Fig. 30, page 58).
  - ◆ Opens the **Start Batch on** dialog box.

Click **Start** to begin equilibration.

The equilibration panel shows the equilibration status of each instrument in the system.

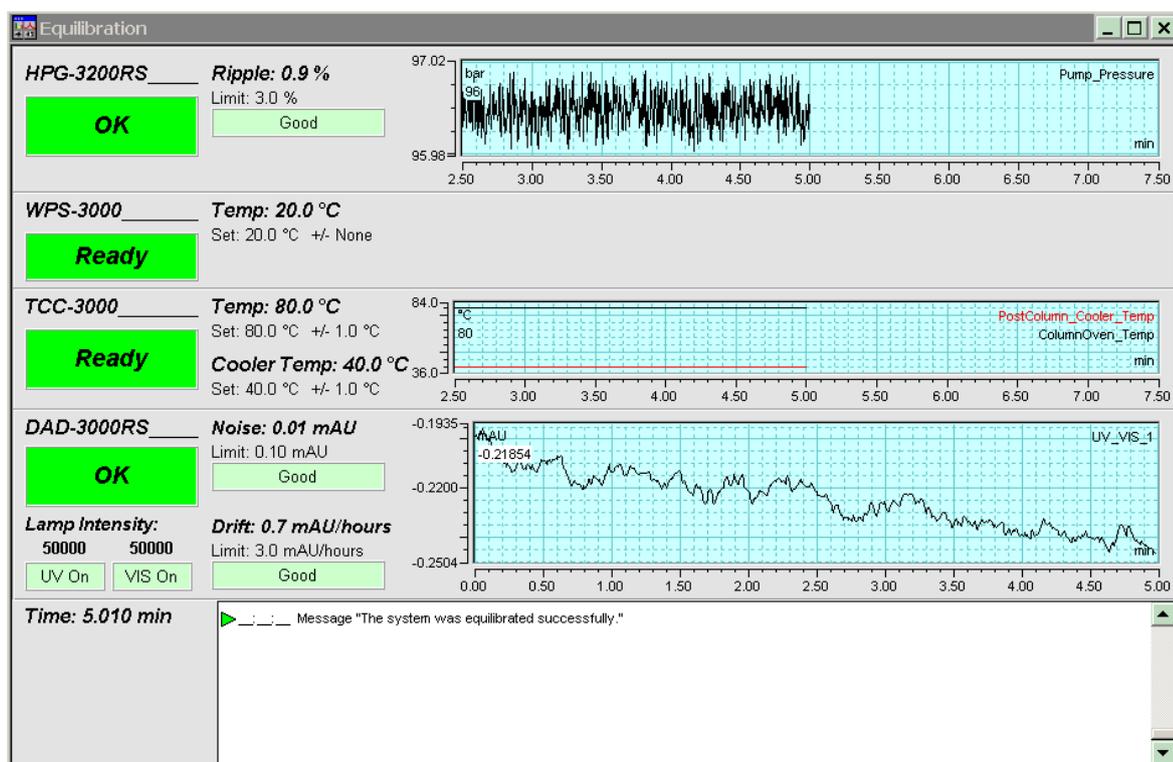


Fig. 30: Equilibration panel

### To equilibrate the system from the front panel menus

Select and perform the operating commands and parameters on the front panel menus of the instruments. For information about the TCC menus, see section 5.4.2 (→ page 68). For information about the menus of other system modules, see the *Operating Instructions* for the respective module.

## 5 Operation and Maintenance

The TCC can be controlled by the Chromeleon Chromatography Management System. For details, see section 5.3 (→ page 61).

In addition, function keys and menus are available on the front panel display to facilitate operation during, for example, initial installation, diagnostics, and maintenance, allowing you to perform certain actions directly from the TCC:

- Executing certain commands (turning temperature control on and off)
- Setting parameters (leak sensor mode, target temperature for column thermostating)
- Viewing diagnostic information
- Viewing and changing the device configuration

For details, see section 5.4.2 (→ page 68).

### 5.1 Power-Up

To start the TCC for the first time, turn on the main power switch on the rear panel of the TCC. The following sequence of events occurs when the TCC is powered up:

- For a short time, general information about the TCC appears on the front panel display: device type, serial number, and bootloader and firmware versions.
- The TCC runs a series of internal tests. During these self-diagnostics, all of the main components are checked. When the self test was successful, the initial screen changes to the status screen (→ page 60).
- If an error is detected, the TCC is not ready for analysis. The **Status** LED on the front panel door changes to red and a message appears on the TCC display. If the TCC is operated from Chromeleon, the message is also displayed in the Chromeleon Audit Trail. Turn off the TCC, take appropriate remedial action (→ page 87), and turn on the TCC again.

For routine operation of TCC, leave the main power switch on. For routine on/off control, use the standby button on the front (→ page 18). Press and hold the button for about one second to allow the TCC to change the mode. Turn off the main power switch when instructed to do so, for example, before performing a service procedure.

## 5.2 Status Screen

When the self test was successful, the initial TCC screen changes to the status screen. The TCC type determines the appearance of the screen.

Fig. 31 shows the status screen for instruments *with* column switching valves. For instruments *without* column switching valves, the appearance of the screen is similar to status screen shown in Fig. 42 (→ page 78).

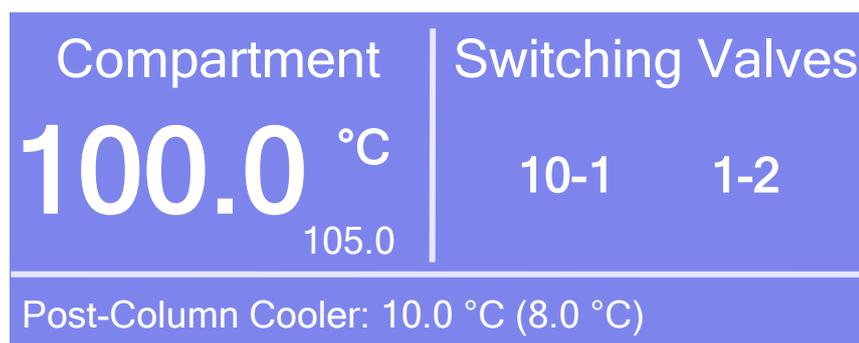


Fig. 31: Status screen (here TCC-3000RS with two 2-position, 10-port switching valves)

Under ...	The following information appears ...
Compartment	Current column temperature (in °C)
	Target temperature for column thermostating (in °C) The temperature value is flashing until the selected temperature is reached. If column thermostating is disabled, Off is displayed.
Switching Valves	Flow path in the column switching valves (if installed).
Post-Column Cooler (TCC-3000RS only)	Current temperature of the post-column cooler (in °C)
	Temperature setpoint for post-column thermostating (in °C) The temperature value is flashing until the selected temperature is reached. If post-column thermostating is disabled, <b>Off</b> is displayed.

You can adapt the screen brightness and contrast to your requirements if necessary (→ page 78).

## 5.3 Operation from Chromeleon

Before you begin, verify that

1. The Chromeleon software is installed on the computer and the license code is entered.
2. The TCC is connected to the Chromeleon computer by means of a USB connection.

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

3. The TCC is set up in Chromeleon, as described in section 3.5 (→ page 35).

Before you can operate the TCC from Chromeleon, you have to connect the timebase in which the TCC is installed to the Chromeleon client program (→ section 5.3.1).

Two modes of software control are available:

- *Direct control* with the parameters and commands in the **Commands** dialog box (→ page 62) or on a control panel (→ page 63).
- *Automated control* with a control program (PGM) (→ page 65).

### 5.3.1 Connecting to Chromeleon

1. Start the Chromeleon **Server Monitor** and the Chromeleon server if they are not yet running (→ page 35).
2. Start the Chromeleon client by clicking the Chromeleon icon  on the desktop. If the Chromeleon icon is not on the desktop, click **Start** on the taskbar, point to **Programs** (or **All Programs**, depending on the operating system), point to **Chromeleon**, and then click **Chromeleon**.
3. Connect the Chromeleon client program to the timebase in which the TCC is installed. For details about how to do this from the Commands dialog box, see page 62. For details about how to do this on a control panel, see page 63.

When the TCC is correctly connected to Chromeleon

- The **Connected** LED on the front panel is green.
- Front panel input related to the measurement is disabled to prevent changes to the operating parameters. (Operating parameters are set to read-only.) Parameters that do not interfere with the measurement, such as the screen brightness or contrast, can still be changed.
- Functions for estimating the lifetime of consumables and monitoring and recording service and (re)qualification information are provided (→ page 82).
- A diagnostics test is available to test the gas sensor performance (→ page 83).
- The Standby button on the front remains active.

Before turning off the TCC by the main power switch, always **disconnect** the TCC in Chromeleon.

### 5.3.2 Direct Control

With direct control, you select operating parameters and commands in the Commands (F8) dialog box. Direct commands are executed as soon as they are entered. For routine operation, most parameters and commands are available also on a control panel.

#### To open the Commands dialog box for the TCC

1. Open a control panel (any panel is possible). To open a control panel, open the Chromeleon Browser and double-click a control panel in the Dionex Templates/Panels folder.
2. Connect the control panel to the timebase in which the TCC is installed. On the **Control** menu, select **Connect to Timebase**, and then select the timebase on the **Timebase** tab. For information about the Timebase dialog, click Help.

 **Tip:** The **Control** menu is visible only when a control panel is already open.

3. Press the F8 key or select **Command** on the **Control** menu.
4. To see the parameters and commands that are available for the TCC, click the plus sign next to **ColumnOven**.

- The commands and parameters available in the dialog box vary, depending on the
- ◆ Chromeleon version
  - ◆ Options selected for the TCC in the Properties dialog (→ page 38).
  - ◆ Display filter level (**Normal**, **Advanced**, or **Expert**)
5. Change the display filter level if necessary. Right-click in the commands list and select the filter level on the menu.

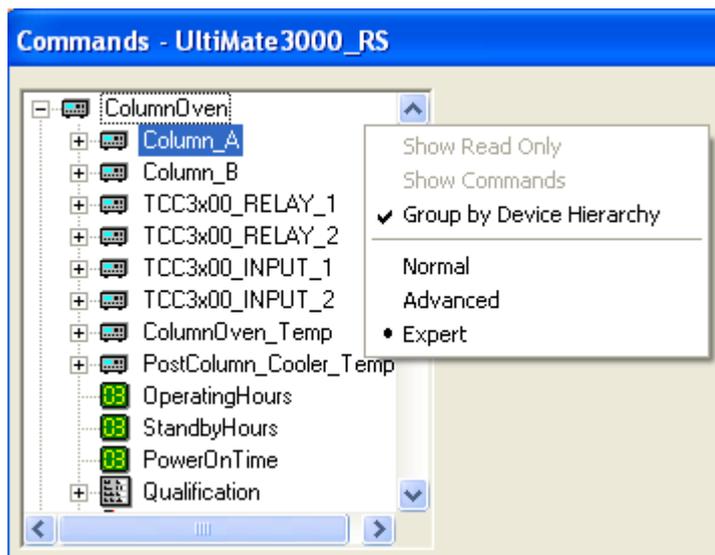


Fig. 32: Command dialog box

6. Verify that the TCC is connected to Chromeleon. If it is not, select **Connect** to connect the TCC.

For a list of the commands and parameters that are supported for the TCC, see the *Chromeleon Help*. In addition to the TCC commands and parameters, the **Commands** dialog box provides access to all of the commands and parameters available for all devices that are installed in the selected timebase.

### To open a control panel for the TCC

1. On the **View** menu, click **Default Panel Tabset** or click the corresponding icon on the toolbar , and then connect to the Chromeleon server.

Chromeleon creates centralized control panels, called panel tabsets, for all timebases available on the Chromeleon server. A panel tabset provides control panels for the individual instruments in a timebase and, in addition, one or more panels for performing system-wide functions, for example, creating and running sequences. For more information about panel tabsets, see the *Chromeleon Help*.

2. On the **Panel Tabset** for your timebase, click the **Col. Comp.** page.

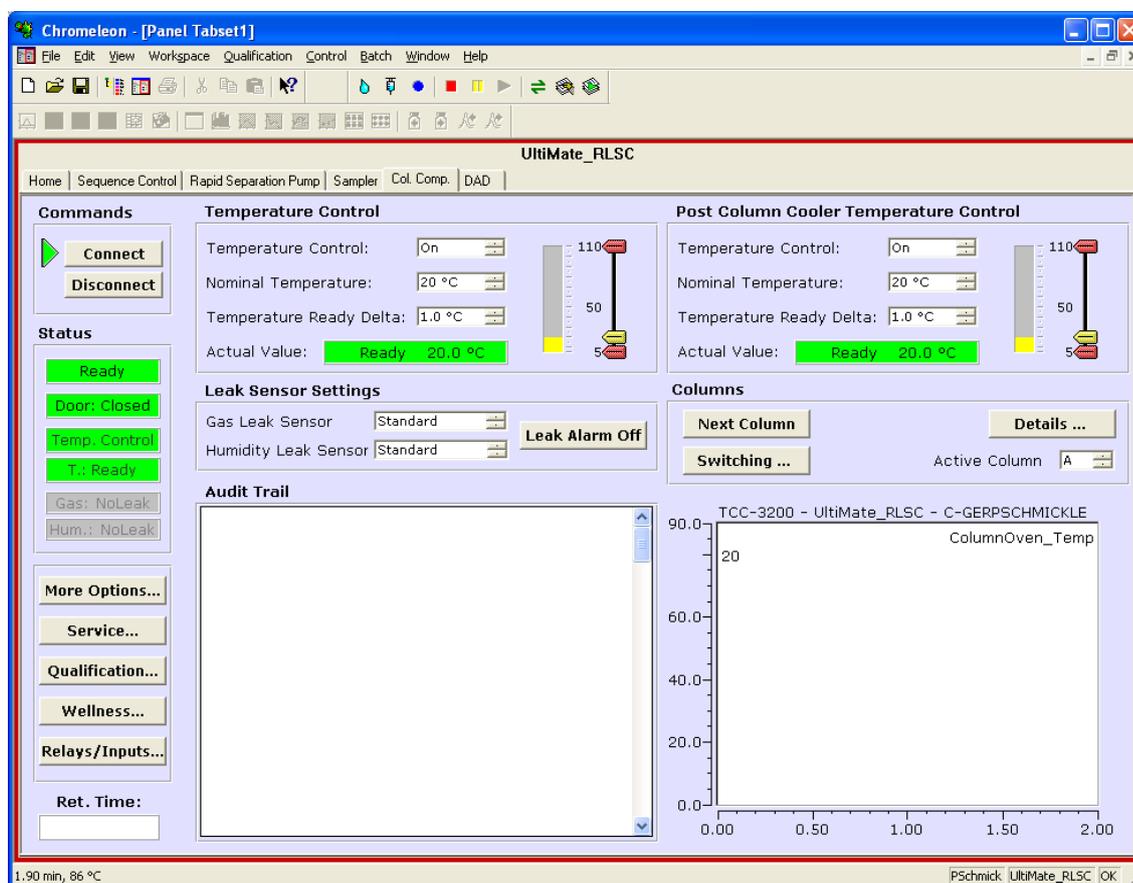


Fig. 33: TCC control panel

3. Verify that the TCC is connected to Chromeleon (the LED next to the Connect button is green). If it is not, click Connect.

