



# P680 HPLC Pumps

## Operating Instructions



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Date: April 2004

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## Declaration of Conformity

**Product:** HPLC Pump  
**Type:** P680

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

- Low-Voltage Equipment Directive 73/23/EEC  
changed by 93/68/EEC
- EMC Directive 89/336/EEC  
changed by 91/263/EEC; 92/31/EEC; 93/68/EEC

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

- EN 61010-1: 1993  
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 standards:

- EN 50081-1: 1992:  
Electromagnetic Compatibility (EMC) - Generic emissions standard  
Part 1: Residential, commercial and light industry
- EN 50082-1: 1992:  
Electromagnetic Compatibility (EMC) - Generic immunity standard  
Part 1: Residential, commercial and light industry
- EN 61000-3-2: 1998  
Electromagnetic Compatibility (EMC)  
Part 3 / Section 2: Limits for harmonic current emissions

This declaration is issued for the manufacturer

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by the President, Dr. Peter Jochum.  
January 30, 2002

# Certificate



Certificate no. **CU 2271314 01**

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 GERMANY

**Manufacturer:**  
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**Test report no.:** JK/cl E 2271503 . 01 **Client Reference:** Burkhard Seyferth

**Tested to:** UL 61010A-1:2002 R4.02  
 CAN/CSA-C22.2 No. 1010.1-92+A2:97

Test object: HPLC Pumps	License Fee-Units
Model Designation: P680A, P680A LPG, P680A HPG/2, P680A HPG/4, P680P HPG	7
Rated Voltage: AC 100/120/220V or 240V, 50-60Hz	
Rated Power: 136VA	
Protection Class: I	
Enclosure: 1	7

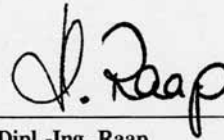
Licensed Test mark:



Signatures



Stephan Schmitt  
 President



Dipl.-Ing. Raap  
 QA Certification Officer

Date of Issue  
 (day/mo/yr)  
 02/12/2002

# Table of Contents

<b>1</b>	<b>Introduction .....</b>	<b>1</b>
1.1	How to Use This Manual .....	1
1.2	Unpacking .....	2
1.3	Intended Use.....	2
1.4	Federal Communications Commission (FCC) Note .....	3
<b>2</b>	<b>Overview.....</b>	<b>5</b>
2.1	Unit Description .....	5
2.2	Supported Configurations .....	5
2.3	Principle of Operation .....	6
2.4	Front Panel Display and Controls .....	7
2.5	Choosing the Solvents.....	10
2.6	System Wellness .....	10
2.7	Safety Precautions .....	11
<b>3</b>	<b>Installation.....</b>	<b>13</b>
3.1	Location.....	13
3.2	Electrical Connections .....	15
3.2.1	Setting the Voltage Selector.....	15
3.2.2	Replacing the Fuses.....	17
3.3	Rear Panel Connectors .....	18
3.3.1	Interfaces for Device Control.....	19
3.3.2	USB .....	19
3.3.3	Digital I/O Port.....	19
3.3.4	Pressure (Analog Pressure Output) .....	21
3.3.5	External Motorized Switching Valve (MSV) or Solvent Rack.....	21
3.3.6	RS-232 Port.....	22
3.3.7	DC Output .....	22
3.4	Fluid Connections .....	23
3.4.1	Connecting the Solvent Reservoirs .....	23
3.4.2	Connections in the Low-Pressure Section.....	28
3.4.3	Connections in the High-Pressure Section.....	29
3.4.4	Active Rear-Seal Wash System.....	31
3.4.5	Purging the Pump .....	34
3.4.6	Fluid Connections in the Purge Block/Outlet Block.....	36
3.5	Isocratic Pump.....	37
3.6	Low-Pressure Gradient Systems (LPG) .....	39
3.6.1	P680 A LPG-4.....	39
3.6.2	P680A DGP-6 .....	42
3.7	High-Pressure Gradient System (HPG).....	45
3.8	Installing the Manual Injection Valve.....	49
3.9	Selecting Solvent Types for Automatic Pre-compression Control .....	50
<b>4</b>	<b>Stand-Alone Operation .....</b>	<b>51</b>
4.1	Power-Up .....	51
4.2	Menu Structure.....	52
4.3	Main Menu .....	53
4.3.1	State Menu.....	53
4.3.2	Programs Menu .....	55
4.3.3	Diagnostics Menu.....	58

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4.3.4	Configuration Menu .....	59
4.3.4.1	TCP/IP .....	59
4.3.4.2	Options .....	60
4.3.4.3	Hardware .....	62
4.4	Starting, Holding, and Stopping a Program .....	63
4.5	Program Examples .....	65
4.6	Special Aspects of a High-Pressure Gradient System.....	69
4.6.1	Supported Gradient Combinations .....	69
4.6.2	Double Flow Mode.....	69
4.6.3	P680P HPG-2 Semi-Preparative Pump .....	70
4.7	Operation after a Power Failure .....	70
<b>5</b>	<b>Automated Control by Chromeleon .....</b>	<b>71</b>
5.1	General .....	71
5.1.1	USB Installation .....	71
5.1.2	LAN Installation.....	72
5.1.2.1	Assigning IP Properties to the Pump .....	77
5.1.2.2	Recommendations for Network Operation .....	78
5.2	Installing the Pump in Chromeleon.....	79
5.3	Synchronizing the ASI-100 with a P680A LPG-4 or P680A DGP-6 .....	88
5.4	Operation with Chromeleon .....	89
<b>6</b>	<b>Troubleshooting.....</b>	<b>95</b>
6.1	List of the Most Frequently Observed Error Messages .....	95
6.2	List of the Most Frequently Observed Problems .....	101
6.3	Chromeleon Error Messages .....	102
<b>7</b>	<b>Maintenance.....</b>	<b>105</b>
7.1	General Notes.....	105
7.2	Maintenance Intervals .....	106
7.3	Leak Sensor .....	106
7.4	Replacing the Check Valves .....	108
7.5	Pistons and Piston Seals .....	109
7.5.1	Visually Inspecting the Piston Seals for Leakage .....	111
7.5.2	Replacing the Piston Seals .....	112
7.5.2.1	Removing the Pump Heads and Pistons.....	112
7.5.2.2	Cleaning the Pistons .....	114
7.5.2.3	Removing the Piston Seals.....	114
7.5.2.4	Reinstalling the Piston, Piston Seal, and Pump Head .....	115
7.6	Mixing Chamber .....	117
7.7	Vacuum Online Degasser.....	120
7.8	Testing the Pump for Leakage (Leak Rate) .....	121
7.9	Shutting Down the Pump .....	122
<b>8</b>	<b>Optimizing the Pump for Special Applications .....</b>	<b>123</b>
8.1	Mixing Chamber Extensions .....	123
8.2	MicroFlow Kits .....	127
8.2.1	Installing and Uninstalling on a P680A LPG-4 pump .....	127
8.2.2	Installing and Uninstalling on a P680A HPG-2 or P680A HPG-4 pump .....	128

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<b>9</b>	<b>Technical Information.....</b>	<b>131</b>
<b>10</b>	<b>Accessories and Spare Parts.....</b>	<b>133</b>
10.1	Standard Accessories (included in the shipment) .....	133
10.2	Optional Accessories.....	139
10.3	Spare Parts.....	140
<b>11</b>	<b>Reference Information.....</b>	<b>143</b>
11.1	Chemical Resistance of PEEK .....	143
11.2	Solvent Miscibility .....	145
11.3	Properties of Common Solvents.....	146
11.4	Safety Information about Flammable Solvents.....	147
<b>12</b>	<b>Technical Appendix - Pinouts .....</b>	<b>149</b>
<b>13</b>	<b>Index .....</b>	<b>151</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 user. However, in order to obtain a full understanding of the P680 pumps, we recommend that you review the manual thoroughly before beginning operation.


We assume that the person using this manual is sufficiently trained in the use of analytical instrumentation and is aware of the potential hazards when using chemical solvents.


Almost all descriptions in the manual apply to all pump types in the P680 series. Therefore, the term "the pump" is used throughout the manual. If some detail applies to only one pump model, the model is identified by name.

 **Please note:** The device configuration may vary, for example, for pumps without gradient option; therefore, not all descriptions necessarily apply to your particular instrument.

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

 **Please note:** Indicates general information intended to optimize the performance of the instrument.

 **Important:** Indicates that failure to take note of the accompanying information may result in damage to the instrument.

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

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. However, Dionex assumes no responsibility and cannot be held liable for any errors, omissions, damage, or loss that might result from any use of this manual or the information contained therein. We appreciate your help in eliminating any errors that may appear in this document.

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## 1.2 Unpacking

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

**i** **Please note:** Immediately report any shipping damage to both, the incoming carrier and Dionex. Shipping insurance will compensate for the damage only if reported immediately.

**i** **Please note:** Keep the original shipping container and the packing material. They will provide excellent protection for the instrument in case of future transit. Shipping the unit in any other packaging automatically voids the product warranty.

To unpack the pump, proceed as follows:

- Place the shipping container on the floor. Remove the white accessories pack and the power cable.
- Grasp the pump by the sides. Slowly and carefully, pull pump out of the shipping container and place it on a stable surface.

**⚠ Important:** To prevent the pump from falling, lift the unit itself from the sides. Do not lift the unit by the packaging material or the front panel.

- Remove the foam inserts, and then remove the polythene packaging.
- Check off the contents of the accessory pack against the list in the Standard Accessories (included in the shipment) section, page 133. For an overview of the alternative equipment, refer to page 5.

**⚠ Caution:** When lifting or moving the P680 pump, lift only from the bottom or sides of the unit. The front panel of the pump tilts upward. Lifting the pump by the front panel may damage to the hinges.

## 1.3 Intended Use

The P680 series pumps are designed for use in analytical HPLC systems. The pumps can either be operated in stand-alone mode or controlled by the Chromeleon Chromatography Management System.

Please note that the pump may be operated only using the accessories originally supplied with the unit (→ page 133) and within its technical specifications (→ page 131).

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

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

## **1.4 Federal Communications Commission (FCC) Note**

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



## 2 Overview

### 2.1 Unit Description

The high-precision P680 HPLC pumps are high-quality modules designed for HPLC analysis as part of a Dionex Summit HPLC system. They are available in various configurations (→ Supported Configurations, page 5) and can thus be used in numerous laboratory environments. The technical specifications of all pumps meet the highest requirements for flow rate reproducibility, zero pulsation, and operational reliability.

The patented isokinetic pre-compression allows a precise and almost pulse-free flow. With flow rates ranging from 1 µl/min to 10 ml/min (analytical version) and operating pressures up to 50 MPa (7250 psi), the pump is suitable for both standard and micro HPLC.

The pump is freely programmable and thus, highly flexible, even in stand-alone operation. For example, you can create programs for gradients and flow parameters or control a motorized switching valve, etc. If a high degree of system integration is required, the pump can be controlled via the Chromeleon Chromatography Management System.

All pump parts in the flow path are made of stainless steel, PCTFE, PEEK, sapphire etc. providing optimum resistance to the most commonly used solvents and buffer solutions (→ Wetted Parts, page 132).

### 2.2 Supported Configurations

The pump is available in various configurations and can thus be used in numerous laboratory environments.

A binary high-pressure gradient system, optionally equipped with the "2 from 4" solvent selector, is available in addition to an isocratic analytical pump and the quaternary low-pressure gradient pump with integrated degasser. For semi-preparative applications, a binary high-pressure gradient pump with a maximum flow of 100 ml/min is provided.

A dual low-pressure gradient pump completes the P680 pump series. You can use this pump to run two ternary gradients independently from each other. Together with a TCC-100 Thermostatted Column Compartment with a 2-position/6-port column switching valve, this pump is the appropriate choice for applications, such as matrix separation or concentration of components. Together with a TCC-100 Thermostatted Column Compartment with 2-position/10-port column switching valve, the pump allows increasing the sample throughput by overlapping injections with offline regeneration of two matched chromatographic columns.

A dynamic mixing chamber with variable volume that can be adjusted to individual requirements offers additional flexibility.

For an overview of the currently available models, refer to the list below. Should you have any questions, please contact the Dionex Sales Department or your Dionex distributor.

Model	Part No.	Function	Options
P680A ISO	5030.0010	Isocratic pump (analytical)	
P680A LPG-4	5030.0015	Low-pressure gradient pump with integrated online degasser (analytical)	Mixing chamber extension (→ page 123) Micro-Flow Kit P680A LPG (→ page 127)
P680A DGP-6	5030.0030	Dual low-pressure gradient pump (analytical)	Mixing chamber extension (→ page 123)
P680A HPG-2	5030.0016	High-pressure gradient pump with two solvent lines (analytical)	Mixing chamber extension (→ page 123) Micro-Flow Kit P680A HPG (→ page 128)
P680A HPG-4	5030.0017	High-pressure gradient pump (analytical) with "2 from 4" solvent selector option	Mixing chamber extension (→ page 123) Micro-Flow Kit P680A HPG (→ page 128)
P680P HPG-2	5030.0025	High-pressure gradient pump (semi-preparative) with two solvent lines	Mixing chamber extension (→ page 123)

## 2.3 Principle of Operation

The pump is a zero-pulsation, serial dual-piston pump with electronic compressibility compensation. The two pump heads are connected in series. The solvent passes through both pump heads, that is, working and equilibration pump head, successively.

Continuous delivery is achieved as follows: The working head delivers at the appropriate flow rate while simultaneously filling the serially connected equilibration head. The latter serves as a reservoir and delivers while the working head carries out the suction stroke. The characteristic feature of the patented isokinetic pre-compression is the 120-degree overlapping phase of the delivery strokes of the working and equilibration pump heads. When delivering compressible liquids without controlled pre-compression, the pulsation increases as the operating pressure increases, since part of the delivery stroke is required for compressing the solvent in the pump head.

Pulsation during the pre-compression phase is reduced to a minimum by velocity modulation of the drive. The highly constant delivery is ensured by a patented secondary control system (automatic compressibility compensation). The flow rate is always kept constant in relation to the atmospheric pressure.

Turning on the **P680A LPG-4** pump automatically activates the integrated online degasser, which continuously degases the solvents via special polymer membranes that are permeable to gas, but not to liquids. The online degasser thus guarantees optimum operation regarding reproducibility and pulsation reduction.

## 2.4 Front Panel Display and Controls

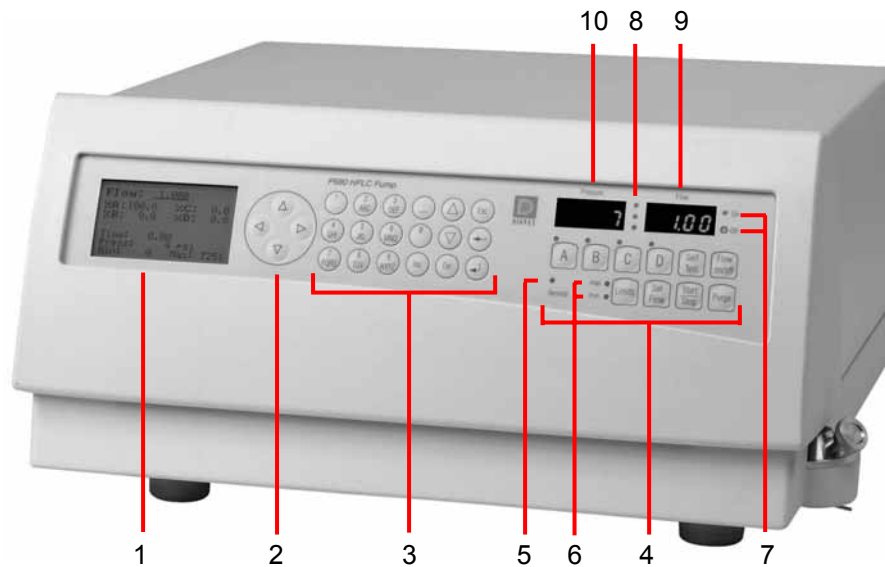


Fig. 1: P680 front panel

No.	Front Panel Element	Description
1	LCD	Displays the current pressure, the menus, the programs, and the individual program steps.
2	△ ▽ ◀ ▶	Cursor keys; move the cursor to the desired position on the LCD. P680A DGP-6: When the State menu is displayed, use the left or right cursor keys to display the state information for the respective pump or to toggle between the user interface for the left and for the right pump.
3	<b>Controls on the center keypad:</b>	
	0...9	Allows direct input of numerical values; allows direct submenu selection.
	A...Z	Allow direct input of the corresponding letters (→ How to enter text and numbers, page 9).
	.	Decimal point.
	-	Minus sign.
	Ins	Inserts a new program or new program step.
	△	Arrow key; allows changing the settings; increments numerical values; pages forward through the commands that are available for selection.
	▽	Arrow key; allows changing the settings; decrements numerical values; pages backward through the commands that are available for selection.
	Del	Deletes the selected program or the selected program step.
	Esc	Returns you to the superior menu on the LCD. Clears error messages.
	←	Deletes the character at the cursor position.
	↵ (Enter)	Confirms the input.


No.	Front Panel	Description
4	<b>Function keys for direct control:</b>	
	<b>A, B, C, D</b>	<p>The LCD shows the State menu. The cursor appears at the input position for the %A to %D portions of the solvent (the corresponding LED lights). For example, if you press the B key the cursor appears at the input position for the %B value. Enter the desired value and press ↵ (<b>Enter</b>) to confirm your input.</p> <p>Pressing the button for approximately 2 seconds sets the corresponding portion to 100%.</p> <p><b>Notes:</b> For a P680A DGP-6 pump, the State menu is opened for the pump selected last on this menu. Use the left/right cursor keys to switch between the pumps. For a P680A DGP-6 pump, the %D portion is not available.</p>
	<b>Self Test</b>	Corresponds to a reset; checks the drives, the sensors, and internal functions. The self-test is performed immediately.
	<b>Flow on/off</b>	<p>Turns the flow on (the <b>On</b> LED is lighting) or off (the <b>Off</b> LED is flashing) (→ P680 front panel , LED No. 7). The <b>Flow</b> display shows the flow rate.</p> <p><b>Note:</b> For a P680A DGP-6 pump, go to the State menu first (→ page 53) and select the pump for which you want to turn the flow on or off.</p>
	<b>Limits</b>	<p>The LCD shows the State menu. The cursor appears at the input position for the upper pressure limit and the lower pressure limit, respectively (if the pump is shut off because the pressure falls below or exceeds the specified limit, the <b>min.</b> or <b>max.</b> LED lights, → P680 front panel , LED No. 6). Enter the desired value and press ↵ (<b>Enter</b>) to confirm your input.</p> <p><b>Note:</b> For a P680A DGP-6 pump, the State menu is opened for the pump selected last on this menu. Use the left/right cursor keys to switch between the pumps.</p>
	<b>Set Flow</b>	<p>The LCD shows the State menu. The cursor appears at the input position for setting the flow rate. Enter the desired value and press ↵ (<b>Enter</b>) or <b>Set Flow</b> to confirm your input.</p> <p><b>Note:</b> For a P680A DGP-6 pump, the State menu is opened for the pump selected last on this menu. Use the left/right cursor keys to switch between the pumps.</p>
	<b>Start / Stop</b>	<p>Start starts the program selected in the <b>Programs</b> menu; Stop stops the running program (→ Starting, Holding, and Stopping a Program, page 63).</p> <p><b>Note:</b> For a P680A DGP-6 pump, go to the State menu first (→ page 53) and select the pump for which you want to turn the flow on or off.</p>
	<b>Purge</b>	<p>Turns the Purge function on and off. Purging the pump means rinsing the system for a short time at a higher flow rate (→ Purging the Pump, page 34). By default, the pump is purged for 5 minutes at 6 ml/min. Changing the default setting is possible in the Options menu (→ page 60).</p> <p><b>Note:</b> For a P680A DGP-6 pump, go to the State menu first (→ page 53) and select the pump for which you want to turn the flow on or off.</p>