The control panel provides access to the operating parameters and commands required for routine operation of the TCC. Additional functions are available in the **Commands** dialog box. To open the **Commands** box from the panel tabset, select **Command** on the **Control** menu.

### 5.3.3 Automated Control

With automated control, you create a program file (PGM) for automated operation of the TCC. You can create programs automatically with the software wizard or manually by editing an existing program. In addition to programs for sample analysis, you can also create programs for special purposes, for example, to ensure that the system automatically restarts operation as desired after a power failure or to automate system shutdown (→ page 85). For details about these programs, see the *Chromeleon Help*.

#### To create a program with the Program Wizard

1. Open the Program Wizard. On the **File** menu, select **New**, and then select **Program File**.
2. The wizard guides you through program creation. The wizard guides you through program creation. For additional information about a page, click Help.
3. After you finish the wizard, Chromeleon automatically creates the program.
4. To start the program, follow the steps below (→ page 66).

#### To create a program manually

1. Open an existing program.  
Select and double-click the program you want to open.  
—or—  
On the **File** menu, select **Open**. In the dialog box, select **Program** on the **Object of Type** list and select the program.

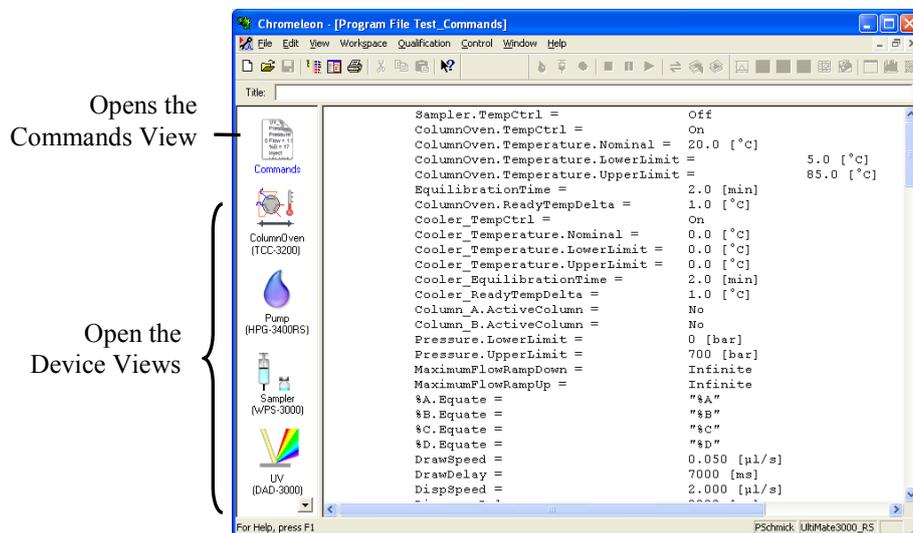


Fig. 34: Chromeleon program (here: program shown in the Commands view)

2. Change the program settings as needed.

The easiest way to edit a program is to do this in the Device Views (→ Fig. 34). Click a device icon and change the settings on the device pages. Editing the program in the Device Views ensures correct command syntax.

If you cannot edit a certain parameter in the Device View, click **Commands** to open the Commands View. The **Commands** view shows the entire program, listing the control commands in chronological order. For more information, see the *Chromeleon Help*.

3. To start the program, follow the steps in the next section.

### **To start a program**

#### *Program for sample analysis*

1. Create a sample list (sequence). A sequence must include the program and a method for evaluating the sample data (for example, for peak identification, area determination, and amount determination).
2. Assign the program and method to each sample on the list.
3. Add the sequence to the batch and start the batch.

For information about each of these steps, see the *Chromeleon Help*.

#### *Other programs*

Add the program to the batch and start the batch.

## 5.4 Display Screens (Function Keys and Menus)

Function keys and menus are available on the front panel display. Thus, you can make several settings or execute certain commands directly from the TCC.

For information about the function keys, see section 5.4.1 and page 69. For information about the menus, see section 5.4.2 (→ page 68).

### 5.4.1 Showing the Function Keys

Four white spots on the front panel mark the positions of four function keys: **Menu**, **Temp**, **Valve**, and **Leak**. To show the keys, touch the position of the utmost left spot on the display with the menu pen.



Fig. 35: Showing the function keys

The function keys replace the information in the bottom line of the status screen. If no key is selected, the bottom line of the status screen is restored after about 5 seconds.

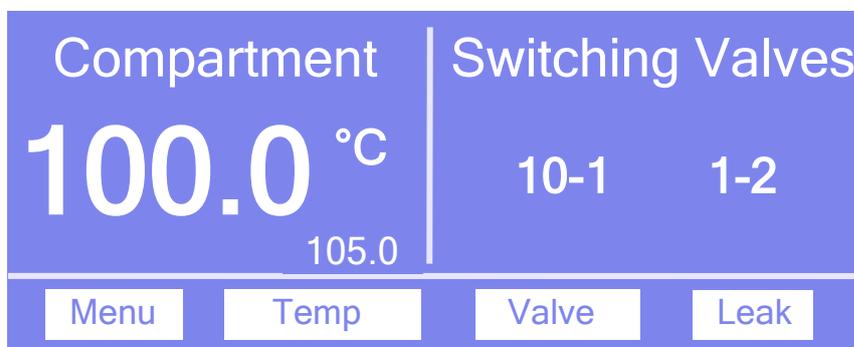


Fig. 36: Function Keys

To ...	Select ...
Open the Main menu (→ page 70).	Menu
Open the <b>Temperature</b> menu (→ page 70).	Temp
Open the <b>Valve</b> menu (→ page 70).	Valve
Open the <b>Leak</b> menu (→ page 70).	Leak

When the TCC is connected in Chromeleon, front panel input related to the measurement is disabled to prevent changes to the operating parameters. Parameters that do not interfere with the measurement, such as the screen brightness or contrast, can still be changed.

## 5.4.2 TCC Menus

Fig. 37 shows an overview of the TCC menus. For information about the general menu layout and structure, see section 5.4.2.1. For information about the commands and parameters that are supported by the menus, see sections 5.4.2.2 through 5.4.2.5 (→ page 70 and following pages).

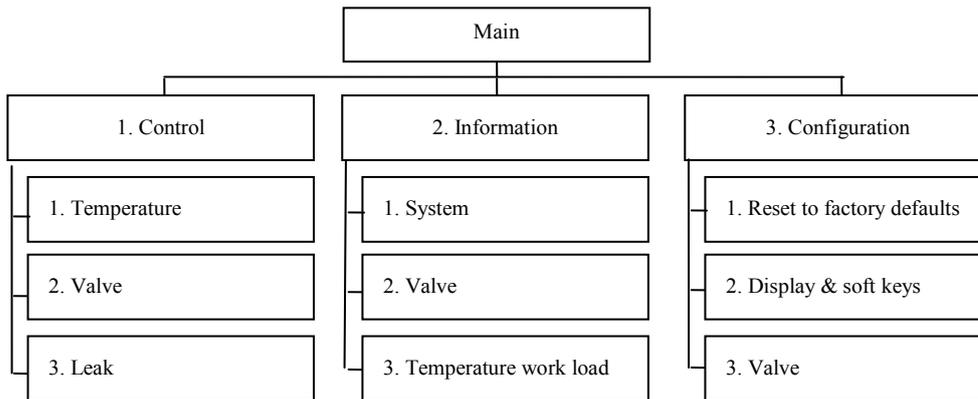


Fig. 37: Menu structure

### 5.4.2.1 General Menu Layout and Structure

In general, the menu layout is as follows:

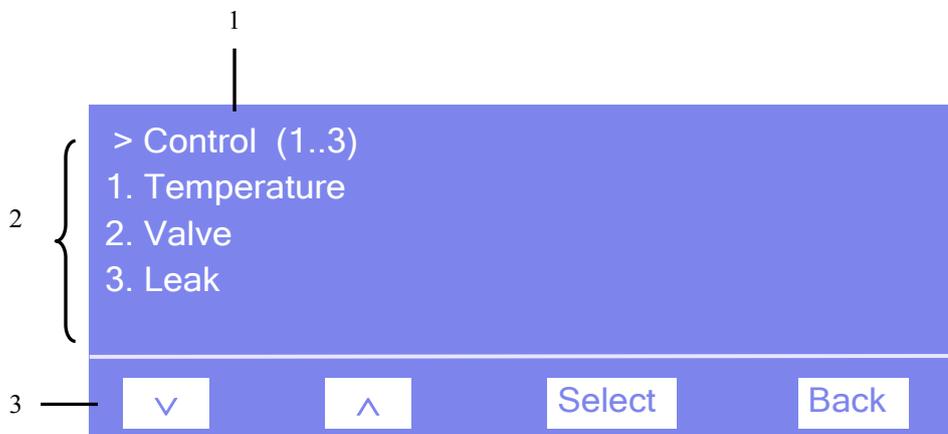


Fig. 38: Menu layout (here Control menu)

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

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

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

To ...	Select ...
Return to the previous entry on a list. If the list contains 5 or more items, you can use the arrow up key to scroll up through the list, after reaching the first line (→ <b>Key autorepeat</b> , page 71).	^
Increment numerical values.	^
Select operating states (e.g., the settings for the leak sensor).	^ or v
Proceed to the next entry on a list. If the list contains 5 or more items, you can use the arrow down key to scroll up through the list, after reaching the fourth line (→ <b>Key autorepeat</b> , page 71).	v
Proceed to the next figure in a number. Any decimal point is skipped.	>
Confirm the selection and activate the input field if applicable. If an item is read-only, the Select key will not be available.	Select
Return to the previous menu level.	Back
Toggle between two operating states (for example, between On and Off).	Toggle
Confirm the selection or input.	OK
Cancel the action and restore the last value.	Cancel
<b>Note:</b> Depending on the selected option, specific keys may replace these general keys.	

If an error is found, one or more messages appear on the TCC display. In this case, the **Prev**, **Next**, and **Clear** keys appear on the navigation bar.

To ...	Select ...
Return to the previous message.	Prev
Proceed to the next message.	Next
Remove a message from the display.	Clear

### 5.4.2.2 Main Menu

The **Main** menu provides top-level access to the menu structure. To open the Main menu, show the function keys and select Menu (→ page 67).

- **Control**  
On the **Control** menu, you can make the different settings for TCC operation (→ page 70).
- **Information**  
The **Information** menu provides information for diagnostic purposes (→ page 71).
- **Configuration**  
The **Configuration** menu provides information about the TCC configuration and allows you to make the required settings or perform the related commands (→ page 71).

### 5.4.2.3 Control Menu

On the **Control** menu, you can make the settings for temperature control and valve control. In addition, you can activate leak detection and specify the sensitivity of the gas and humidity sensors.

To ...	Select ...
Set the setpoint temperature for thermostating and turn thermostating on or off. To do so, select <b>Compartment</b> and <b>Compartment control</b> for column thermostating. TCC-3000RS: For post-column thermostating, select <b>Post-cooler</b> and <b>Post-cooler control</b> .	Temperature
Determine the switching position of the valve (= the fluid connections through the valve).	Valve
Determine whether leak detection is performed and how you are alerted in case of an alarm. Select the sensor and set the sensitivity: <b>low, standard, or high</b> —turns leak detection on and sets the sensitivity with which the sensors respond to excessive gas or humidity. When a sensor is activated, a message appears on the TCC display and a beep sounds. <b>low silent, standard silent, or high silent</b> —turns leak detection on and sets the sensitivity with which the sensors respond to gas or humidity. When a sensor is activated, a message appears on the TCC display, but no a beep sounds. <b>off</b> —turns leak detection off.	Leak

#### 5.4.2.4 Information Menu

The **Information** menu provides information for diagnostic purposes (read-only).

To ...	Select ...
See general information about the TCC, for example, firmware version, serial number, operating hours, and the last 10 errors.	System
See general information about the switching valves, for example, configuration and switching cycle counter.	Valve
See information about the temperature, for example working load and cooling load.	Temperature work load

#### 5.4.2.5 Configuration Menu

The **Configuration** menu provides information about the configuration of the TCC and allows you to make the required settings or change the settings.

To ...	Select ...
Restore the factory settings. In the <b>Reset to factory defaults?</b> dialog box, select <b>OK</b> to confirm the restore or select <b>Cancel</b> to keep your settings.	Reset to factory defaults
Set the display and function key parameters: <b>Brightness</b> —sets the screen brightness. (The input is in per cent.) <b>Contrast</b> —sets the screen contrast. (The input is in percent.) <b>Key sound</b> —sets whether a beep sounds when you select a function key. <b>Key autorepeat</b> —sets whether the keystroke is automatically repeated when you remain on the key for a longer period, for example, to change a value quickly ( <b>On</b> = yes or <b>Off</b> = no). <b>Valve display</b> —sets the appearance of the status screen. For the status screen shown in Fig. 31 (→ page 60), select <b>Big</b> . For the screen shown in Fig. 42 (→ page 78), select <b>Small</b> .	Display & soft keys
Specify which valve is present in the right and/or left position. The entry consists the valve type (= <b>HT</b> for <i>TitanHT</i> valves or <b>HP</b> for <i>TitanHP</i> valves) and the number of valve ports and positions. <i>Examples:</i> If a TitanHT 2-position, 10-port valve is installed, select <b>HT 10-port, 2-pos.</b> If a TitanHP 2-position, 6-port valve is installed, select <b>HP 6-port, 2-pos.</b> If no valve is installed, select <b>Not installed</b> .	Valve

## 5.5 Operational Settings

This section provides specific information about settings and functions that should be considered for operating the TCC.

To learn more about ...	See page ...
Turning on column thermostating	73
Turning on post-column thermostating (TCC-3000RS)	74
Activating column identification	75
Selecting the column	76
Adjusting the sensitivity of the gas and humidity sensors	77
Selecting the status screen (TCC with column switching valves)	78
Adjusting the screen brightness or contrast	78
SmartStartup and SmartShutdown	79

Observe also the information about special functions that Chromeleon supports for operating the TCC (→ page 80).