<b>LEDs:</b>		
5	<b>Remote</b>	The LED lights when Chromeleon controls the pump.
6	<b>max. / min.</b>	The max. LED lights when the pump is shut off because the pressure exceeds the upper pressure limit. The min. LED lights when the pump is shut-off because the pressure falls below the lower pressure limit. (→ P680 front panel , Limits key)  <b>Note:</b> For a P680A DGP-6 pump, the LED lights for the pump currently set on the State menu.
7	<b>On / Off</b>	On lights when the flow is turned on; Off flashes when the flow is turned off (→ P680 front panel , Flow key).  <b>Note:</b> For a P680A DGP-6 pump, the LED lights for the pump currently set on the State menu.
8	<b>3 LEDs</b>	The green center LED lights when a drop is recognized on the sensor of the active rear-seal wash system.
<b>Other Displays</b>		
9	<b>Flow</b>	Indicates the current flow rate.  <b>Note:</b> For a P680A DGP-6 pump, the flow is displayed for the pump currently set on the State menu.
10	<b>Pressure</b>	Indicates the current pressure.  <b>Note:</b> For a P680A DGP-6 pump, the pressure is displayed for the pump currently set on the State menu.

### How to enter text and numbers

Press the corresponding key once to enter the first letter indicated on the key. To enter the second letter, quickly press the key twice. For the third letter, press the key three times. To enter the indicated numerical value, quickly press the key four times. Keep the key pressed to scroll through all of the allowed parameters.

 **Please note:** Letter input is disabled for inputs and settings that require numerical values.

## 2.5 Choosing the Solvents

Depending on the pump model, the wetted parts of the pump are made of stainless steel, PEEK, sapphire, ruby, ceramics, etc. (→ Wetted Parts, page 132).

Use standard HPLC solvents and buffer, compatible with the flow path materials, only. Note the special properties of the solvents such as viscosity, boiling point, UV absorption (UV/VIS detector), refractive index (refractive index detector), and dissolved gas (degasser).

Buffer concentration: typically up to 1 mol/L. Please make sure to use the active rear-seal wash system (→ page 31).

pH-range: 1-13 (with less than 0.1 mol/L chloride ions).

Make sure to use special (highly pure) solvents for gradient operation. They are usually labeled accordingly by the vendor.

For more information about the chemical resistance of PEEK, refer to the table in section 11.1 (→ page 143).

**i** **Please note:** As standard, the pumps are fitted with reversed phase piston seals. However, normal phase seals can be installed instead if required. For information about the installation procedure and the corresponding part numbers, refer to Replacing the Piston Seals (→ page 112).

## 2.6 System Wellness


The P680 supports several System Wellness and reliability features that can help you detect small problems before they turn into big ones.


If an error is found, an error message is displayed on the pump's front panel. If the instrument is controlled by Chromeleon, the error is logged in the Chromeleon Audit Trail.


Feature	Description
Leak sensor (→ page 106)	Reliable operation
Monitoring of piston seal tightness (→ page 61)	Reliable operation
Pressure limits (→ page 53)	Prolongs the life of HPLC columns, reliable operation
Total workload monitoring (→ page 58)	Allows you to schedule the next service date
Degasser vacuum level monitoring (→ page 120)	Reliable operation
Active rear-seal wash system (→ page 31)	Prolongs the life of the consumable parts
Monitoring of the liquid level for rear-seal washing (→ "Case B", page 33)	Reliable operation


## 2.7 Safety Precautions


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


 **Important:** When operating the HPLC system, always set the low pressure limit for the pump. This prevents damage resulting from leakage or from running the pump dry.


 **Important:** If you use solvents with a high salt content, do not operate the pump without rear-seal washing for a longer time (> 5 minutes). This may cause damage to the piston seals and the piston (→ Active Rear-Seal Wash System, page 31)


 **Important:** Never run the pump dry! Damage to the pistons or the piston seals could result.


 **Important:** After operation, rinse out buffers and solutions that form peroxides. This will reduce the equilibration time of the column, as well as the lamps in any UV or RI detectors connected to the pump, when operation is resumed.


 **Important:** Before switching from buffer to organic solution, rinse the pump thoroughly with deionized water.

 **Important:** When switching to another solvent, ensure that the new solvent is miscible with the one contained in the pump. Otherwise, the pump can be damaged; for example, by flocculations!

 **Important:** If the pump flow is interrupted for longer periods (> 1 hour), turn off the lamps in any UV or RF detector connected to the pump. This will prevent evaporation in the flow cell.

 **Important:** With isocratic pumps (P680A ISO) and high-pressure pumps without Solvent Selector (P680A HPG-2, P680P HPG-2), the solvent can pass through the device even if the flow equals zero or if the pump is turned off. That is why solvent reservoirs that are positioned higher than the pump can run out through the pump due to hydrostatic pressure; for example, if the purge valve screw is open or the if the fluid system is dismantled.

 **Please note:** As a rule of thumb, you will need approximately 30 ml rinsing volume per solvent channel to completely rinsing the pump (including the degasser). Thus, at a flow rate 3 ml/min, each channel must be rinsed for minimum 10 minutes.

 **Important:** When lifting or moving the P680 pump, lift only from the bottom or sides of the unit. The front panel of the pump tilts upward. Lifting the pump by the front panel may damage the hinges.

**i** **Please note:** Before interrupting operation for an extended period (i.e, several days), observe the precautions in Shutting Down the Pump (→ page 122).

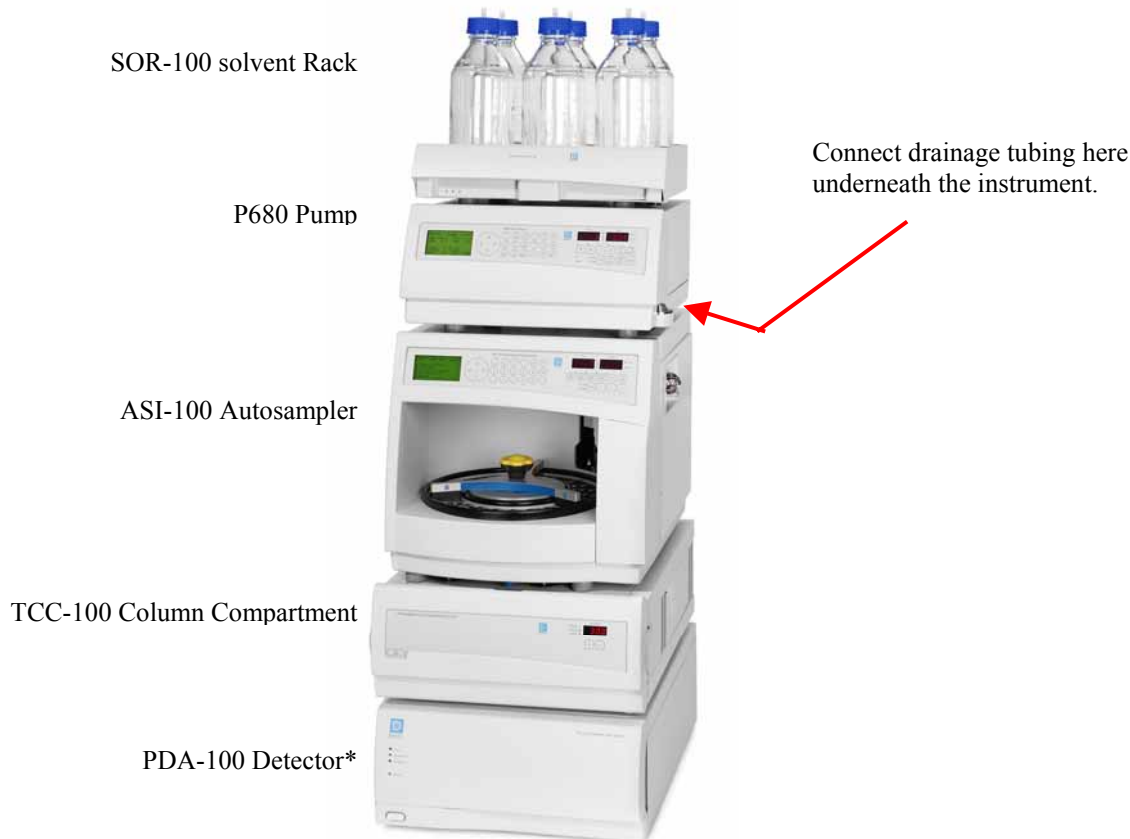
## 3 Installation

### 3.1 Location

After unpacking the P680, allow the pump to warm up for 4 hours before connecting it to the power supply. This delay allows any condensation that might have occurred during shipping to evaporate. After 4 hours, check the pump; if condensation is still there, allow the instrument to continue to warm up (without connecting it to the mains) until the condensation is completely gone.

Install the pump in the laboratory on a stable surface that is free of vibrations. Make sure that the surface is resistant to solvents. Avoid locations with extreme changes in temperature (such as direct sunlight or drafts) and high air humidity. Allow sufficient clearance behind the P680 for power connections and ventilation.

If the pump is part of a Summit HPLC system, we recommend that you stack the individual modules as shown below. This arrangement optimizes the flow path and ensures a low dead volume.



*Fig. 2: Summit HPLC system with P680 pump*

(\* As an alternative, the Summit HPLC system may include a UVD 170U or UVD 340U Detector.)

**i Please note:** For safety reasons, stack the solvent reservoirs on the reservoir tray on top of the pump (→ Fig. 2). The following solvent racks are available from Dionex:

Model	Part No.	Description
SOR-100	5030.9200	Solvent Rack without degasser for P680A LPG-4 pumps
SOR-100A-2	5030.9210	Solvent Rack with integrated 2-channel degasser (analytical) for P680A ISO and P680A HPG-2 pumps
SOR-100A-4	5030.9220	Solvent Rack with integrated 4-channel degasser (analytical) for P680A HPG-4 pumps
SOR-100A-6	5030.9230	Solvent Rack with integrated 6-channel degasser (analytical) for P680A DGP-6 pumps

**i Please note:** Drainage tubing can be connected at the bottom right of the unit to direct liquid leaks to the waste (→ Fig. 3). To prevent damage to the pump, make sure that no part of the tubing is placed higher than the connection port.

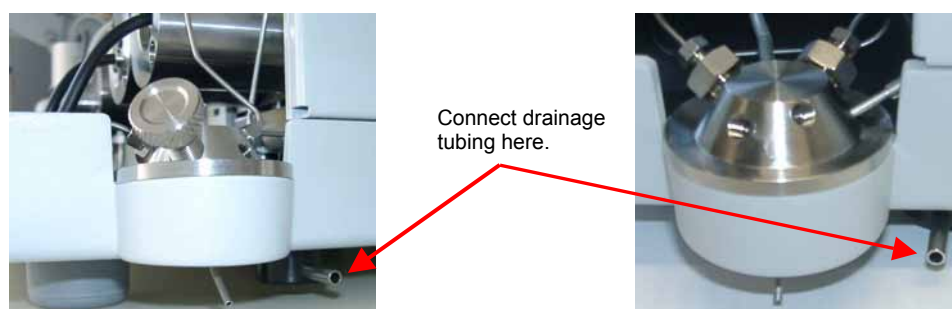


Fig. 3: Waste outlet (left: all P680 pumps except P680A DGP-6; right: P680A DGP-6)

## 3.2 Electrical Connections

### 3.2.1 Setting the Voltage Selector

Dionex instruments are factory-set for operation at the local voltage requirements of the destination country.



Fig. 4: Factory-set voltage selection, here: 230V

If the setting is not appropriate for your local requirements, reset the voltage at the selector on the instrument's rear panel (next to the main supply connector) as explained below:

**STOP Warning:** Before resetting the voltage, turn off the pump. Be sure to disconnect the power cord from its source.

- Remove the fuse cartridge using a small screwdriver (→ Fig. 5).
- Use small pliers or tweezers to pull the small voltage selector board out of the power socket enclosure (→ Fig. 6).



Fig. 5: Fuse cartridge



Fig. 6: Voltage selector board

- Place the board (with the writing face up) on a firm surface.
- Turn the board so that you see the correct voltage selection, as shown in → Fig. 7.
- Without turning the board, adjust the plastic clip as required for the mains voltage (→ Fig. 7). Make sure that the clip locks into position.

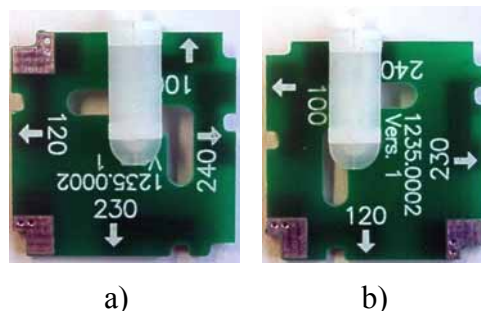


Fig. 7: Voltage selector board settings  
a) for 200V-240V and b) for 90V-130V

**i** **Please note:** Set the voltage selector as follows:  
For a voltage of 90V-130V: Set the selector to 100 or 120.  
For a voltage of 200V-240V: Set the selector to 230 or 240.

- Reinstall the voltage selector board in the power socket enclosure.
- If necessary, install new fuses of the correct rating (→ Replacing the Fuse, page 17).
- Reinstall the fuse cartridge and check that the correct voltage is set.

**⚠** **Important:** During initial installation of the pump, check the correct power supply, the grounding, and the fuses.

**i** **Please note:** For minimum interference effects, all components of the analytical system should be connected to the same mains output (same phase).



### 3.2.2 Replacing the Fuses

To replace the fuses, follow the steps below:

**STOP Warning:** Before replacing the fuses, turn off the pump. Be sure to disconnect the power cord from its source.

- Remove the fuse cartridge, using a small screwdriver (→ Fig. 5).
- Replace the fuses with fuses of the appropriate rating.



Fig. 8: Fuses

**⚠ Important:** Verify that two fuses are installed! Do not operate the pump with only one fuse.

**⚠ Important:** Use only the fuses indicated below or those listed in the Accessories/Spare Parts List (→ page 133).

Voltage	Description	Part No.
200V- 240V*	Fuse, 1 A, TT, 5 x 20 mm, 250V	Included in Fuses Kit Europe, part no. 6030.9002
90V - 130V**	Fuse, 2 A, TT, 5 x 20 mm, 250V	Included in Fuses Kit USA, part no 6030.9003

\* The voltage selector is set to 230V or 240V.

\*\* The voltage selector is set to 100V or 120V.

- Reinstall the fuse cartridge.
- Reconnect the power cord to its source and turn on the pump.

### 3.3 Rear Panel Connectors

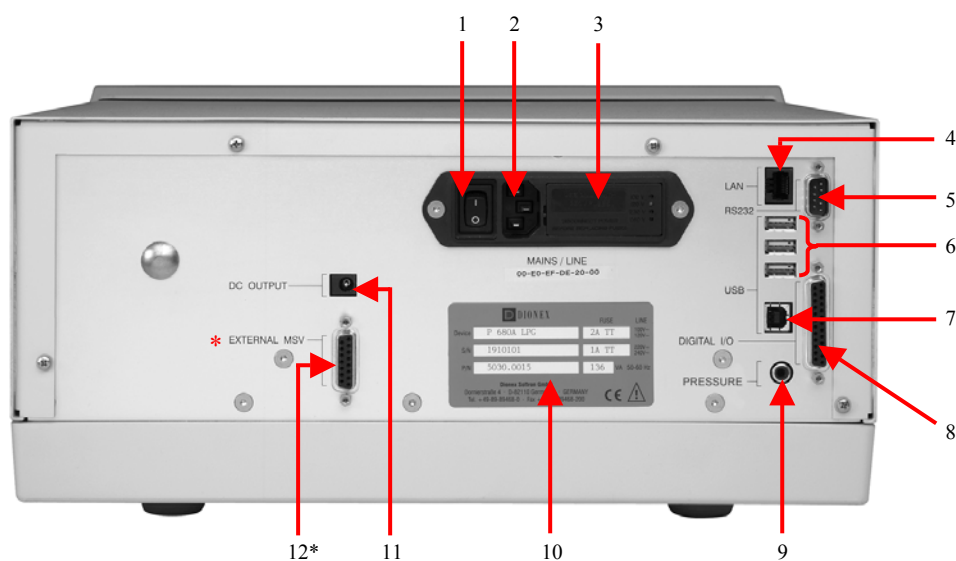



Fig. 9: P680 rear panel

\* The text reads either External MSV or Solvent Rack (→ table).

No.	Description
1	Power switch
2	Mains connection
3	Fuses and voltage selector ( → section 3.2, page 15)
4	LAN port (Local Area Network); allows you to control the pump by Chromeleon (→ section 3.3.1)
5	RS-232 port for connection of the Dionex ASI-100 Autosampler or the Dionex STH585 Column Thermostat ( → section 3.3.6)
6	USB (Universal Serial Bus) ports for connection to one Summit HPLC device (e.g., TCC-100) or to one USB hub each (→ section 3.3.2)
7	USB port for connection to the server PC (→ section 3.3.2)
8	Digital I/O port; allows you to connect, for example an accessory, such as an autosampler, manual injection valve, or a diagnosis cable of a stand-alone SOR-100 Solvent Rack with integrated degasser (→ section 3.3.3)
9	Pressure: Analog pressure output (→ section 3.3.4)
10	Type label
11	DC Output (→ section 3.3.7)
12	External MSV or Solvent Rack Depending on the text, you can connect an external motorized switching valve or an SOR-100 Solvent Rack with integrated degasser (→ section 3.3.5).

### 3.3.1 Interfaces for Device Control

The Chromeleon Chromatography Management System can use either a LAN or USB connection to control the pump. Data is transferred digitally via the appropriate cable (USB cable, part no. 8911.0002; USB extension cable 8911.0004, LAN cable (RJ45 cable for Ethernet hub), part no. 8906.2038). The LAN and USB ports are on the instrument's rear panel (→ Fig. 9).


 **Important:** To ensure trouble-free operation, all LAN and USB cables (see above) should be ordered from Dionex.

### 3.3.2 USB

Connect the pump to the server PC via the USB port (→ Fig. 9, no. 7). To do so, select one of the following alternatives:


- Connect the pump directly to the USB port on the server PC.
- Connect the pump to the server PC via another Summit HPLC instrument that is already connected to the server PC.
- Connect the pump to the server PC via a USB hub.

The other three USB ports (→ Fig. 9, no. 6) allow the pump to be connected to either one instrument in the Summit HPLC product line or one USB hub each. Additional Summit HPLC instruments can then be connected to the hub.