### 5.5.1 Turning on Column Thermostatting

You can turn column thermostatting on and off and set the temperature in Chromeleon or on the instrument display.

#### To turn on column thermostatting from Chromeleon

1. In Chromeleon, open the Commands dialog box for the TCC.
2. Select **ColumnOven**.
3. Select **Temperature** and **Nominal**, and then enter the temperature. TempCtrl is automatically set to On. Column thermostatting is active.

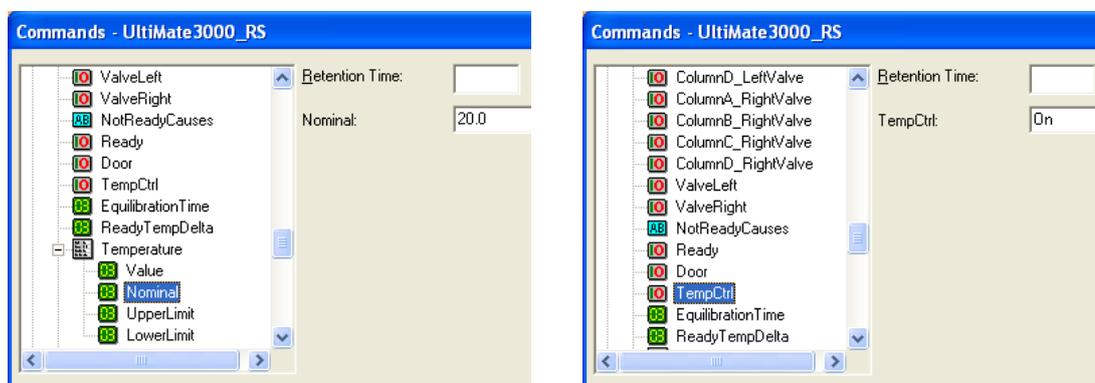


Fig. 39: Turning on column thermostatting

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

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

#### To turn on column thermostatting on the front panel display

1. Show the function keys and select **Temp**.
2. Select **Compartment** and enter the temperature. **Compartment control** is automatically set to **On**. Column thermostatting is active.

Set **Compartment control** to **Off** if you do not want to use column thermostatting.

If you want to use column thermostatting later again, set **Compartment Control** to **On** again. When you change the temperature setting under **Compartment**, **Compartment control** is automatically set to **On**.

## 5.5.2 Turning on Post-Column Thermostatting

Only TCC-3000RS

You can turn post-column thermostatting on and off and set the temperature in Chromeleon or on the front panel display

### To turn on post-column thermostatting from Chromeleon

1. On the **Components** page in the **Properties** dialog of the TCC, verify that the **Post-column Cooler** check box is selected (→ page 39).
2. In Chromeleon, open the Commands dialog box for the TCC.
3. Select **ColumnOven**.
4. Select **Cooler\_Temperature** and **Nominal**, and then enter the temperature. **Cooler\_TempCtrl** is automatically set to **On**. Post-column thermostatting is active.

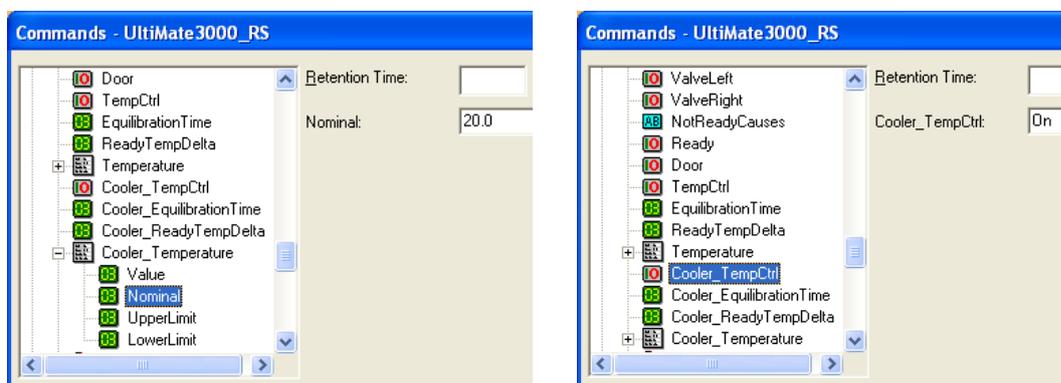


Fig. 40: Turning on post-column thermostatting

Set **Cooler\_TempCtrl** to **Off** if you do not want to use post-column thermostatting for a certain application.

If you want to use post-column thermostatting later again, set **Cooler\_TempCtrl** to **On**. When you change the temperature setting under **Nominal**, Chromeleon sets **Cooler\_TempCtrl** automatically to **On**.

### To turn on post-column thermostatting on the front panel display

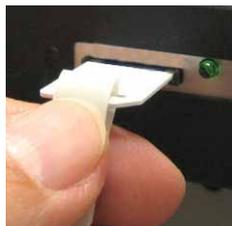
1. Show the function keys and select **Temp**.
2. Select **Post-cooler** and enter the temperature. Post-cooler control is automatically set to **On**. Post-column thermostatting is active.

Set **Post-cooler** control to **Off** if you do not want to use post-column thermostatting for a certain application.

If you want to use post-column thermostatting later again, set **Post-cooler control** to **On**. When you change the temperature setting under **Post-cooler**, **Post-cooler control** is automatically set to **On**.

### 5.5.3 Activating Column Identification (Column ID)

1. Verify that the column ID chip card is attached to the column (→ page 51).
2. Insert the chip card, with the chip facing down, into one of the four chip card readers (A - D). (The chip card reader at the utmost left is the reader for column A; the chip card reader at the utmost right is the reader for column D.) Four chip cards can be used at the same time. When the chip card is installed correctly, the LED next to the chip card reader is green.



*Fig. 41: Inserting a column ID chip card in a chip card reader*

3. In the Chromeleon **Server Configuration** program, verify that the columns to be monitored are selected on the **Components** page for the TCC (→ page 39). If a column check box is cleared, no information will be available for the column in Chromeleon.
4. The information on the column ID chip card (→ page 75) is continuously updated and can be reviewed at any time in Chromeleon, as long as the column and chip card are installed in the TCC.
  - ◆ Open the **Commands** dialog box for the TCC and select **Column\_A** (**B**, **C**, or **D**).
  - ◆ Open the tabset panel for the TCC and click **Details** in the **Columns** section.

#### Column Properties

The chip card provides the following types of information:

- **Primary column properties**

The primary column properties are used for column identification. The information is entered once by the column manufacturer or user and will not be changed during the lifetime of the column. The primary column properties are, for example, the batch number, product ID, serial number, and the date of manufacture.

- **Secondary column properties**

Secondary properties are entered by the user and can be changed whenever required. The secondary column properties are, for example, the manufacturer and the packing material and particle size of the column, but also temperature, pressure, and pH limits.

- **Operational column properties**

Chromeleon determines and updates the operational information upon each injection. The operational column properties are, for example, the date of the first injection, the date of the last injection, the maximum flow rate while the column is in use, or the total volume of sample that has been injected onto the column. Operational column properties are read-only.

For a complete list of column properties and for more information about the column identification system, see the *Chromeleon Help*.

### 5.5.4 Selecting the Column

For a TCC with one or two column switching valves, column programming is performed in Chromeleon. The number of column switching valves, the valve model, and the application determine which commands and properties are used.

The following commands and properties are available in the **Commands** dialog box:

To ...	Select ...
Set in which position the left or right valve shall be switched to direct the flow onto the column (A, B, C, or D).	<b>ColumnX_LeftValve</b> or <b>ColumnX_RightValve</b> (where X = A, B, C, or D) and enter the position, for example, 6_1 or 10_1.
Specify which columns are alternately used for the injections.	<b>ColumnsToUse</b> and enter the columns, for example, AB or AC.
Specify the column on which the current injection is performed.	<b>CurrentColumn</b> and enter the column.
Switch valve to the other column for the next injection.	<b>NextColumn</b>

The commands and properties are available also on the tabset panel for the TCC and in the program wizard.

For more information, see the *Chromeleon Help*.

### 5.5.5 Adjusting the Sensitivity of the Gas and Humidity Sensors

You can adjust the sensitivity of the gas or humidity sensor in Chromeleon or on the front panel display.

#### To adjust the sensitivity from Chromeleon

1. In Chromeleon, open the Commands dialog box for the TCC.
2. Select **GasLeakSensor** or select **HumidityLeakSensor** and set the sensor sensitivity:  
Select **Low**, **Standard**, or **High**. When the sensor is activated
  - ◆ The **Status** LED on the front panel door is red.
  - ◆ A message appears in Chromeleon and on the TCC display.
  - ◆ A beep sounds.Select **Low\_Silent**, **Standard\_Silent**, or **High\_Silent**. When the sensor is activated
  - ◆ The **Status** LED on the front panel door is red.
  - ◆ A message appears in Chromeleon and on the TCC display.
  - ◆ *No* beep sounds.Select **Off** to deactivate leak detection.

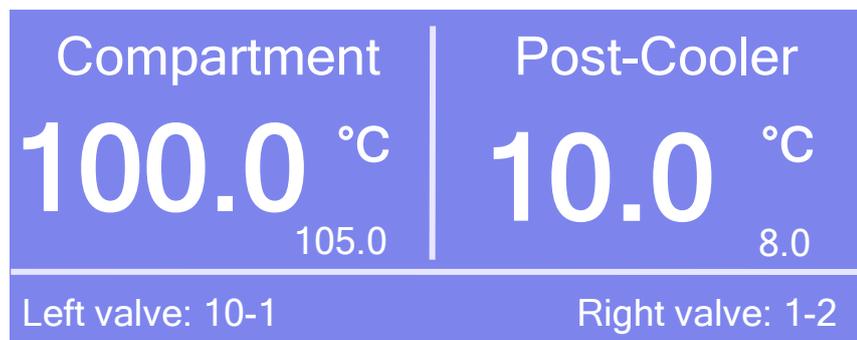
#### To adjust the sensitivity on the front panel display

1. Show the function keys and select **Leak**.
2. Select **Gas leak mode** or **Humidity leak mode**.
3. Select **low**, **standard**, or **high**, or select **low silent**, **standard silent**, or **high silent**. (For details about these settings, see further up in this section.) To deactivate leak detection, select **off**.

### 5.5.6 Selecting the Status Screen

Only TCC with column switching valves

As an alternative to the status screen in Fig. 31 (→ page 60), you can select this type of appearance if the instrument is fitted with one or two column switching valves:



*Fig. 42: Alternative status screen  
(here TCC-3000RS with two 2-position, 10-port switching valves)*

1. Show the function keys and select Menu.
2. Select the **Configuration** menu and select **Display & soft keys** (→ page 71).
3. Select Valve display and Small.

### 5.5.7 Adjusting the Screen Brightness or Contrast

You can adjust the screen brightness or screen contrast to your requirements from Chromeleon or on the TCC display.

#### To adjust the settings from Chromeleon

1. In Chromeleon, open the Commands dialog box for the TCC.
2. Select Brightness and change the value for the screen brightness as appropriate. Select **Contrast** and change the value for the screen contrast as appropriate.

#### To adjust the settings on the front panel display

1. Show the function keys and select Menu.
2. Select the **Configuration** menu and select **Display & soft keys** (→ page 71).
3. Select Brightness and change the value for the screen brightness as appropriate. Select **Contrast** and change the value for the screen contrast as appropriate.

### 5.5.8 SmartStartup and SmartShutdown

The SmartStartup wizard assists you in automating regular routine tasks (→ page 57). With SmartStartup, the different modules of the UltiMate 3000 system are turned on automatically and in a controlled manner. For example, for the TCC, the column chamber and all components inside are brought to the preferred temperature. For example, SmartStartup can purge the pump of the HPLC system automatically, flush the column, and perform system equilibration. Important module parameters are monitored. When the modules operate within these limits, the sample sequence, which was set up before, can be started automatically. SmartStartup can be used at any time.

If you have to interrupt system operation, use the **SmartShutdown** wizard to create a program to set the HPLC system into standby mode or to automate shutdown of the system (→ page 85).

## 5.6 Special Chromeleon Functions

This section provides a short overview of some special functions that Chromeleon supports for the TCC.

To learn more about ...	See page ...
Equilibration Time and Ready Temp Delta	See below.
Predictive performance	82
Diagnostics	83
Recording the temperature signals	83
Operational Qualification and Performance Qualification	83

All of these functions are available in the Commands dialog box (unless otherwise noted). In addition, some functions are available also on the control panel for the TCC. For additional information about a function, see the *Chromeleon Help*.

### 5.6.1 Ready Temp Delta and Equilibration Time

The **Ready** property indicates whether the TCC is ready for operation. When the TCC is in the status NotReady, you cannot start the analysis.