 **Important:** We recommend using these USB ports (→ Fig. 9, No. 6) for connections to Dionex instruments only. Dionex cannot guarantee correct functioning if instruments from other manufacturers are connected.

### 3.3.3 Digital I/O Port

The digital I/O port on the pump (→ Fig. 9, no. 8) provides a connection to an accessory; for example, an autosampler or a hand-operated valve. The connector supplies the **Start**, **Stop**, and **Hold** digital inputs as well as four relay outputs. The **Operable Out** relay output (relay 3) closes when the HPLC pump is not ready to operate, that is, in case of an error or if the instrument is turned off. The R1, R2, and R4 relays are controlled via a pump program or via Chromeleon. In addition, Chromeleon controls the **Operable Out** relay.

 **Please note:** If the pump is controlled by Chromeleon, the digital inputs and outputs can be used as universal inputs and outputs without specification if the special functions are disabled on the pump, i.e., if the corresponding function (Op. Out, LPG Sync Out, Start/Stop/Hold) is set to No. For more information, refer to the Options (→ page 60) and Operation with Chromeleon (→ page 89).

The functions of the **START IN** and **STOP IN** digital inputs (digital inputs 3 and 2, respectively) correspond to the **Start/Stop** key on the pump's front panel keypad (→ Front Panel Display and Controls, page 7). The program marked by an asterisk (\*) on the **Programs** menu (→ page 58) is started via digital input 3. If a program marked by an asterisk is running, it can be stopped via digital input 2. If, additionally, a program is marked by an exclamation mark (!) on the **Programs** menu, it will be started automatically following the program marked by the asterisk. If no program is marked by an asterisk, the program marked by the exclamation mark can be started via the digital input 3.

**i Please note:** We recommend marking a program by an exclamation mark in the Programs menu; for example, to shut down the pump in a controlled way when the program is complete.

The function of the **HOLD IN** digital input (digital input 1) corresponds to the **Hold/Continue** option on the **Program Stop** menu (→ page 63). The **Hold** signal pauses the currently running program. The program continues when the **Hold** signal no longer applies.

**i Please note:** For a P680A DGP-6 pump, the functions of the digital inputs are executed for the right pump.

Pin	Signal Name	Signal Level	Remarks
1			Marked wire / reserved
2			Reserved
3	RELAY 3 OUT	Potential free	Closing contact
4	RELAY 1 OUT	Potential free	Opening contact
5	RELAY 2 OUT	Potential free	Opening contact
6	RELAY 3 OUT	Potential free	Opening contact/Operable Out
7	RELAY 1 OUT	Potential free	Middle contact
8	RELAY 2 OUT	Potential free	Middle contact
9	GND	Ground	Reference potential
10	HOLD IN	Ground	Reference potential
11	STOP IN	Ground	Reference potential
12	START IN	Ground	Reference potential
13			Reserved
14	RELAY 4 OUT	Potential free	Closing contact
15	RELAY 4 OUT	Potential free	Middle contact
16	RELAY 4 OUT	Potential free	Opening contact
17			Reserved
18	RELAY 3 OUT	Potential free	Middle contact/Operable Out
19	RELAY 1 OUT	Potential free	Closing contact
20	RELAY 2 OUT	Potential free	Closing contact
21	Vcc_Save	+5V/500mA	
22	HOLD IN	TTL	Digital input 1
23	STOP IN	TTL	Digital input 2
24	START IN	TTL	Digital input 3
25			Reserved

Fig. 10: 25-pin D-Sub I/O port (female)

**⚠ Important:** The maximum switching voltage of the relays is 24 V. The switching current must not exceed 100 mA.

### 3.3.4 Pressure (Analog Pressure Output)

The analog pressure output records the operating pressure of the pump (→ Fig. 9, no. 9). The pressure output is set to 5 mV/bar (50 mV/MPa). You may connect a device such as the UCI-100 Universal Chromatography Interface, a recorder, or an A/D converter, to monitor the pump pressure.

Pin Assignment for 2-Pin Cinch Connector	
Inner ring:	Signal (pressure)
Outer ring:	GND

### 3.3.5 External Motorized Switching Valve (MSV) or Solvent Rack

The pump's rear panel provides a port that is labeled either External MSV or Solvent Rack (→ Fig. 9, no. 12). It depends on the text whether you can connect an external motorized switching valve (MSV) or a Solvent Rack. For information about the pinout of the 15-pin D-Sub connector, refer to the Technical Appendix (→ page 149).

#### External MSV

If the text is External MSV, you may connect an external MSV-6 (part no. 5804.0002) or MSV-2x3 (part no. 5804.0004) motorized switching valve; for example, for column switching. The MSV-6 provides a Rheodyne Model 7000 high-pressure valve; the MSV-2x3 provides a Rheodyne Model 7030 high-pressure valve. The motorized switching valve can be controlled via a pump program or Chromeleon.

**⚠ Important:** Do not substitute any other motorized switching valve for the MSV-6 or MSV-2x3 motorized switching valve!

#### Solvent Rack

If the text is Solvent Rack, you may connect a Solvent Racks with integrated degasser to an analytical P680 pump:

Model	Part No.	Description
SOR-100A-2	5030.9210	Solvent Rack with integrated 2-channel degasser (analytical) for P680 ISOA and P680A HPG-2 pumps
SOR-100A-4	5030.9220	Solvent Rack with integrated 4-channel degasser (analytical) for P680A HPG-4 pumps
SOR-100A-6	5030.9230	Solvent Rack with integrated 6-channel degasser (analytical) for P680A DGP-6 pumps

**⚠ Important:** Do not substitute any other solvent rack for the Solvent Racks mentioned in the above table.

**i** **Please note:** Connect the Solvent Racks with analytical degasser only to analytical pumps. Do not connect these racks to a semi-preparative pump.

**i** **Please note:** A Solvent Rack without degasser (SOR-100, part no. 5030.9200) completes the Solvent Rack series.

**i** **Please note:** For more information about the Solvent Racks, refer to their *Operating Instructions*.

### 3.3.6 RS-232 Port

The RS-232 port on the pump's rear panel (→ Fig. 9, no. 5) allows the connection of a Dionex ASI-100 autosampler or a Dionex STH585 Column Thermostat. Depending on its connection mode, the pump converts the RS-232 communication to a LAN or USB transfer.

The interface parameters are as follows:

- Up to 9600 baud
- 8 data bits, 1 stop bit (Neither use any other number of data bits nor 2 stop bits.)
- Parity: even, odd, or none
- Hardware handshake and software handshake are not possible

**i** **Please note:** Verify that the pump is connected to Chromeleon via USB or an instrument LAN. The RS-232 port is not supported when the pump is connected to Chromeleon via an office LAN.

**i** **Please note:** If you use the **Disconnect** command in Chromeleon to disconnect the pump from the data system, all other instruments connected via this RS-232 interface are automatically disconnected as well.

Pin	Signal Name	Signal Level	Remarks
1			Reserved
2	RXD	RS-232	Data receive path
3	TXD	RS-232	Data transmit path
4			
5	GND	Ground	Reference potential
6			Reserved
7			
8			
9			Reserved

Fig. 11: 9-pin D-Sub RS-232 port (male)

### 3.3.7 DC Output

Reserved for the connection of future low voltage devices of the HPLC Summit series.

### 3.4 Fluid Connections

**⚠ Important:** The pump is primed with 2-propanol. During initial operation of the pump, make sure that the solvents used are miscible with 2-propanol. Otherwise, follow the appropriate intermediate steps.

To access the fluid connection in the pump, tilt the front panel upward. It is not necessary to lock the open panel in place.

**⚠ Important:** When lifting or moving the P680 pump, lift only from the bottom or sides of the unit. Lifting the pump by the front panel may damage the hinges.

#### 3.4.1 Connecting the Solvent Reservoirs

To provide a secure location of the solvent reservoirs, Dionex provides the following solvent racks (→ Fig. 12)

Model	Part No.	Description
SOR-100	5030.9200	Solvent Rack without degasser for P680A LPG-4 pumps
SOR-100A-2	5030.9210	Solvent Rack with integrated 2-channel degasser (analytical) for P680A ISO and P680A HPG-2 pumps
SOR-100A-4	5030.9220	Solvent Rack with integrated 4-channel degasser (analytical) for P680A HPG-4 pumps
SOR-100A-6	5030.9230	Solvent Rack with integrated 6-channel degasser (analytical) for P680A DGP-6 pumps



Fig. 12: P680 with SOR Solvent Rack

**i Please note:** The procedure how the solvent reservoirs are connected is the same for all pump types.

All Solvent Racks are shipped with solvent reservoirs and ready-made tubing. It depends on the model whether the rack is fitted with a degasser and whether this degasser is a 2-channel, 4-channel, or 6-channel-degasser. The bottle cap has five holes. Four holes are capped by default (white caps) and one is open. The solvent line is installed in the open hole. A retaining guide holds the tubing in place.

How to connect the solvent lines to the solvent reservoir (→ Fig. 13):

- Feed the solvent line through the retaining guide and then into the open hole in the reservoir cap.
- Slide an appropriate filter frit from the pump's accessories kist onto the end of the line.
- Fill the solvent reservoir and then, place the complete assembly in the reservoir.
- Tighten the reservoir cap hand-tight, by holding the cap and turning the bottle.



Fig. 13: Connecting the solvent lines to the reservoir

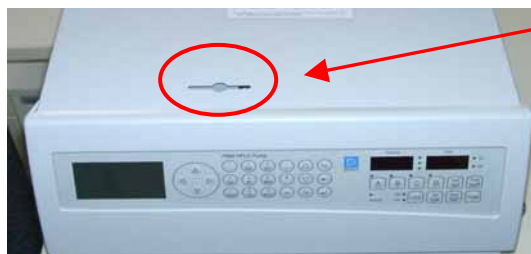
**⚠ Important:** Always install filter frits on the solvent lines. This prevents contaminants from reaching the HPLC system.