Keep in mind that the settings for Ready Temp Delta and Equilibration Time influence the time that the TCC needs to enter the Ready state:

Setting	Description
ReadyTempDelta	<p>Indicates for how much degrees the current temperature may be above or below the temperature set point.</p> <p>If the current temperature deviates from the temperature set point by more degrees than the value entered here, the TCC enters the NotReady state and is not ready for operation.</p> <p>Example: Temperature set point: 45 °C, ReadyTempDelta: 1 °C The TCC is ready for operation when the current temperature is between 44 °C and 46 °C. If the current temperature is outside this range, the TCC enters the NotReady state.</p> <p>If ReadyTempDelta is set to None, Chromeleon does not check whether the current temperature deviates from the temperature set point.</p>

Setting	Description
Equilibration Time	<p>Indicates for how long the preferred temperature must be in the range specified by the temperature set point and the setting for ReadyTempDelta before the TCC is ready for operation and the analysis can be started.</p> <p><i>Example:</i></p> <p>Temperature set point: 45 °C, ReadyTempDelta: 1 °C, EquilibrationTime: 0.5 min</p> <p>The TCC is ready for operation when the current temperature is between 44 °C and 46 °C and has remained in this range for 0.5 minutes.</p> <p>If EquilibrationTime is set to None, Chromeleon does not check how long the current temperature remains in the specified range.</p>

The picture illustrates the scenario:

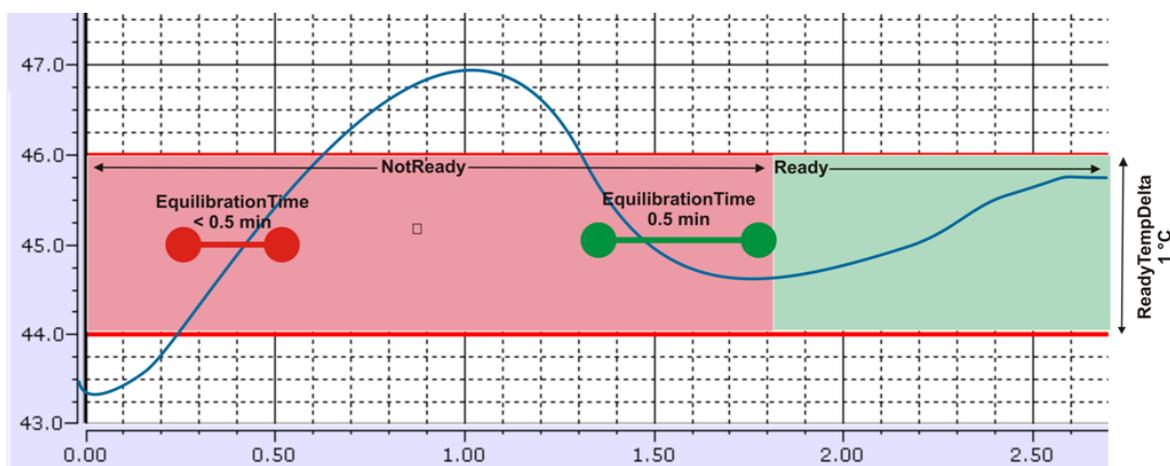


Fig. 43: Interdependencies between ReadyTempDelta, EquilibrationTime, and Ready

Observe the following:

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

## 5.6.2 Predictive Performance

Predictive Performance provides various functions for estimating the lifetime of consumables and for monitoring and recording service and (re)qualification information.

### Commands Dialog Box

Open the **Commands** dialog box for the TCC and enter the limits for the predictive performance parameters. For a list of the commands and counters that are supported for the TCC, see the *Chromeleon Help*.

To keep the predictive performance information up-to-date, perform the following commands (→ table).

After you have ...	Perform the following command ...
Replaced the rotor seal of the left valve	LeftRotorSealChanged
Replaced the rotor seal of the right valve	RightRotorSealChanged
Serviced the instrument (for example, annual maintenance)	ServiceDone
Performed instrument qualification	QualificationDone

These commands reset the counters and update the information when the action was performed.

### Control Panel

On the control panel for the TCC, click **Wellness**, **Qualification**, and **Service** to see the related predictive performance commands and parameters on separate panels. On these panels, you can enter the limits and reset the counters. In addition, wellness bars provide visual indicators of qualification and service periods.

The color-coding of the wellness bars provides information about the status:

Color	Description
Green	OK.
Yellow	The value will soon reach the specified limit and/or the related component needs servicing or should be replaced soon.
Orange	(Only for monitoring Qualification properties.) The value has reached the specified limit. However, a Grace Period has been specified during which the TCC may still be operated.
Red	The value has reached the specified limit or the specified grace period has expired. Replacement, servicing, or qualification of the TCC is overdue. The TCC can no longer be operated. Besides, it is not possible to start a batch.

In addition, a message appears in the Chromeleon Audit Trail when a limit has been reached.

### 5.6.3 TCC Diagnostics

You can check the performance of the TCC gas sensor:

1. On the **Control** menu, select **Diagnostics**.  
The Control menu is visible only when a control panel is open.
2. Click Gas Sensor Test on the diagnostics test list.  
The Diagnostics dialog box lists all tests that are available for the devices in the current timebase.
3. A wizard guides you through the test. For more information about the test, see the *Chromeleon Help*.

If the test fails, check the Chromeleon Diagnostics Messages section for a short description of possible causes along with recommended courses of action (→ page 91).

### 5.6.4 Recording the Temperature Signals

On the **Configuration** page, the **Temperature Signal** check boxes are selected by default when the TCC is installed and configured in Chromeleon (→ page 42).

- **Temperature Signal** generates the channel for recording the temperature signal of the TCC (channel name: **ColumnOven\_Temp**).
- **Cooler Temp. Signal** generates the channel for recording the temperature signal of the post-column cooler (channel name: **PostColumn\_Cooler\_Temp**). The signal will be recorded only if you have also selected the post-column cooler check box on the **Components** page (→ page 39).

If a problem occurs, the temperature signals can provide helpful information to identify and eliminate the source for the problem. Therefore, always record the temperature signals.

### 5.6.5 Operational Qualification and Performance Qualification

To check and document the performance of the HPLC system, perform Operational and Performance Qualification. All materials required for performing qualification and detailed instructions are available on request.

## 5.7 Shutting Down the TCC

Observe the following precautions before interrupting the operation or before shipping the TCC:

- For longer periods of inactivity or if saliferous buffers are used, rinse the fluid lines with MS-grade water. This avoids salt crystallization, which may impair the instrument performance.
- For longer periods of inactivity (more than one week) or when shipping the TCC, no water must remain in the fluid passages. This is, for example, to avoid failure of the sealing surfaces of the column switching valve when the temperature falls below 0 °C.
- Ship the TCC only in the original shipping container. If the TCC is fitted with one or two column switching valves, you have to remove the entire valve unit (drive and drip tray) before you place the TCC in the shipping container. Observe the packing instructions.

If the original shipping container is not available, appropriate shipping containers and packing material can be ordered from Thermo Fisher Scientific sales organization for Dionex HPLC products. The packing instructions are included in the "Installation and Qualification Documents for Chromatography Instruments" binder and are available on request.

Shipping the TCC in anything other than the original packaging voids the warranty.

If you are running Chromeleon, you can set the TCC and HPLC system into the standby mode or automate system shutdown (see the next section).

### Standby Program

A standby program sets the HPLC system into standby mode. The main program steps are:

- At the end of the program, the program automatically reduces the flow.
- The program reduces temperature of all temperature-controlled modules in the system.

From the standby mode, you can reactivate the application very quickly.

### Shutdown Program

A shutdown program automates shutdown of the HPLC system. The main program steps are:

- At the end of the program, the program automatically reduces the flow.
- The program turns off certain system components and functions (for example, detector lamps, temperature control).

### To create a standby or shutdown program

Select one of the following alternatives:

- Select and perform the operating commands and parameters from the **Commands** dialog box.
- Create and run a corresponding program to automate the process (→ page 65).
- Use the SmartShutdown Wizard to create and run the program (see further down in this section).

### To create the program with the SmartShutdown wizard

1. To open the wizard, click **SmartShutdown** on the **Batch** menu.
2. Follow the instructions as they appear on each page of the wizard. For additional information about a page, click **Help**.
3. After you finish the wizard, Chromeleon
  - ◆ Creates the program and saves it in the timebase for which you create the program.
  - ◆ Opens the **Start Batch on** dialog box.

Select the program and click **Start** to run the program.

For more information about the SmartShutdown wizard, see the *Chromeleon Help*.

## 5.8 Routine and Preventive Maintenance

The TCC is made of high-quality components and materials to minimize maintenance requirements. All surfaces are resistant to weak acids, alkali, and organic solvents. Nevertheless, immediately wipe up all liquids spilled onto the device surface, by using lint-free cloth or paper. If surfaces are exposed for longer periods, these liquids can cause damage.

To ensure optimum performance and maximum uptime of the TCC, perform the maintenance procedures listed in the table at regular intervals. The exact maintenance schedule depends on a number of factors.

Frequency	What you should do...
<b>Daily</b>	Check the TCC components for indications of leakage and tighten leaking connections. Replace fittings and ferrules if needed.
<b>Regularly</b>	Clean the column chamber, by using a lint-free cloth. Use paper to absorb any humidity in the column chamber. The cleaner the column chamber is, the better the sensors are at detecting excessive gas or humidity.
	Inspect the seal installed in the front panel door. A defective door seal impairs the performance of the instrument. If the seal is defective, contact Service.
	Inspect the column switching valve for indications of leakage (→ page 99).
	Drain tubing is connected to the drain port on the bottom right of the TCC. Verify that the tubing are unclogged and routed below the drain ports. Empty the waste container as needed.
	After using saliferous buffers, rinse the fluid lines with de-ionized water.
<b>Annually</b>	Have authorized Service personnel perform preventive maintenance once a year.

 **Tip:** Chromeleon supports functions for estimating the lifetime of consumables and a diagnostics test (→ pages 82 and 83).

## 6 Troubleshooting

### 6.1 Overview

The following features help you to identify and eliminate the source for problems that may occur during the operation of the TCC or UltiMate 3000 system.

#### Status LEDs

The status LEDs (light emitting diodes) on the front panel provide a quick visual check of the operational status of the TCC. They indicate whether the TCC is turned on, connected in Chromeleon, and operating properly (→ page 18).

#### Messages

If a fault or error is detected during the operation of the TCC, a message appears on the TCC display. Check the Messages on the TCC Display section for recommended courses of action (→ page 88). If the TCC is operated by Chromeleon, a message is also displayed in the Chromeleon Audit Trail.

 **Tip:** For information about operating problems that might occur during the operation of an UltiMate 3000 system, see Operating Problems (→ page 92).

#### Diagnostics Test

If the TCC is connected in Chromeleon, Chromeleon provides a diagnostics test allowing you to check the performance of the gas sensor (→ page 83). If a test fails, check the Chromeleon Diagnostics Messages section for a short description of possible causes along with recommended courses of action (→ page 91).

If you are unable to eliminate a problem following the instructions given here, contact Thermo Fisher Scientific Service for Dionex HPLC Products.

## 6.2 Messages on the TCC Display

Each time a fault or error occurs during the operation of the TCC, the **Status** LED on the front panel door changes to red and a message appears on the TCC display. In this case, the Prev, Next, and Clear keys appear on the navigation bar.

To ...	Select ...
Return to the previous message.	Prev
Proceed to the next message.	Next
Remove a message from the display.	Clear

These keys are active also when the TCC is connected in Chromeleon.

When the TCC is connected in Chromeleon

- The error is also displayed in the Chromeleon Audit Trail. The Audit Trail may provide additional information.
- Messages on the front panel display can be removed also by performing the **ClearDisplayError** command in Chromeleon.

The table lists TCC-related messages along with appropriate remedial actions. In addition to the messages listed in the table, other messages may appear. If you cannot eliminate the problem, note the exact wording of the message. Contact Thermo Fisher Scientific Service for Dionex HPLC Products.

Message	Remedial Action
Compartment temperature sensor communication error!	Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.
Cooler temperature sensor communication error!	Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.
Chip card error! Chip card <i>x</i> data inconsistent.	<i>(with x = chip card A, B, C, or D)</i> The data on the chip card are inconsistent. Verify that the chip card is installed properly. The chip card may be defective. Use a new chip card if necessary.
Error cooler overload! Reduce flow or temperature drop.	The thermo element for post-column cooling has reached the limit of the cooling performance. Reduce the flow rate or reduce the temperature for post-column thermostating.
Error heater overload! Reduce flow or temperature.	The thermo element for the column chamber has reached the limit of the heating performance. Verify that the clearance behind, to the sides, and on the bottom of the TCC is sufficient for ventilation. Reduce the flow rate or reduce the temperature for column thermostating.

<b>Message</b>	<b>Remedial Action</b>
Error while programming flash!	<i>(This message may be extended by additional text.)</i> Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.
Flash object error!	<i>(This message may be extended by additional text.)</i> Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.
Gas leak alarm!	The gas sensor detected excessive gas in the column chamber. Eliminate the cause. Tighten leaking connection and vent the column chamber.  The gas sensor may be influenced by the drain tubing from other modules in the UltiMate 3000 system. Verify that the drain tubing of the TCC is connected as described in the installation instructions provided the system drain kit. As an alternative, connect separate drain tubing to both the TCC and the system module stacked upon the TCC.
Gas leak sensor error!	Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.
Humidity leak alarm!	The humidity sensor reports an increased concentration of humidity in the column chamber. Eliminate the cause. Tighten leaking connection and vent the column chamber (→ page 22).
Humidity leak sensor error!	Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.
I2C bus error! <i>(This message may be extended by additional text.)</i>	Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.
I2C bus device <i>x</i> timeout! <i>(where x = chip card, temperature sensor, or valve)</i>	Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.
Leak temperature sensor communication error!	Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.
Left valve controller no communication.	Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.
Left valve controller configuration error!	Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.
Left valve moving timeout error!	Check whether the spanner has been tightened too firmly. If the spanner is too tight, the valve cannot be switched. Loosen the spanner a bit and retry. Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.
Rear temperature sensor communication error!	Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.

Message	Remedial Action
Right valve controller no communication.	Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.
Right valve controller configuration error!	Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.
Right valve moving timeout error!	Check whether the spanner has been tightened too firmly. If the spanner is too tight, the valve cannot be switched. Loosen the spanner a bit and retry. Turn the TCC off and on again by pressing the power switch on the rear of the TCC and retry.

When the TCC is operated from Chromeleon and if communication between Chromeleon and the TCC cannot be established, messages appear in the Chromeleon Audit Trail.

Message	Remedial Action
TCC-3x00@USB-1610103 - Device not found on the USB.	The USB connection between the TCC and the Chromeleon server may be interrupted. Check the USB connection. The power supply to the TCC may be interrupted. Check the power supply connection of the TCC.
Error opening TCC-3x00 @USB-1610103 – The System cannot find the file specified	The USB connection between the TCC and the Chromeleon server may be interrupted. Check the USB connection. The power supply to the TCC may be interrupted. Check the power supply connection of the TCC.
Error issuing control request to TCC-3x00@USB-1610103	The USB connection between the TCC and the Chromeleon server may be interrupted. Check the USB connection. Check the power supply connection of the TCC. Remove the TCC specified in the message from the server configuration or else, select a different TCC from the list of available TCC in the server configuration program.
Error reading from TCC-3x00 @USB-1610103 Data error (cyclic redundancy check)	Check the USB connection. The connection to the next hub must not exceed 5 m. The overall connection length, including the hub connections must not exceed 30 m. Replace any defective USB cable or hub.
Error reading from TCC-3x00 @USB-1610103	The USB connection between the TCC and the Chromeleon server may be interrupted. Check the USB connection. The power supply to the TCC may be interrupted. Check the power supply connection of the TCC.

### 6.3 Chromeleon Diagnostics Messages

If the TCC fails the gas sensor test, perform the instructions given here. If the TCC still fails the test, contact Thermo Fisher Scientific Service for Dionex HPLC Products.

<b>Test Result</b>	<b>Probable Cause</b>	<b>Remedial Action</b>
Error, gas leak detected!	<p>The gas sensor detected excessive gas in the column chamber.</p> <p>The gas sensor may be influenced by the drain tubing from other modules in the UltiMate 3000 system.</p>	<p>Eliminate the cause. Tighten leaking connection and vent the column chamber.</p> <p>Verify that the drain tubing of the TCC is connected as described in the installation instructions provided the system drain kit. As an alternative, connect separate drain tubing to both the TCC and the system module stacked upon the TCC.</p>
Error, gas leak sensor error!	The gas sensor is defective.	Repeat the test.
Error, gas leak sensor not ready!	The temperature set point has not been reached. The thermal unit may be defective.	Repeat the test.
Error, no gas leak detected.	During the test the gas sensor was supposed to detect excessive gas in the column chamber. The gas sensor may be defective.	Repeat the test.

## 6.4 Operating Problems

The table provides information about common operating problems that might occur with an UltiMate 3000 system and lists probable causes, as well as remedial actions.

For more information and remedial actions, see the manuals for the other modules of the UltiMate 3000 system.

Problem	Probable Cause	Remedial Action
No information appears on the front panel display.	<p>The TCC is not connected to the mains.</p> <p>The power is turned off.</p> <p>The TCC is in standby mode.</p> <p>The screen brightness or contrast is not adjusted correctly.</p> <p>The fuses blow.</p> <p>Replacement fuse blows immediately.</p> <p>An error occurred in the electronic system.</p>	<p>Connect the power cord.</p> <p>Turn on the power to the device.</p> <p>Press the Standby key on the front panel.</p> <p>Adjust the brightness and/or contrast (→ page 78).</p> <p>Replace the fuses (→ page 108).</p> <p>Contact Service.</p> <p>Contact Service.</p>
The TCC does not work correctly when controlled by Chromeleon.	<p>There is no connection between the TCC and the Chromeleon computer.</p> <p>The USB port on the computer is not ready for operation.</p>	<p>Check the USB cable and connection to the computer.</p> <p>Check the USB port on the computer.</p>
The system has very high backpressure.	<p>One or more capillaries in the system are blocked or damaged by bending.</p> <p>The pre-column heater is blocked.</p> <p>A valve (if installed) is blocked.</p> <p>For additional causes, refer to the operating instructions for the pump.</p>	<p>Check the capillaries in the system systematically from the detector to the pump. Replace the capillaries if needed.</p> <p>Rinse the capillary of the pre-column heater and pre-column heater, by using an appropriate solvent. Replace the pre-column heater.</p> <p>Check the valve for indications of blockage. It might be necessary to replace the valve.</p> <p>→ <i>Pump manual</i></p>

<b>Problem</b>	<b>Probable Cause</b>	<b>Remedial Action</b>
The system has very high backpressure at the column and pump.	The column is contaminated or blocked.	Rinse or replace the column.
The temperature does not change for some time although the temperature set point has not been reached.	<p>The ambient temperature is too high or the set point is lower than the specified difference to the ambient temperature.</p> <p>The ventilation slots on the TCC are obstructed.</p> <p>The front panel door of the TCC is not completely closed.</p> <p>The capillaries are placed in such a manner that ambient air can enter the column chamber.</p> <p>Temperature control is turned off. (The following information appears on the status screen: Setpoint: Off.)</p> <p>The TCC door seal is damaged.</p>	<p>Reduce the ambient temperature (for example, by ventilating the room).</p> <p>Make sure that the ventilation slots are not obstructed in any way.</p> <p>To close, push the door upward forcefully if necessary.</p> <p>Verify that the capillaries are routed correctly through the guides on the sides of the column chamber and/or rest flat on the edge of the enclosure (→ Tips in section 4.2, page 46).</p> <p>In Chromeleon, check and change the TempCtrl setting if necessary. (TempCtrl = on turns temperature control on.)</p> <p>Contact Service.</p>
Leakage at the pre-column heater.	The fittings at the pre-column heater are not tightened correctly.	<p>Tighten the fittings on the pre-column heater inlet and outlet.</p> <p>→ "The system has very high backpressure" further up in this list.</p>
Leakage at the post-column cooler	The fittings on the post-column cooler are not tightened correctly.	Tighten the fittings on the post-column cooler inlet and outlet. Install a new post-column cooler insert.
Impaired performance of the pre-column heater.	<p>The flow path is not correct.</p> <p>The pre-column heater is not installed correctly, that is, the thermal contact is imperfect.</p> <p>The calibration of the TCC is incorrect.</p> <p>The pre-column heater is defective.</p>	<p>Check and correct the flow path, if necessary.</p> <p>Reinstall the pre-column heater.</p> <p>Contact Service.</p> <p>Replace the pre-column heater.</p>

Problem	Probable Cause	Remedial Action
Impaired performance of the post-column cooler	The post-column cooler insert is not installed correctly.  The post-column cooler insert is blocked or defective.  The opening for the post-column cooler insert is defective.	Verify that the post-column cooler is installed correctly. The label must face away from the instrument (→ page 52).  Install a new post-column cooler insert.  Contact Service.

## 7 Service

### 7.1 General Notes and Safety Precautions

The following sections describe all service and repair procedures that the user may perform. All other maintenance and service procedures must be performed only by Thermo Fisher Scientific service personnel.

 **Warning:** The fluid components of the device may be filled with solvents that are harmful to health. Wear appropriate personal protective equipment. Rinse the fluid components with an appropriate solvent to remove harmful substances.

For information about the proper handling of a particular substance and for advice on specific hazards, refer to the material safety data sheet for the substance you are using. Observe the guidelines of Good Laboratory Practice (GLP).

 **Avertissement:** Les composants fluidiques de l'instrument peuvent être remplis de solvants nocifs. Portez l'équipement de protection personnel approprié. Rincez les composants fluidiques avec un solvant approprié afin d'éliminer les substances nocives.

Pour les informations sur la manipulation correcte des composés et des recommandations pour les situations de risque spécifiques, veuillez consulter la fiche de données de sécurité des substances que vous utilisez. Veuillez respecter des directives des Bonnes Pratiques de Laboratoire (BPL).

*Before starting maintenance or service procedures, observe the following precautions:*

- For all service and repair procedures, observe all precautionary statements provided in these operating instructions.
- Do not touch any metal or plastic parts inside the column chamber while the temperature is higher than 50 °C. Wait for the chamber to cool down before you carry out any work in the column chamber.
- Use only the original spare parts authorized for the device by Thermo Fisher Scientific.
- Before returning the TCC for repair, contact Thermo Fisher Scientific Service for Dionex HPLC Products. An RMA (Return Material Authorization) number is required to track your instrument. Always use the original packaging and observe the packing instructions when shipping the TCC. Shipping the TCC in anything other than the original packaging will void the warranty.

If the original shipping container is not available, appropriate shipping containers and packing material can be ordered from Thermo Fisher Scientific sales organization for Dionex HPLC products. The packing instructions are included in the "Installation and Qualification Documents for Chromatography Instruments" binder and are available on request.

For instructions on shutting down the TCC, see page 84.

## **7.2 Removing Gases and Humidity from the Column Chamber**

A gas sensor and a humidity sensor are installed inside the TCC. The sensors detect any gas or humidity that may accumulate in the column chamber. When a certain concentration of gas or humidity is reached inside the TCC (while the door of the column chamber is closed), the corresponding sensor is activated and the Status LED on the front panel door lights red.

1. Find and eliminate the leak (wearing appropriate protective clothing).  
Beeping stops for the current alarm when you open the front panel door.
2. Ventilate the interior of the column chamber thoroughly before closing the front panel door.
3. If the sensor is not activated again, resume operation.
4. To remove the message from the TCC display, select **Clear** on the navigation bar (→ page 69).

The Status LED on the front panel door remains red as long as the sensor is exposed to gases or humidity.

### 7.3 Column Switching Valve

The TCC can hold one or two column switching valves (→ page 17).

To ensure optimum operation of the valve, observe the following guidelines:

- The valve should not be used with concentrated formic acid.
- Operating, storing, or shipping the valve below 0 °C with water in the fluid passages may cause failure of the sealing surfaces.
- To connect the capillaries to the column switching valve, install only Viper fitting connections and/or the ferrules and fitting nuts provided in the accessories kit or original Dionex spare parts.

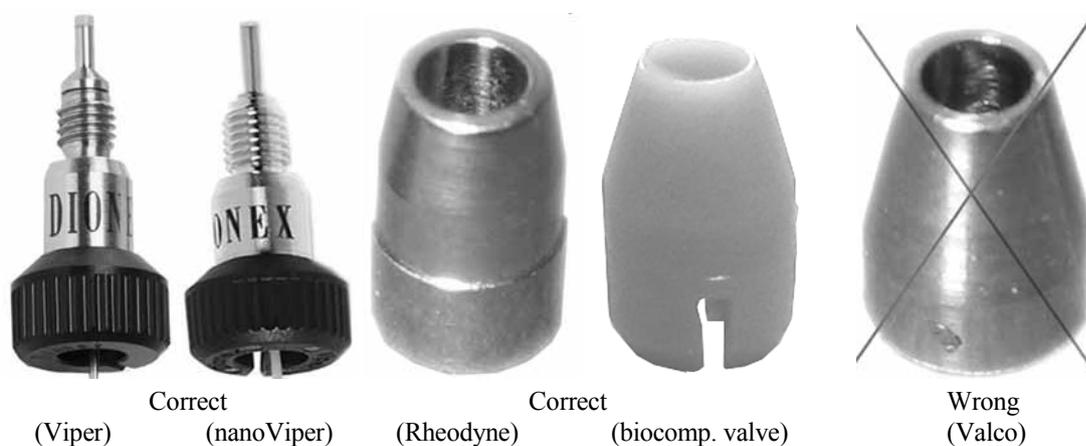


Fig. 44: Viper fitting connections and other valve ferrules (examples)

Maintenance requirements are kept to a minimum. In most instances, it will be sufficient to clean the valve by flushing all lines with an appropriate solvent. The nature of the solvent to be used depends on the samples and the mobile phases that are used.

The seals (rotor seal and stator face seal) are consumables that should be replaced as necessary (→ page 107).

### 7.3.1 Inspecting the Column Switching Valve for Leakage

Several drain holes are provided on the stator ring. If liquid droplets appear on one or more drain holes, this may indicate valve leakage.



*Fig. 45: Drain holes on the column switching valve  
left: TitanHP valve; right: TitanHT valve*

Take the following remedial action:

- Replace the rotor seal or replace the rotor seal and stator face seal whatever is applicable (→ page 107).
- Replace the stator (→ page 105).
- Replace the valve pod (→ page 100).

### 7.3.2 Replacing the Valve Pod

Valve pod* for	Part No.
<p><i>TitanHP™ column switching valves</i> <i>suitable for pressures &lt; 41 MPa (6000 psi)</i></p> <p>2-position, 6-port valve (SST)* 2-position, 10-port valve (SST)* 6-position, 7-port valve (Ti)</p> <p>The rotor seal in the valve pod is suitable for pH values &lt; 10. * To use these valves for applications with pH values &gt; 10, replace this rotor seal with the PEEK rotor seal and stator face seal (→ page 107).</p>	<p>6722.9013 6722.9023 6722.9035</p>
<p><i>Biocompatible TitanHP™ column switching valves (PEEK)</i> <i>suitable for pressures &lt; 34 MPa (5000 psi)</i></p> <p>2-position, 6-port valve (PEEK) 2-position, 10-port valve (PEEK)</p> <p>The rotor seal in the valve pod is suitable for pH values 0 - 14.</p>	<p>6723.9013 6723.9023</p>
<p><i>TitanHT™ column switching valves</i> <i>suitable for pressures &lt; 103 MPa (15000 psi)</i></p> <p>2-position, 6-port valve (SST) 2-position, 10-port valve (SST) 6-position, 7-port valve (SST)</p> <p>The rotor seal in the valve pod is suitable for pH values 0 - 14.</p>	<p>6730.0006 6730.0026 6730.0016</p>
<p><i>Biocompatible TitanHT™ column switching valves,</i> <i>suitable for pressures &lt; 103 MPa (15000 psi)</i></p> <p>2-position, 6-port valve (Ti) 2-position, 10-port valve (Ti) 6-position, 7-port valve (Ti)</p> <p>The rotor seal in the valve pod is suitable for pH values 0 - 14.</p>	<p>6730.0031 6730.0032 6730.0030</p>
<p><i>TitanHT™ column switching valve,</i> <i>suitable for pressures &lt; 125 MPa (18130 psi)</i></p> <p>6-position, 7-port valve (SST)</p> <p>The rotor seal in the valve pod is suitable for pH values 0 - 10.</p>	<p>6730.0050</p>

\* All valve pods are shipped with appropriate fitting connections.

1. Switch the valve into the appropriate position for the change:  
In Chromeleon, select **ValveLeft** or **ValveRight** and select the position.  
— or —  
On the front panel display, show the function keys and select **Valve**. Select **Left valve** or **Right valve** and select the position:  
*2-position, 6-port or 2-position, 10-port column switching valves*  
Switch the valve into position 1-2.  
*6-position, 7-port column switching valve*  
Switch the valve into position 1.
2. Disconnect all liquid lines connected to the column switching valve.
3. The replacement procedure depends on the valve type. Continue with the steps that are appropriate for your valve.
  - ◆ TitanHT column switching valve: Follow the steps on page 102.
  - ◆ TitanHP column switching valve: Follow the steps on page 103.

### TitanHT Column Switching Valve

4. Unscrew and remove the locking ring (spanner). Unscrew the spanner using only your hand. Do not use a wrench.

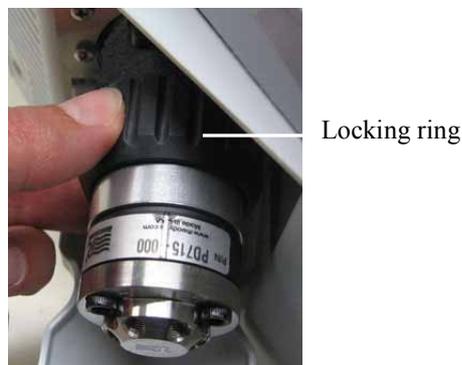


Fig. 46: Removing the spanner

5. Grasp the pod and pull out firmly to remove the pod from the valve drive body.
6. Align the locating pin on the replacement pod with the matching opening in the valve drive body.