**i Please note:** When replacing a solvent line, remove the frit first, then the solvent line, and then the retaining guide.

**i Please note:** Regularly check the suction frits for permeability. Especially when working with aqueous solvents, algae and other microorganisms can grow and be deposited on the filter frits. Therefore, replace the solvents at regular intervals. Rinse the reservoirs thoroughly before refilling them. Replace the suction frits as necessary.



Please note: In the P680A ISO, P680A HPG-2, P680A HPG-4, and P680A DGP-6 pumps, the appropriate solvent lines are connected at the factory and routed through the opening in the top cover of the pump. For all other pump types, for which the solvent lines are not yet connected, route the lines through this opening as well (→ Fig. 14)



For P680A ISO, P680A HPG-2, P680A HPG-4, and P680A DGP-6 pumps, the solvent lines are already installed at the factory and routed through this opening in the top cover.

Fig. 14: Opening for the solvent lines

- For the **P680A LPG-4** pump, connect the solvent lines to the associated connection ports on the degassing module (A-D). Remove the dummy fitting from the degasser inlet and connect the line with the corresponding label (→ Fig. 15 and Fig. 16).

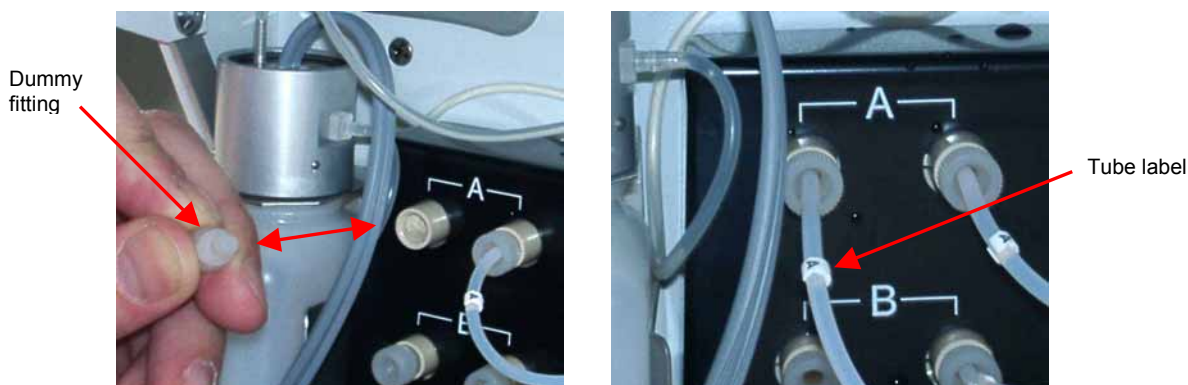


Fig. 15: Connecting the solvent reservoir (P680A LPG-4 pump)

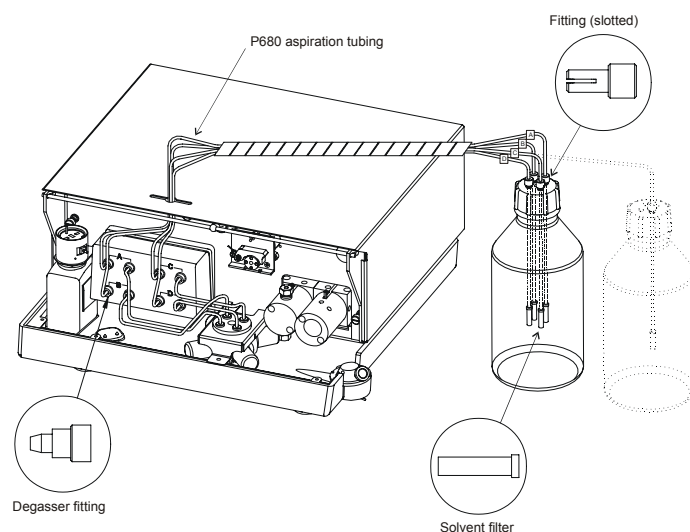


Fig. 16: P680A LPG-4 pump with solvent rack connection

- For the **P680A DGP-6** pump, the solvent lines are connected at the factory to the 3-port proportioning valves (→ Fig. 17). If your HPLC system includes the appropriate Solvent Rack with integrated degasser, make sure that the tubing connecting the pump to the degasser is as short as possible. Therefore, stack the rack onto the pump as shown in Fig. 2. For information about how to connect the tubing to the degasser, refer to the *Operating Instructions for the SOR-100 Solvent Racks*.

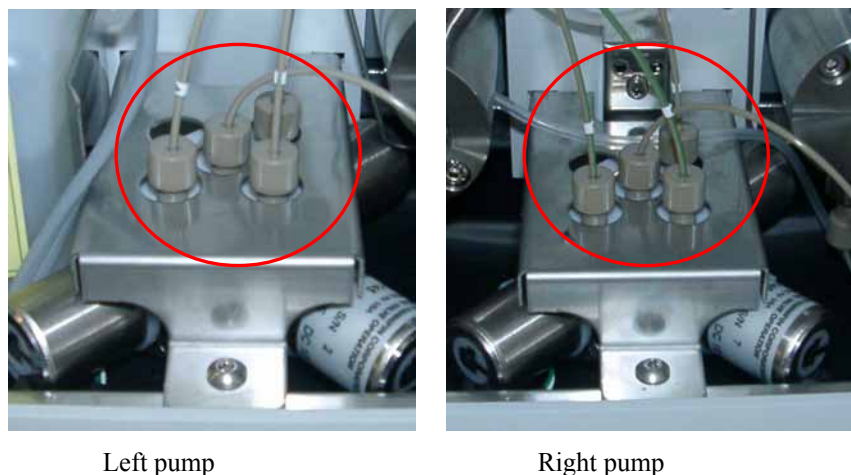


Fig. 17: Connecting the solvent lines (P680A DGP-6 pump)

- For the **P680A ISO** and **P680A HPG-2** pumps, the solvent lines are connected at the factory to the working pump head.  
For the **P680P HPG-2**, screw the solvent line into the inlet valve and then tighten the fitting hand-tight (approximately one-quarter turn!) (→ Fig. 18).  
If your HPLC system includes the appropriate Solvent Rack with integrated degasser, make sure that the tubing connecting the pump to the degasser is as short as possible. Therefore, stack the rack onto the pump as shown in Fig. 2. For information about how to connect the tubing to the degasser, refer to the *Operating Instructions for the SOR-100 Solvent Racks*.

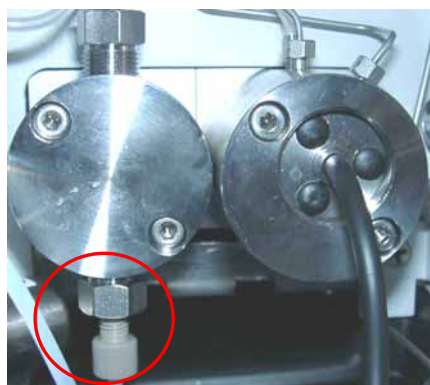
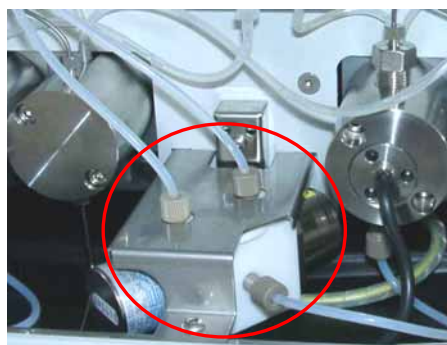


Fig. 18: Solvent line connected to the working pump head (here: P680A ISO)

- For the **P680A HPG-4** pump, the solvent lines are connected at the factory to the 2/3-way valve of the solvent selector (→ Fig. 19). If your HPLC system includes the appropriate Solvent Rack with integrated degasser, make sure that the tubing connecting the pump to the degasser is as short as possible. Therefore, stack the rack onto the pump as shown in Fig. 2. For information about how to connect the tubing to the degasser, refer to the *Operating Instructions for the SOR-100 Solvent Racks*.



Left pump block

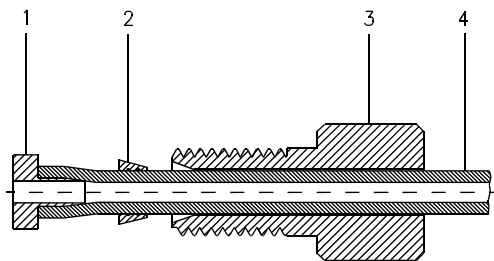


Right pump block

*Fig. 19: Connecting the solvent lines (P680A HPG-4)*

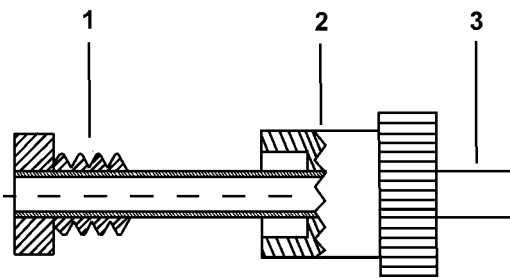
### 3.4.2 Connections in the Low-Pressure Section

The illustration below shows the solvent connections in the low-pressure section of the pump:



No.	Description
1	Support flange
2	Clamp ring
3	Knurled fitting
4	PTFE tube

Fig. 20: Solvent line connection on low-pressure side (all pump types except P680A DGP-6)



No.	Description
1	Ferrule
2	Fitting
3	PEEK tube

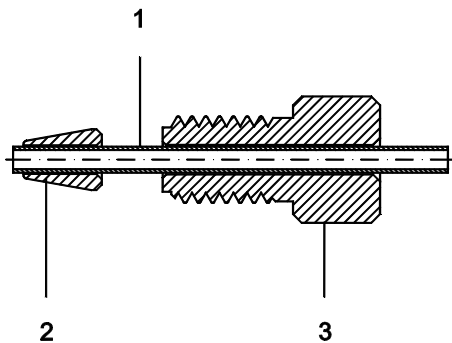
Fig. 21: Solvent line connection on low-pressure side (P680A DGP-6)

**⚠ Important:** Do not overtighten these fitting connections; the connections should be no more than hand-tight. If necessary, retighten leaking connections.