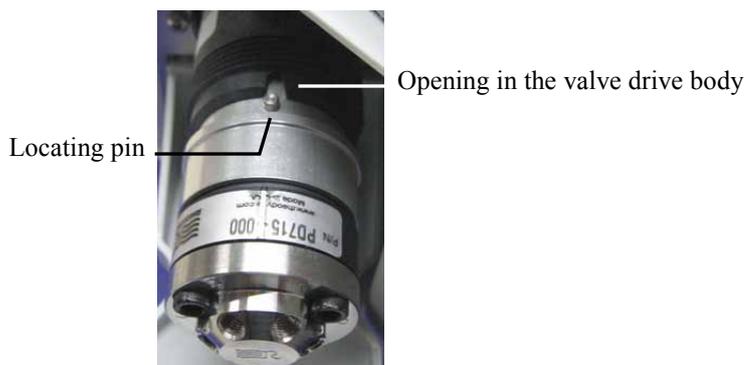


Fig. 47: Aligning the valve pod

7. Push the pod completely into the valve drive body.  
If you cannot push the pod completely into the valve drive body, refer to the Troubleshooting Tip (→ page 103).
8. Tighten the spanner firmly with your hand only (without using any tool). If the spanner is too tight, the valve may not switch. If you attempt to switch the valve, a message appears, for example, **Right (or Left) valve moving timeout error**.
9. When the valve is replaced, the rotor seal is also replaced. Therefore, in Chromeleon, update the service information for the rotor seal. Perform the **LeftRotorSealChanged** command or **RightRotorSealChanged** command as appropriate.

### Troubleshooting Tip

If you cannot push the pod completely into the valve drive body, the position of the valve coupling does not match the position of the valve drive.

1. Switch the valve into another position and try again.
2. If this does not help, turn the pod in the valve drive body until the valve coupling locks in place in the drive. Continue turning to align the locating pin on the pod with the opening in the valve drive body, and then push the pod completely into the body.

### TitanHP Column Switching Valve

4. Unscrew and remove the locking ring (spanner). Unscrew the spanner using only your hand. Do not use a wrench. Grasp the pod and pull out firmly to remove the pod from the valve drive body.



*Fig. 48: Removing the spanner*

To facilitate removing the valve pod, you may use the so-called pod popper. Place the tab of the popper into one of the drain holes on the stator ring. Unscrew the spanner (using only your hand) while holding the popper in place with pressure. This will force the pod out. Unscrew the spanner until the pod is completely removed from the valve drive body.



*Fig. 49: Pod popper*

5. Push the pod completely into the valve drive body.  
Be sure to install the pod in the correct orientation. Align the large slot in the pod with the matching runner in the valve drive body.

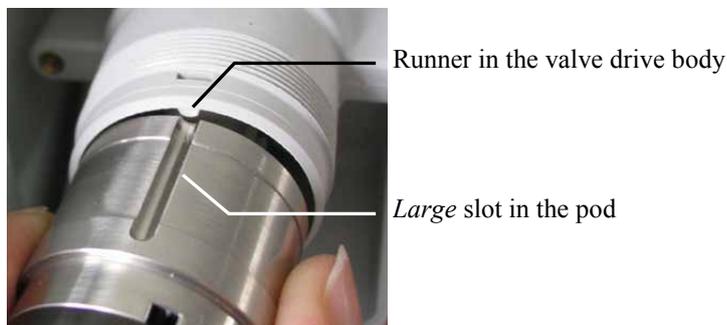


Fig. 50: Installing the column switching valve

If you cannot push the pod completely into the valve drive body, refer to the Troubleshooting Tip (see further down in this section).

6. Tighten the spanner firmly with your hand only (without using any tool). If the spanner is too tight, the valve may not switch. If you attempt to switch the valve, a message appears, for example, **Right** (or **Left**) **valve moving timeout error**.
7. When the valve is replaced, the rotor seal is also replaced. Therefore, in Chromeleon, update the service information for the rotor seal. Perform the **LeftRotorSealChanged** command or **RightRotorSealChanged** command as appropriate.

### Troubleshooting Tip

If you cannot push the pod completely into the valve drive body, the position of the valve coupling does not match the position of the valve drive.

1. Switch the valve into another position and try again.
2. If this does not help, the valve coupling is not aligned properly. Turn the coupling by hand until you can push the pod completely into the body.

### 7.3.3 Replacing the Valve Stator

Stator for	Part No.
<i>TitanHP™ column switching valves</i> <i>suitable for pressures &lt; 41 MPa (6000 psi)</i> 2-position, 6-port switching valve (SST) 2-position, 10-port switching valve (SST) 6-position, 7-port switching valve (Ti)	6722.9011 6722.9021 6722.9031
<i>Biocompatible TitanHP™ column switching valves (PEEK)</i> <i>suitable for pressures &lt; 34 MPa (5000 psi)</i> 2-position, 6-port switching valve (PEEK) 2-position, 10-port switching valve (PEEK)	6723.9011 6723.9021
<i>TitanHT™ column switching valves</i> <i>suitable for pressures &lt; 103 MPa (15000 psi)</i> 2-position, 6-port switching valve (SST) 2-position, 10-port switching valve (SST) 6-position, 7-port switching valve (SST)	6840.0011 6730.0028 6730.0018
<i>Biocompatible TitanHT™ column switching valves,</i> <i>suitable for pressures &lt; 103 MPa (15000 psi)</i> —and— <i>TitanHT™ column switching valve,</i> <i>suitable for pressures &lt; 125 MPa (18130 psi)</i> Replace the valve pod (→ page 100).	

1. Remove the three stator screws located in the stator. Remove the screws simultaneously to avoid that the stator gets jammed.



Fig. 51: Stator screws

2. Remove the stator from the valve body.
3. Mount the replacement stator on the valve so that the stator locating pins in the valve body enter the matching holes in the stator.
4. Tighten all stator screws hand-tight in turns, and then tighten the screws firmly (no more than 0.7 Nm).

### 7.3.4 Rotor Seal and Stator Face Seal

The valve type *and* the pH value of the application determine the type of seals:

Description	Part No.
<p><i>Rotor Seal kit<sup>1</sup> for TitanHT™ valves, for pressures &lt; 41 MPa (6000 psi) and pH values &lt; 10</i></p> <p>2-position, 6-port switching valve (SST) 2-position, 10-port switching valve (SST) 6-position, 7-port switching valve (Ti)</p>	<p>6722.9012 6722.9022 6722.9032</p>
<p><i>Rotor Seal and Stator Face Seal kit<sup>2</sup> for TitanHP™ valves, for pressures &lt; 41 MPa (6000 psi) and pH values &gt; 10</i></p> <p>2-position, 6-port switching valve (SST)* 2-position, 10-port switching valve (SST)*</p> <p>* <i>Tip:</i> There will be an increase in dead volume with this two-piece seal.</p>	<p>6722.9014 6722.9024</p>
<p><i>Rotor Seal and Stator Face Seal kit<sup>2</sup> for biocompatible TitanHP™ valves (PEEK), for pressures &lt; 34 MPa (5000 psi) and pH values 0 - 14</i></p> <p>2-position, 6-port switching valve (PEEK) 2-position, 10-port switching valve (PEEK)</p>	<p>6722.9014 6722.9024</p>
<p><i>Rotor Seal kit<sup>1</sup> for TitanHT™ valves, for pressures &lt; 103 MPa (15000 psi) and pH values 0 - 14</i></p> <p>2-position, 6-port switching valve (SST) 2-position, 10-port switching valve (SST) 6-position, 7-port switching valve (SST)</p>	<p>6730.0007 6730.0027 6730.0017</p>
<p><i>Rotor seal for biocompatible TitanHT™ column switching valves, suitable for pressures &lt; 103 MPa (15000 psi) —and— TitanHT™ column switching valve, suitable for pressures &lt; 125 MPa (18130 psi) Replace the valve pod (→ page 100).</i></p>	

<sup>1</sup> The kit includes a rotor seal, hexagon wrench, and installation instructions. For information about how to replace the rotor seal, see section 7.3.4.1.

<sup>2</sup> The kit includes a rotor seal, stator face seal, hexagon wrench, and installation instructions. For information about how to replace the rotor seal and the stator face seal, see section 7.3.4.2 (→ page 108).

Observe the following precautions when replacing the seals:

- To avoid scratches on the valve surfaces, do not use pointed or sharp-edged tools to remove or install a seal. Even minute scratches may result in poor sealing performance of the valve.
- When mounting a new seal, be careful to avoid contamination on the valve parts. Even minute particles may cause damage to the valve and result in poor sealing performance.

#### 7.3.4.1 Replacing the Rotor Seal

1. Remove the stator screws located in the stator (→ Fig. 51, page 105), and then remove the stator from the valve body.
2. Remove the rotor seal. Observe the precautions on page 108.
3. Mount the replacement rotor seal on the valve body with the grooves facing the stator. The three pins on the shaft assembly fit into the matching holes in the rotor seal only one way. Also observe the information on page 108.
4. Reinstall the stator (→ page 105).
5. Update the service information in Chromeleon. Perform the **LeftRotorSealChanged** command or **RightRotorSealChanged** command as appropriate.

#### 7.3.4.2 Replacing the Rotor Seal and Stator Face Seal

1. Remove the stator screws located in the stator (→ Fig. 51, page 105), and then remove the stator from the valve body.
2. Remove the rotor seal. Observe the precautions on page 108.
3. Mount the replacement rotor seal on the valve body with the grooves facing the stator. The three pins on the shaft assembly fit into the matching holes in the rotor seal only one way (see the installation instructions shipped with the kit). Also observe the information on page 108.
4. Remove the old stator face seal from the stator. Observe the precautions on page 108.
5. Mount the replacement stator face seal on the stator. The three pins on the seal fit into the matching holes in the stator only one way. Also observe the information on page 108.
6. Reinstall the stator (→ page 105).
7. Update the service information in Chromeleon. Perform the **LeftRotorSealChanged** command or **RightRotorSealChanged** command as appropriate.

## 7.4 Replacing the Main Power Fuses

**STOP** **Warning:** Turn off the TCC. Disconnect the power cord from its source.

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

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

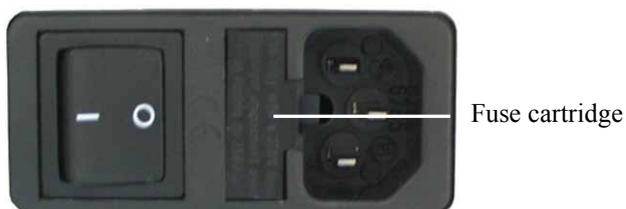


Fig. 52: Fuse cartridge

2. Replace the fuses.

**STOP** **Warning:** Always install two fuses. Use only the fuses indicated in the following table.

**STOP** **Avertissement:** Installez toujours deux nouveaux fusibles. Utilisez uniquement les fusibles indiqués ci-dessous.

Description	Part No.
Fuse, 2A, slow-blow (5 x 20 mm)	Included in Fuses Kit (part no. 6710.9001) For information about the kit, see section 9.3 (→ page 120).

3. Reinstall the fuse cartridge.
4. Reconnect the power cord to its source. Turn on the power to the TCC.

## 7.5 Updating the TCC Firmware

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

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

- *Firmware version installed in the TCC*
  - Turn on the TCC by pressing the power switch on the rear of the TCC. General information about the TCC appears on the display, including the firmware version.
  - On the TCC display, select the Main menu and **Information** (→ page 71), and then select **System** and **Firmware version**.
- *Firmware version in Chromeleon*

In the Windows Explorer, locate the **IQReport.log** file in the **IQ** folder of your Chromeleon installation. In the file, search for UM3\_TCC\_RS.hex.

 **Tip:** When updating the TCC firmware from Chromeleon, this information will also be provided during the download (see further down in this section).

Whenever a new firmware version is released for the TCC, the new version will be provided with the next Chromeleon Service Release and described in the release notes.

The new firmware will not be downloaded automatically to the TCC when you install a Chromeleon Service Release. To update the firmware in the detector, follow these steps:

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

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

1. Before you begin, verify that
  - ◆ The TCC is connected in Chromeleon.
  - ◆ The Chromeleon server is in running idle mode. All processes on the Chromeleon server PC and in Chromeleon have been stopped.
2. Start the **Server Configuration** program (→ page 37).
3. Right-click the TCC in the timebase and click Properties on the menu.

4. On the **General** page (→ page 38), click **Firmware Download**. A message displays the firmware version that is currently installed in the TCC and the version that will be downloaded from Chromeleon.

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

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

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

If the download from Chromeleon is not successful, the related messages appear in the Audit Trail. In this case, turn the TCC off and on. Repeat the download as described above. If the download fails again, contact Thermo Fisher Scientific Service for Dionex HPLC Products.



## 8 Technical Information

<b>Temperature range:</b> TCC-3000RS TCC-3000SD	5 °C to 110 °C, max. 18 °C below ambient 5 °C to 80 °C, max. 18 °C below ambient
<b>Temperature Accuracy (Column Chamber):</b>	±0.5 °C
<b>Temperature Stability (Column chamber):</b>	±0.1 °C
<b>Temperature precision (Column chamber):</b>	±0.1 °C
<b>Column capacity:</b>	Up to 12 columns, depending on the column length Column length: max. 300 mm
<b>Heat up time (column chamber):</b>	from 20 °C to 50 °C in 12 minutes (typically) at an ambient temperature of 25 °C
<b>Cool down time (column chamber):</b>	from 50 °C to 20 °C in 15 minutes (typically) at an ambient temperature of 25 °C
<b>Temperature range of post-column cooler:</b> (TCC-3000RS only)	5 °C to 110 °C (settable) Min. 40 °C below the column chamber temperature (column temperature: 100 °C, water as eluent, flow rate: 3 mL/min)
<b>Control:</b>	All functions software-controlled via USB
<b>I/O interfaces:</b>	2 digital inputs 2 programmable relay outputs
<b>Column switching valves:</b>	1 or 2 switching valves, depending on the pressure range 2-position, 6-port valve 2-position, 10-port valve 6-position, 7-port valve
<b>Wetted parts:</b>	Column switching valve (TitanHT: SST, 125 MPa/18,130 psi): SST and Vespel® Column switching valve (TitanHT: SST/Ti, 103 MPa/15000 psi): SST and PEEK/Ti and PEEK Column switching valve (TitanHP: SST/Ti, 41 MPa/6000 psi): SST and Vespel/Ti and Vespel Column switching valve (TitanHP, PEEK): PEEK Biocompatible pre-column heater: Fluorinated Sol-Gel-Nanocomposite
<b>Safety features:</b>	Humidity sensor and gas sensor Temperature control and temperature sensors
<b>User input/display:</b>	LCD indicating system parameters Standby button 3 LEDs (Power, Connected, and Status) for status monitoring 4 function keys for operation during initial installation and maintenance

<b>GLP features:</b>	Electronic identification system for 4 columns In Chromeleon: Full support of automatic equipment qualification (AutoQ™ routines) and System Wellness monitoring All system parameters are recorded in the Chromeleon Audit Trail.										
<b>Power requirements:</b>	100 - 120 V, 60 Hz; 200 - 240 V, 50 Hz; max. 150 VA										
<b>Emission sound pressure level:</b>	Typically < 65 dB(A) in 1-m distance										
<b>Environmental conditions:</b>	<table> <tr> <td>Range of use:</td> <td>Indoor use</td> </tr> <tr> <td>Temperature:</td> <td>10 °C to 35 °C (50 to 95 °C)</td> </tr> <tr> <td>Air humidity:</td> <td>80% relative humidity, non-condensing</td> </tr> <tr> <td>Overvoltage category:</td> <td>II</td> </tr> <tr> <td>Pollution degree:</td> <td>2</td> </tr> </table>	Range of use:	Indoor use	Temperature:	10 °C to 35 °C (50 to 95 °C)	Air humidity:	80% relative humidity, non-condensing	Overvoltage category:	II	Pollution degree:	2
Range of use:	Indoor use										
Temperature:	10 °C to 35 °C (50 to 95 °C)										
Air humidity:	80% relative humidity, non-condensing										
Overvoltage category:	II										
Pollution degree:	2										
<b>Dimensions (h × w × d):</b>	19 x 42 x 51 cm (7.5 x 16.5 x 20 inch)										
<b>Weight</b>	TCC-3000SD: 12.8 kg (28.2 lbs), no column switching valves installed TCC-3000RS: 13.0 kg (28.7 lbs), no column switching valves installed										

Technical information: September 2013

All technical specifications are subject to change without notice.

## 9 Accessories, Consumables, and Spare Parts

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

### 9.1 Standard Accessories

The following standard accessories are shipped with the instrument (subject to change without notice). Some parts listed in the following tables are included in one of the spare part kits. For information about these kits, see section 9.3 (→ page 120).

The part number always refers to the packing unit. Unless otherwise stated, the packing unit is 1 unit. For more information, contact the Thermo Fisher Scientific sales organization for Dionex HPLC Products.

Description	Part No.	Qty in the accessories kit
<b>Accessories kit of TCC-3000SD, including:</b>		
Fuse, 6.3A, slow-blow (5 x 20 mm)	Included in 6710.9001	1
Fuse, 2A, slow-blow (5 x 20 mm)	Included in 6710.9001	2
Column ID	Included in 6710.1505	2
Column clip (= pack of 6 clips) for columns with an outer diameter of < 8 mm	6722.0290	1
Hexagon wrench (size 2.5 mm)	6146.2625	1
USB cable, type A to type B, high speed USB 2.0 (cable length: 1 m)	6035.9035	1

Description	Part No.	Qty in the accessories kit
<b>Accessories of TCC-3000RS, including:</b>		
Fuse, 6.3A, slow-blow (5 x 20 mm)	Included in 6710.9001	1
Fuse, 2A, slow-blow (5 x 20 mm)	Included in 6710.9001	2
Column ID	Included in 6710.1505	2
Column clip (= pack of 6 clips) for columns with an outer diameter of < 8 mm	6722.0290	1
Pre-column heater (2 µL), SST with Viper connectors (for pressures up to 125 MPa)	6722.0530	1
Post-column cooler insert SST with Viper connectors (thermally effective volume: 2 µL, total volume: 5 µL)	6730.0008	1
Hexagon wrench (size 2.5 mm)	6146.2625	1
USB cable, type A to type B, high speed USB 2.0 (cable length: 1 m)	6035.9035	1

## 9.2 Optional Accessories

Column Switching Valves	Part No.
To fit the TCC with column switching valves, you need the appropriate valve drive (actuator) and pod.	
Valve Drive (Actuator) for	
<i>TitanHP™ column switching valve, suitable for pressures &lt; 41 MPa (6000 psi)</i> Installation kit (including installation instructions) for Right-side installation Left-side installation	6730.0003 6730.0004
<i>TitanHT™ column switching valve, suitable for pressures &lt; 125 MPa (18130 psi)</i> Installation kit (including installation instructions) for Right-side installation Left-side installation	6730.0001 6730.0002
Pods for	
<i>TitanHP™ column switching valve, suitable for pressures &lt; 41 MPa (6000 psi)</i> 2-position, 6-port switching valve (SST)* 2-position, 10-port switching valve (SST)* 6-position, 7-port switching valve (Ti) The rotor seal in the valve pod is suitable for pH values < 10. * To use these valves for applications with pH values > 10, replace this rotor seal with the PEEK rotor seal and stator face seal (→ page 107).	6722.9013 6722.9023 6722.9035
<i>TitanHP™ column switching valves, biocompatible suitable for pressures &lt; 34 MPa (5000 psi)</i> 2-position, 6-port switching valve (PEEK) 2-position, 10-port switching valve (PEEK) The rotor seal in the valve pod is suitable for pH values 0 - 14.	6723.9013 6723.9023
<i>TitanHT™ column switching valve, suitable for pressures &lt; 103 MPa (15000 psi)</i> 2-position, 6-port switching valve (SST) 2-position, 10-port switching valve (SST) 6-position, 7-port switching valve (SST) The rotor seal in the valve pod is suitable for pH values 0 - 14.	6730.0006 6730.0026 6730.0016
<i>TitanHT™ column switching valve, biocompatible, suitable for pressures &lt; 103 MPa (15000 psi)</i> 2-position, 6-port switching valve (Ti) 2-position, 10-port switching valve (Ti) 6-position, 7-port switching valve (Ti) The rotor seal in the valve pod is suitable for pH values 0 - 14.	6730.0031 6730.0032 6730.0030

Column Switching Valves		Part No.
Pods for (Cont'd)	<i>TitanHT™ column switching valve, suitable for pressures &lt; 125 MPa (18130 psi)</i> 6-position, 7-port switching valve (SST) The rotor seal in the valve pod is suitable for pH values 0 - 10.	6730.0050

Pre-Column heaters		Part No.
1 µL pre-column heater SST, with Viper connectors (pressures up to 125 MPa)		6722.0510
2 µL pre-column heater: SST, with Viper connectors (pressures up to 125 MPa) Biocompatible (suitable for the pH range 2-10 and pressures up to 34 MPa)		6722.0530 6723.0232
7 µL pre-column heater: SST, with Viper connectors (pressures up to 125 MPa) Biocompatible (suitable for the pH range 2-10 and pressures up to 34 MPa)		6722.0540 6723.0242
11 µL pre-column heater: SST, with Viper connectors (pressures up to 125 MPa) Biocompatible (suitable for the pH range 2-10 and pressures up to 34 MPa)		6722.0550 6723.0252

Miscellaneous		Part No.
Drain kit for UltiMate 3000 systems The kit includes all required components for system drainage and detailed installation instructions.		6040.0005
Column clips for columns with an outer diameter of 8-12 mm Column clip (= pack of 6 clips) for columns with an outer diameter of 8-12 mm		6722.0280
Signal cable, 6-pin Mini-DIN cable (5 m)		6000.1004

<b>Capillary kits (Viper) for UltiMate 3000</b>		<b>Part No.</b>
RSLC Systems (Single stack setup)	Kit for UltiMate 3000 RSLC systems with LPG-3400RS or DGP-3600RS The kit includes 3 Viper capillaries (SST; one each of 0.13 x 250 mm, 0.13 x 350 mm, and 0.18 x 450 mm I.D. x L).	6040.2301
	Kit for UltiMate 3000 RSLC systems with HPG-3200RS or HPG-3400RS The kit includes 3 Viper capillaries (SST; one each of 0.13 x 250 mm, 0.13 x 350 mm, and 0.18 x 550 mm I.D. x L).	6040.2308
	Kit for UltiMate 3000 Bio RS systems with UltiMate 3000 RS pump The kit includes 3 Viper capillaries, MP35N <sup>®</sup> (one each of 1x 0.10 x 250 mm, 0.10 x 350 mm, and 0.18 x 550 mm (I.D. x L)).	6841.2301
Standard systems (Single stack setup)	Kit for UltiMate 3000 standard systems with ISO-3100SD, LPG-3400SD, or DGP-3600SD The kit includes 3 Viper capillaries (SST; one each of 0.18 x 250 mm, 0.18 x 350 mm, and 0.18 x 450 mm I.D. x L).	6040.2302
	Kit for UltiMate 3000 standard systems with HPG-3200SD or HPG-3400SD The kit includes 3 Viper capillaries (SST; one each of 0.18 x 250 mm, 0.18 x 350 mm, and 0.18 x 550 mm I.D. x L).	6040.2309
Capillary kit, Viper, standalone OAS-3x00TXRS	The kit includes the following Viper capillaries for connecting UltiMate 3000 modules in a system with a standalone OAS-3x00TXRS: 4 Viper capillaries, stainless steel (1 each of 0.10 x 65 mm, 0.10 x 250 mm, 0.13 x 750 mm, and 0.18 x 750 mm (I.D. x L))	6845.2301A
Capillary kit, Viper, for LPG-3400XRS	The kit includes the following Viper capillaries for connecting UltiMate 3000 modules in a system with LPG-3400XRS: 2 Viper capillaries, SST (1 each of 0.1 x 350 mm and 0.13 x 550 mm (I.D. x L)) 1 Viper capillary, PEEK (0.065 x 250 mm (I.D. x L))	6043.2301

### 9.3 Consumables and Spare Parts

The part number always refers to the packing unit. Unless otherwise stated, the packing unit is 1 unit. For more information, contact the Thermo Fisher Scientific sales organization for Dionex HPLC Products.

Description	Part No.
1 $\mu$ L pre-column heater SST, with Viper connectors (pressures up to 125 MPa)	6722.0510
11 $\mu$ L pre-column heater: SST, with Viper connectors (pressures up to 125 MPa) Biocompatible (suitable for the pH range 2-10 and pressures up to 34 MPa)	6722.0550 6723.0252
2 $\mu$ L pre-column heater: SST, with Viper connectors (pressures up to 125 MPa) Biocompatible (suitable for the pH range 2-10 and pressures up to 34 MPa)	6722.0530 6723.0232
7 $\mu$ L pre-column heater: SST, with Viper connectors (pressures up to 125 MPa) Biocompatible (suitable for the pH range 2-10 and pressures up to 34 MPa)	6722.0540 6723.0242
Capillaries, kit of capillaries for LPG-3400XRS The kit contains the following Viper capillaries for connecting UltiMate 3000 modules in a system with LPG-3400XRS: 2 Viper capillaries, SST (1 each of 0.1 x 350 mm and 0.13 x 550 mm (I.D. x L)) 1 Viper capillary, PEEK (0.065 x 250 mm (I.D. x L))	6043.2301
Capillaries, kit of capillaries, for UltiMate 3000 systems with standalone OAS-3x00TXRS The kit includes the following Viper capillaries for connecting UltiMate 3000 modules in a system with a standalone OAS-3x00TXRS: 4 Viper capillaries, stainless steel (1 each of 0.10 x 65 mm, 0.10 x 250 mm, 0.13 x 750 mm, and 0.18 x 750 mm (I.D. x L))	6845.2301A
Capillaries, kit of capillaries for UltiMate 3000 Bio RS systems with UltiMate 3000 RS pump The kit includes 3 Viper capillaries, MP35N (one each of 0.10 x 250 mm, 0.10 x 350 mm, and 0.18 x 550 mm (I.D. x L)).	6841.2301
Capillaries, kit of capillaries for UltiMate 3000 RSLC systems with LPG-3400RS or DGP-3600RS The kit includes 3 Viper capillaries, SST (one each of 0.13 x 250 mm, 0.13 x 350 mm, and 0.18 x 450 mm I.D. x L).	6040.2301
Capillaries, kit of capillaries for UltiMate 3000 RSLC systems with HPG-3200RS or HPG-3400RS The kit includes 3 Viper capillaries, SST (one each of 0.13 x 250 mm, 0.13 x 350 mm, and 0.18 x 550 mm I.D. x L).	6040.2308
Capillaries, kit of capillaries for UltiMate 3000 SD systems with ISO-3100SD, LPG-3400SD, or DGP-3600SD The kit includes 3 Viper capillaries, SST (one each of 0.18 x 250 mm, 0.18 x 350 mm, and 0.18 x 450 mm I.D. x L).	6040.2302

Description	Part No.
Capillaries, kit of capillaries for UltiMate 3000 SD systems with HPG-3200SD or HPG-3400SD The kit includes 3 Viper capillaries, SST (one each of 0.18 x 250 mm, 0.18 x 350 mm, and 0.18 x 550 mm I.D. x L).	6040.2309
Capillary (0.25 x 1.58 mm) (I.D. x O.D.) , SST, including fitting connections e.g., for the connection from the WPS-3000SL Analytical to the TCC-3000	6820.2418
Cleaning swabs (10 swabs)	6040.0006
Column brackets (pack of 2 brackets)	6720.0601
Column clip (= pack of 6 clips) for columns with an outer diameter of < 8 mm	6722.0290
Column clip (= pack of 6 clips) for columns with an outer diameter of 8-12 mm	6722.0280
Column ID (pack of 5 IDs)	6710.1505
Drain kit for UltiMate 3000 systems The kit includes all required components for system drainage and detailed installation instructions.	6040.0005
Ferrules and Fittings kit (RH) for SST column switching valve The kit includes 6 ferrules and 6 fitting nuts (long).	6822.0011
Ferrules and Fittings kit, 1/16", PEEK (RheFlex) for biocompatible switching valve (PEEK). The kit includes 10 fitting nuts (short) and 10 ferrules.	6723.0010
Ferrules, 1/16", PEEK (RheFlex), for biocompatible switching valve (PEEK) (pack of 10)	6723.0011
Fuses kit TCC-3x00, including: 10 fuses (2 A, slow-blow, 5 x 20 mm) 5 fuses (6.3 A, slow-blow, 5 x 20 mm)	6710.9001
Menu pen	6300.0100
(Double) open-end wrench (size 1/4" x 5/16")	6000.0051
<i>Pod for biocompatible TitanHP™ valves (PEEK), suitable for pressures &lt; 34 bar (5000 psi)</i> 2-position, 6-port switching valve (PEEK) 2-position, 10-port switching valve (PEEK) The rotor seal in the valve pod is suitable for pH values 0 - 14.	6723.9013 6723.9023
<i>Pod for biocompatible TitanHT™ column switching valve, suitable for pressures &lt; 103 MPa (15000 psi)</i> 2-position, 6-port switching valve (Ti) 2-position, 10-port switching valve (Ti) 6-position, 7-port switching valve (Ti) The rotor seal in the pod is suitable for pH values 0 - 14.	6730.0031 6730.0032 6730.0030