**⚠ Important:** Avoid cross-threading when installing the fittings on the PTFE valve block. Cross-threading might damage the valve blocks.

### 3.4.3 Connections in the High-Pressure Section

All capillary connections in the high-pressure section of the pump are supplied with fitting screws and ferrules:



No.	Description
1	Capillary
2	SR-7 ferrule
3	FS-7 fitting screw

Fig. 22: Fitting screw and ferrule

The following ready-made capillaries are used in the pump:

#### P680A ISO

Description	Part No.
Capillary between working pump head and equilibration pump head	5030.3015
Capillary between equilibration pump head and purge block	5030.3014

#### P680A LPG-4

Description	Part No.
Capillary between working pump head and equilibration pump head	5030.3015
Capillary between equilibration pump head and mixing chamber	5030.3013
Capillary between mixing chamber and purge block	5030.3016

#### P680A DGP-6

Description	Part No.
Capillary between working pump head and equilibration pump head	5030.3015
Capillary between equilibration pump head and mixing chamber (right pump)	5030.3021
Capillary between equilibration pump head and mixing chamber (left pump)	5030.3022
Capillary between mixing chamber (right pump) and outlet block	5030.3041
Capillary between mixing chamber (left pump) and outlet block	5030.3042

**P680A HPG-2 und P680A HPG-4**

Description	Part No.
Capillary between working pump head and equilibration pump head	5030.3015
Capillary between the left equilibration pump head and the purge block (tee)	5030.3018
Capillary between the right equilibration pump head and the purge block (tee)	5030.3017
Capillary between the purge block (tee) and the mixing chamber	5030.3019
Capillary between mixing chamber and purge block	5030.3016

**P680P HPG-2**

Description	Part No.
Capillary between the working pump head and the equilibration pump head	5030.3025
Capillary between the left equilibration pump head and the purge block (tee)	5030.3028
Capillary between the right equilibration pump p head and the purge block (tee)	5030.3027
Capillary between the purge block (tee) and the mixing chamber	5030.3029
Capillary between mixing chamber and purge block	5030.3026

**⚠ Important:** Do not overtighten these fitting connections; the connections should be hand-tight plus an additional one-quarter turn. If necessary, retighten leaking connections.

Use only the ready-made capillaries shipped with the pump. Use only capillaries that are clean inside! If necessary, shorten the capillaries with the capillary cutting tool (part no. 2140.0001). Never use a file to shorten the capillaries! Contaminants or filings (even minute parts) can cause damage to the HPLC system (pump, injection valve, etc.).

**⚠ Important:** To connect the capillaries to an injection valve or selector valve, use the ferrules and fitting screws that are shipped with the valve. Follow the installation instructions from the valve manufacturer!

**ℹ Please note:** For details on how to install the high-pressure gradient option, refer to High-Pressure Gradient System (HPG) (→ page 45).

### 3.4.4 Active Rear-Seal Wash System

When using highly concentrated buffer solutions, Dionex recommends continuously rinsing the back of the piston seal to remove salt crystals and prolong the life of the seal. For this purpose, active rear-seal washing is available for all P680 pumps. Enable and disable the active seal wash system on the Options menu on the pump's front panel (→ page 60).

The active rear-seal wash system consists of a peristaltic pump (tubing pump) and a liquid reservoir with integrated sensors. Rear-seal washing is activated periodically once per hour and runs for five minutes.

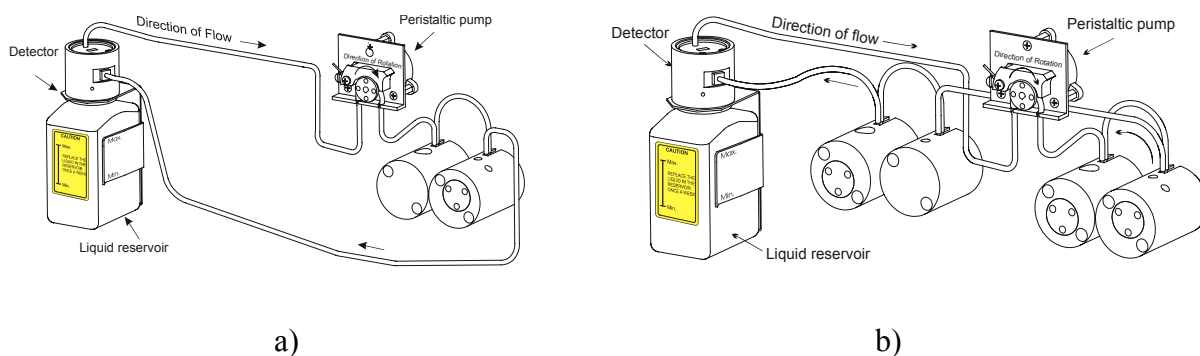


Fig. 23: Active rear-seal wash system (connection)

a) for a P680A ISO and P680A LPG-4

b) for a P680A HPG-2, P680A HPG-4, P680A DGP-6, and P680P HPG-2

**i Please note:** The rear-seal wash system for the P680A DGP-6 pump is connected in the same way as illustrated in Fig. 23 b). The only difference is that both equilibration pump heads of the P680A DGP-6 are equipped with a pressure sensor and that both working pump heads are not (→ Fig. 35, page 42).

**i Please note:** Fill the liquid reservoir before you turn on the pump for the first time. Approximately 50 ml of fluid will be sufficient. For information on the seal-washing medium itself, refer to below (→ page 33).

**i Please note:** Regularly check the filling level in the liquid reservoir, making sure that the level is always between the min. and max. markers on the label.

To fill the liquid reservoir or exchange the washing liquid, hold the liquid reservoir including the holding clip and push both parts together vertically toward the top. The holding clip disengages. While holding the reservoir by its cap (= detector), unscrew the reservoir including the holding clip from the cap (→ Fig. 24).

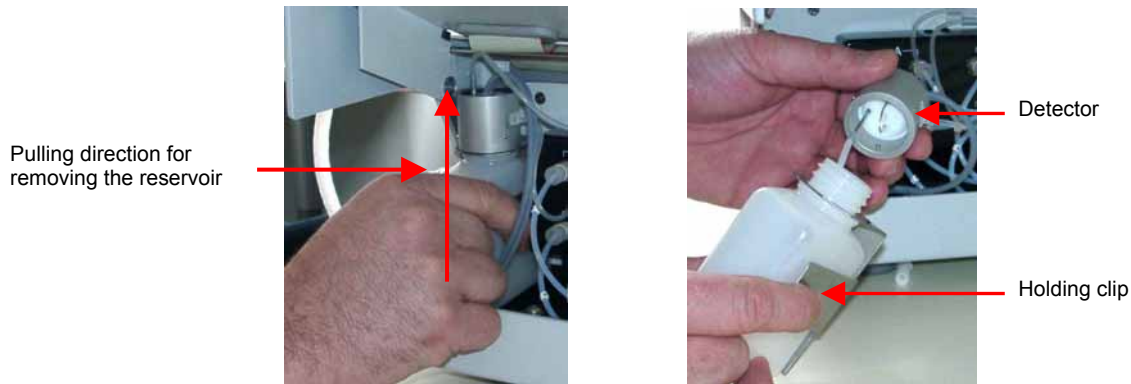


Fig. 24: Liquid reservoir of the rear-seal wash system

**i Please note:** Verify that the peristaltic tubing is engaged in the peristaltic pump before you turn on the pump for the first time. The tubing under the peristaltic pump lever remains compressed and does not relax, thus blocking the wash solution. This can happen if the pump is not running for a longer period, e.g., during shipment. That is why the pump is shipped with the active rear-seal wash tubing bypassing the peristaltic pump. We also recommend pulling the tubing out of the peristaltic pump (→ Fig. 25) if the pump is not running for more than five days. To remove the tubing, slightly press the lever upward, remove the tubing, and release the lever.

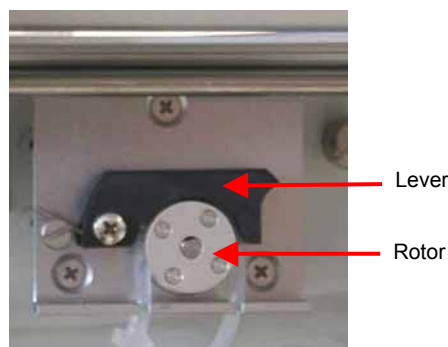


Fig. 25: Peristaltic pump

The sensor, which is integrated in the detector cap monitors:

- The function of the rear-seal wash system
- The main piston seal for possible leakage

### Case A - Rear-seal washing performs correctly

The delivery period of the peristaltic pump is five minutes. During this period, liquid reaches the detector on the liquid reservoir (the drops are counted). This means that the rear-seal wash system performs correctly. The liquid reservoir contains enough liquid for seal washing, the tubing is all right, and the peristaltic pump works correctly.



### Case B - Malfunctioning of the rear-seal wash system

If no drops reach the detector on the liquid reservoir after maximum five minutes although the peristaltic pump is pumping, this indicates that either the liquid reservoir is empty or the peristaltic tubing is broken or sticks together.