Description	Part No.
<p><i>Pod for TitanHP™ column switching valves, suitable for pressures &lt; 41 MPa (6000 psi)</i>                      2-position, 6-port switching valve (SST)*                      2-position, 10-port switching valve (SST)*                      6-position, 7-port switching valve (Ti)*                      The rotor seal in the valve pod is suitable for pH values &lt; 10.                      * To use these valves for applications with pH values &gt; 10, replace this rotor seal with the PEEK rotor seal and stator face seal (→ page 107).</p>	6722.9013 6722.9023 6722.9035
<p><i>Pod for TitanHT™ column switching valves suitable for pressures &lt; 103 MPa (15000 psi)</i>                      2-position, 6-port switching valve (SST)                      2-position, 10-port switching valve (SST)                      6-position, 7-port switching valve (SST)                      The rotor seal in the pod is suitable for pH values 0 - 14.</p>	6730.0006 6730.0026 6730.0016
<p><i>Pod for TitanHT™ column switching valves suitable for pressures &lt; 125 MPa (18130 psi)</i>                      6-position, 7-port switching valve (SST)                      The rotor seal in the valve pod is suitable for pH values 0 - 10.</p>	6730.0050
<p>Post-column cooler insert, SST, Viper                      (thermally effective volume: 2 µL, total volume: 5 µL)</p>	6730.0008
<p>Power cord, Australia, China</p>	6000.1060
<p>Power cord, Denmark</p>	6000.1070
<p>Power cord, EU</p>	6000.1000
<p>Power cord, India/SA</p>	6000.1090
<p>Power cord, Italy</p>	6000.1040
<p>Power cord, Japan</p>	6000.1050
<p>Power cord, Switzerland</p>	6000.1030
<p>Power cord, UK</p>	6000.1020
<p>Power cord, US</p>	6000.1001
<p><i>Rotor Seal and Stator Face Seal for TitanHP™ column switching valves, suitable for pressures &lt; 41 MPa (6000 psi) and pH values &gt; 10:</i>                      2-position, 6-port switching valve (SST)                      2-position, 10-port switching valve (SST)                      The kit includes a rotor seal, stator face seal, hexagon wrench, and installation instructions.  <i>Note:</i> There will be an increase in dead volume with this two-piece seal.</p>	6722.9014 6722.9024
<p><i>Rotor Seal and Stator Face Seal kit for biocompatible TitanHP™ column switching valves (PEEK), suitable for pressures &lt; 34 MPa (5000 psi) and pH values 0 - 14:</i>                      2-position, 6-port switching valve (PEEK)                      2-position, 10-port switching valve (PEEK)                      The kit includes a rotor seal, stator face seal, hexagon wrench, and installation instructions.</p>	6722.9014 6722.9024

Description	Part No.
<p><i>Rotor Seal kit for biocompatible TitanHT™ column switching valves, suitable for pressures &lt; 103 MPa (15000 psi) and pH values 0 - 14</i>  <i>TitanHT™ column switching valve (6 positions, 7 ports)</i>  <i>suitable for pressures &lt; 125 MPa (18130 psi) and pH values 0 - 10</i>                      With this valve, you have to replace the pod (→ page 100).</p>	
<p><i>Rotor Seal kit for TitanHP™ column switching valves, suitable for pressures &lt; 41 MPa (6000 psi) and pH values &lt; 10</i>                      2-position, 6-port switching valve (SST)                      2-position, 10-port switching valve (SST)                      6-position, 7-port switching valve (Ti)                      The kit includes a rotor seal, hexagon wrench, and installation instructions.</p>	6722.9012 6722.9022 6722.9032
<p><i>Rotor Seal kit for TitanHT™ column switching valves, suitable for pressures &lt; 103 MPa (15000 psi) and pH values 0 - 14</i>                      2-position, 6-port switching valve (SST)                      2-position, 10-port switching valve (SST)                      6-position, 7-port switching valve (SST)                      The kit includes a rotor seal, hexagon wrench, and installation instructions.</p>	6730.0007 6730.0027 6730.0017
Signal cable (6-pin Mini-DIN, 5 m)	6000.1004
<p><i>Stator for biocompatible TitanHT™ column switching valves, suitable for pressures &lt; 103 MPa (15000 psi) and pH values 0 - 14</i>  <i>TitanHT™ column switching valve (6 positions, 7 ports)</i>  <i>suitable for pressures &lt; 125 MPa (18130 psi) and pH values 0 - 10</i>                      With this valve, you have to replace the pod (→ page 100).</p>	
<p><i>Stator for biocompatible TitanHP™ column switching valves, suitable for pressures &lt; 34 MPa (5000 psi)</i>                      2-position, 6-port switching valve (PEEK)                      2-position, 10-port switching valve (PEEK)</p>	6723.9011 6723.9021
<p><i>Stator for TitanHP™ column switching valves, suitable for pressures &lt; 41 MPa (6000 psi)</i>                      2-position, 6-port switching valve (SST)                      2-position, 10-port switching valve (SST)                      6-position, 7-port switching valve (Ti)</p>	6722.9011 6722.9021 6722.9031
<p><i>Stator for TitanHT™ column switching valves, suitable for pressures &lt; 103 MPa (15000 psi)</i>                      2-position, 6-port switching valve (SST)                      2-position, 10-port switching valve (SST)                      6-position, 7-port switching valve (SST)</p>	6840.0011 6730.0028 6730.0018
USB cable, type A to type B, high speed USB 2.0 (cable length: 0.5 m)	6720.8910
USB cable, type A to type B, high speed USB 2.0 (cable length: 1 m)	6035.9035



## 10 Appendix - Digital I/O (Pin Assignment)

The two digital I/O ports provide two digital inputs and two relay outputs that can be used to exchange digital signals with external devices. The port numbering on the rear panel corresponds to the numbering of the relays and digital inputs in Chromeleon.

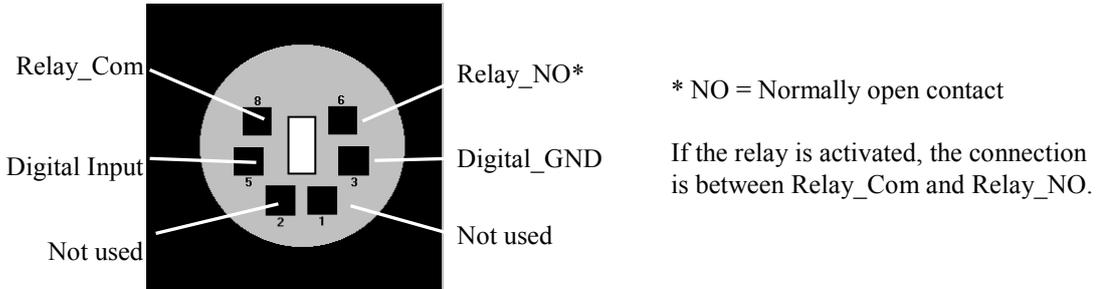


Fig. 53: Digital I/O (view from the rear)

	Description
Digital Input ↔ Digital GND	0 to +5V
Relay_Com ↔ Relay_NO	Switching voltage: 100V DC; switching current: 0.25 A Carry current: 0.5 A; Switching capacity: 3 W Contact resistance: max. 200 mOhm

Fig. 54: Digital I/O

To connect an external device to the digital I/O ports on the rear panel, use the appropriate mini-DIN cable (part no. 6000.1004). The table lists the functions assigned to the connector pins and the color and label of the cable wire connected to each pin.

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

Fig. 55: 6-pin Mini-DIN port and cable



## 11 Index

<p style="text-align: center;"><b>A</b></p> <p>Accessories</p> <p style="padding-left: 20px;">Optional ..... 117</p> <p style="padding-left: 20px;">Standard ..... 115</p> <p style="text-align: center;"><b>B</b></p> <p>Back ..... 69</p> <p>Batch ..... 66</p> <p style="text-align: center;"><b>C</b></p> <p>Cancel ..... 69</p> <p>Capillaries (Connecting) ..... 46</p> <p>Capillaries (Viper) ..... 46</p> <p>Chromleon ..... 26, 61</p> <p style="padding-left: 20px;">Automated Control ..... 65</p> <p style="padding-left: 20px;">Connect ..... 61</p> <p style="padding-left: 20px;">Create Program ..... 65</p> <p style="padding-left: 20px;">Direct Control ..... 62</p> <p style="padding-left: 20px;">Installation Program ..... 35</p> <p style="padding-left: 20px;">License ..... 26</p> <p style="padding-left: 20px;">Predictive Performance ..... 82</p> <p style="padding-left: 20px;">Program Wizard ..... 65</p> <p style="padding-left: 20px;">Server Configuration Program ..... 35, 37</p> <p style="padding-left: 20px;">Server Monitor ..... 35, 37</p> <p style="padding-left: 20px;">Special Functions ..... 80</p> <p style="padding-left: 20px;">TCC Configuration ..... 38</p> <p style="padding-left: 20px;">TCC Installation ..... 37</p> <p style="padding-left: 20px;">USB Driver ..... 35</p> <p>Chromleon Dialog</p> <p style="padding-left: 20px;">Components ..... 39</p> <p style="padding-left: 20px;">Configuration ..... 42</p> <p style="padding-left: 20px;">Error Levels ..... 43</p> <p style="padding-left: 20px;">General ..... 38</p> <p style="padding-left: 20px;">Inputs ..... 43</p> <p style="padding-left: 20px;">Relays ..... 43</p> <p>Column Chamber ..... 48</p> <p>Column ID ..... 24, 51, 75</p> <p>Column Identification System ..... 24, 51, 75</p> <p>Column Installation ..... 50</p> <p>Column Selection ..... 76</p> <p>Column Switching Valve ..... 22, 53, 98</p> <p>Column Switching Valve (Biocompatible) ..... 53</p> <p>Column Thermostatting</p> <p style="padding-left: 20px;">Temperature ..... 73</p> <p style="padding-left: 20px;">Turn off ..... 73</p> <p style="padding-left: 20px;">Turn on ..... 73</p> <p>Commands (Dialog Box) ..... 62</p> <p>Commands (Display) ..... 67</p> <p>Components (Dialog Box) ..... 39</p>	<p>Configuration ..... 17</p> <p style="padding-left: 20px;">Dialog Box ..... 42</p> <p style="padding-left: 20px;">Menu ..... 71</p> <p>Connection</p> <p style="padding-left: 20px;">Chromleon Computer ..... 33</p> <p style="padding-left: 20px;">Digital I/O ..... 34, 125</p> <p style="padding-left: 20px;">Power Cord ..... 34</p> <p style="padding-left: 20px;">Signal Cable ..... 34</p> <p style="padding-left: 20px;">USB ..... 33</p> <p>Consumables ..... 120</p> <p>Control</p> <p style="padding-left: 20px;">Automated ..... 61, 65</p> <p style="padding-left: 20px;">Direct ..... 61, 62</p> <p>Control (Menu) ..... 70</p> <p>Control Elements ..... 18</p> <p>Control Panel ..... 63</p> <p>Cooler Temp. Signal ..... 42</p> <p style="text-align: center;"><b>D</b></p> <p>DCMSLink ..... 44</p> <p>Device View ..... 66</p> <p>Diagnostics ..... 27, 83</p> <p>Diagnostics Messages ..... 91</p> <p>Digital I/O ..... 20, 34, 125</p> <p>Display ..... 60</p> <p style="padding-left: 20px;">Brightness ..... 78</p> <p style="padding-left: 20px;">Contrast ..... 78</p> <p style="padding-left: 20px;">Function Keys ..... 67</p> <p style="padding-left: 20px;">Power-Up ..... 59</p> <p style="padding-left: 20px;">Status Screen ..... 78</p> <p>Display &amp; Soft Keys ..... 71</p> <p>Display Filter Level ..... 63</p> <p>Drain System ..... 56</p> <p>Drainage</p> <p style="padding-left: 20px;">System ..... 56</p> <p style="padding-left: 20px;">TCC ..... 56</p> <p style="padding-left: 20px;">Valve ..... 49</p> <p style="text-align: center;"><b>E</b></p> <p>Equilibration ..... 57</p> <p>Equilibration (SmartStartup Wizard) ..... 57</p> <p>Equilibration Program ..... 57</p> <p>Equilibration Time ..... 80</p> <p>Error Levels (Dialog Box) ..... 43</p> <p style="text-align: center;"><b>F</b></p> <p>Firmware Download ..... 39, 110</p> <p>Firmware Update ..... 39, 110</p> <p>Found New Hardware Wizard ..... 36</p> <p>Front Panel Display ..... 18</p>
--	--



<b>S</b>	<b>T</b>
Safety ..... 3	TCC Display ..... 18
Safety Precautions ..... 4, 95	TCC Drainage ..... 56
Select ..... 69	Technical Information ..... 113
Sensitivity (Sensor) ..... 77	Temperature ..... 70, 71
Server Configuration Program ..... 37, 44	Temperature Signal ..... 42
Server Monitor ..... 37	Temperature Signals ..... 83
Service ..... 95	Toggle ..... 69
Column Switching Valve ..... 98	Troubleshooting ..... 87
Firmware Update ..... 110	Diagnostics Messages ..... 91
Fuse Replacement ..... 109	Messages ..... 87, 88
General Notes ..... 95	Operating Problems ..... 92
Safety Precautions ..... 95	
Valve Tightness ..... 99	<b>U</b>
Shut Down ..... 84	Unit Description
Shutdown Program ..... 84	Operating Principle ..... 16
Signal Cable ..... 34	Overview ..... 15
SmartShutdown ..... 79, 85	Unpacking ..... 29
SmartStartup ..... 57, 79	USB ..... 33
Soft Keys ..... 67	USB Configuration File ..... 36
Software Operation ..... 61	USB Port ..... 20
Solvents ..... 12	
Spare Parts ..... 120	<b>V</b>
Specification ..... 113	Valve ..... 70, 71
Standard Accessories ..... 115	Valve Drainage ..... 49
Standby Program ..... 84	Viper Capillaries ..... 46
Startup ..... 45	
Actions ..... 45	<b>W</b>
Connecting Capillaries ..... 46	Wellness ..... 27
System Equilibration ..... 57	
Stator ..... 105	
Stator Face Seal ..... 107	
Status Indicator (LED) ..... 18	
Status Screen (Display) ..... 60, 78	
Symbols ..... 3	
System ..... 71	