This malfunctioning may also occur if the sensor on the liquid reservoir is very dirty. The following error message appears "The rear-seal leak sensor is malfunctioning." Press Esc. to confirm the message. Clean the electrodes of the sensor, using water or solvent.


In all cases, the LCD displays the message "Rear-seal wash system has run out of wash solution". Press Esc to confirm the message. Refill the liquid reservoir or replace the defective peristaltic tubing. For more information regarding this message, refer to the List of the Most Frequently Observed Error Messages (→ page 95).


### Case C - Possible leakage of the main piston seal


If drops are counted (that is, more drops than specified for the piston leak threshold (→ page 61)) during the 55 minutes in which the peristaltic pump is idle, this indicates possible leakage of the main piston seal. The LCD displays the message "Possible piston seal leak detected" or "The rear seal leak count is xx (= number of counted drops) and has exceeded the limit of yy (= leak threshold value)". Press Esc to confirm the message. Visually inspect the piston seals for leakage (→ page 111). Replace the piston seals and support rings as necessary (→ Removing the Piston Seals, page 114) or increase the default value for the rear-seal leak threshold on the pump's Options menu (→ page 60).

For reliable sensor performance, make sure that the seal-washing medium is slightly conductive. Standard HPLC-grade water is appropriate. If a medium other than HPLC-grade water has to be used due to the solubility of the delivered solvent, make the medium slightly conductive using the appropriate additives (do not use additives with a high salt content or additives that cause solid residuals upon evaporation). Make sure that the seal-washing medium is compatible with the silicone tubing.

 **Important:** If you use solvents with a high salt content, do not operate the pump without rear-seal washing for a longer time (> 5 minutes). This may cause damage to the piston seals and the piston.

 **Important:** Make sure that the liquid used for rear-seal washing is miscible with the solvent. This is to avoid impairing the tightness of the pump.

 **Important:** Do not forget to empty the liquid reservoir before shipping the pump.

 **Please note:** Replace the liquid in the liquid reservoir in regular intervals. To avoid salt concentration and to prevent damage to the piston seals when using solvents with a high salt content, replace the liquid in the reservoir **at least** once a week.

### 3.4.5 Purging the Pump

Purging the pump means rinsing the system for a short time at a higher flow rate. By default, the pump is purged for 5 minutes at 6 ml/min. Change the default setting in the Options menu (→ page 60) as necessary.

**i Please note:** For the P680A DGP-6, the purge screws are located on the equilibration pump head of the respective pump (→ Fig. 27). For all other pump models, the purge screw is located on the purge block (→ Fig. 26).

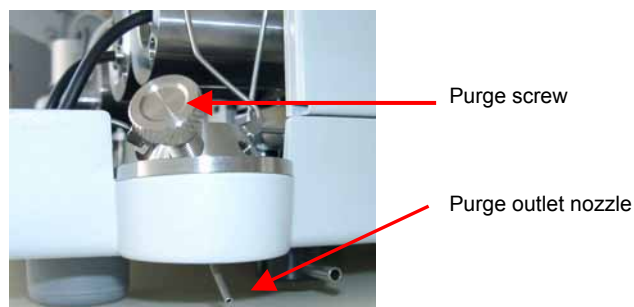


Fig. 26: Purge block for all P680 pump types except P680A DGP-6

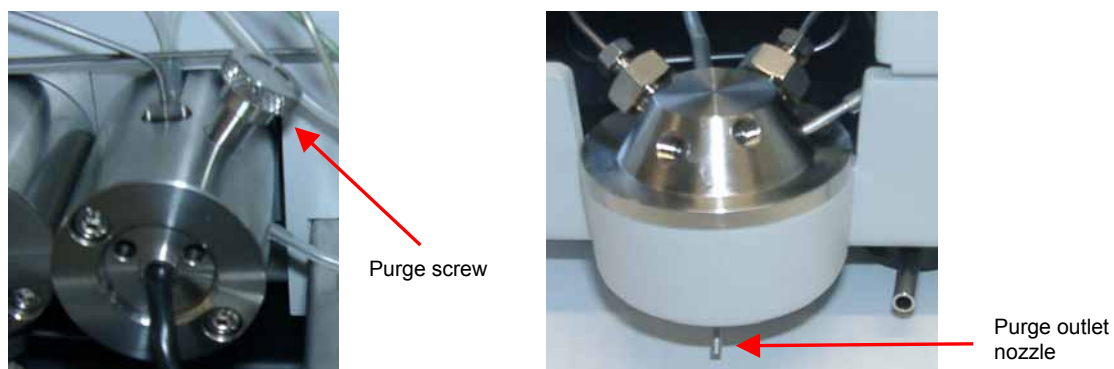
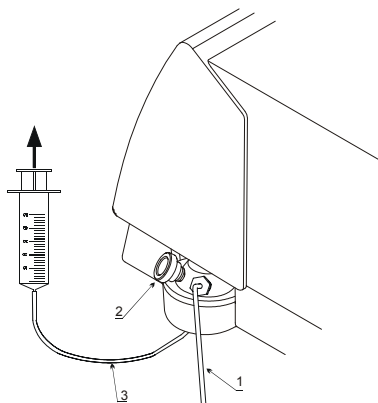


Fig. 27: Purge screw and purge outlet nozzle for a P680A DGP-6 pump

To purge the pump, follow the steps below:

**i Please note:** The two pumps of a P680A DGP-6 can be purged together or separately.

- Attach a piece of silicone tube (provided in the accessory kit) to the purge outlet nozzle. Fasten the other end of the tube to a plastic syringe (provided in the accessory kit)



No.	Description
1	Outlet nozzle
2	Purge screw Note: For the P680A DGP-6, the purge screw is on the equilibration pump head (→ Fig. 27).
3	Purge outlet nozzle with silicone tubing and syringe

Fig. 28: Purging the pump

- Loosen the purge valve screw by **one** turn.
- To be able to generate negative pressure, an autosampler or other type of pressure drop needs to be connected to the pump outlet. If necessary, cap the pump outlet.
- Set the channel to be purged to 100%; for example, channel A.
- Press the **Purge** key (→ Front Panel Display and Controls, page 7) and draw the solvent with the syringe. If there are no air bubbles left, press the **Purge** key again to stop purging.

**i Please note:** When working with a P680A DGP-6 pump, you can use the left/right cursor keys to toggle between the left and the right pump.

- Repeat the above procedure for all channels to be purged.
- Close the purge valve screw. Do not overtighten the screw. (When in doubt, tighten the screw slightly. In case of leakage, retighten later as necessary.)

**! Important:** Do not use any tools to tighten the purge valve screw! Overtightening may destroy the cap seal. Open or close the purge valve screw only when the system pressure is down.

**i Please note:** If the set maximum pressure or a pressure of 50 bar is exceeded during purging, the following error message appears on the display "The maximum purge pressure was exceeded" and purging is aborted. Check whether the purge valve is open; open the purge valve if necessary.

### 3.4.6 Fluid Connections in the Purge Block/Outlet Block

For information about the fluid connections in the purge/outlet block, refer to the pictures below:

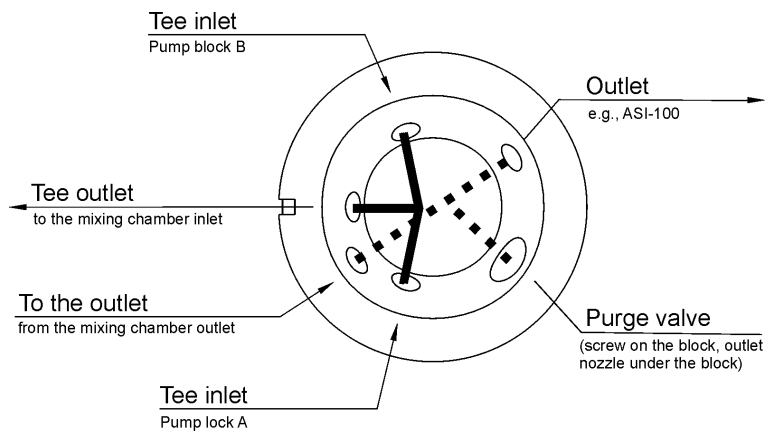


Fig. 29: Purge block (except for P680A DGP-6 pumps)

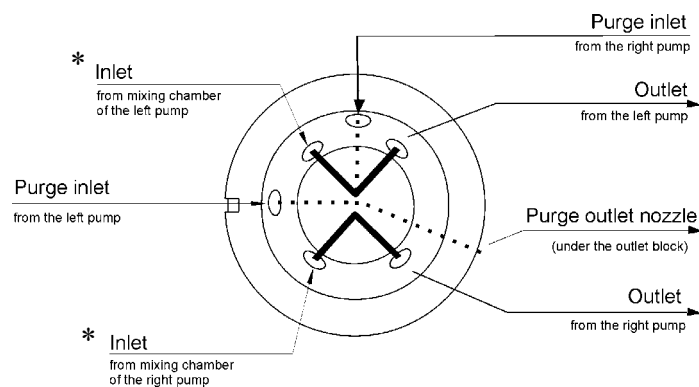


Fig. 30: Outlet block (for P680A DGP-6 pumps)

\* These two inlets are fitted with frit holders and inline filters. P680A DGP-6 pumps are factory-fitted with stainless steel frits (porosity: 10 µm).

**i Please note:** Check the permeability of the filter frits at regular intervals. When the pump delivers water at a flow rate of 2 ml/min and when the outlet is open, the pressure should not exceed 8 bar. Replace the filter frits (part no. 2268.0031 = filter frits with SS 10µm) if necessary.

**i Please note:** Do not interconnect the two outlets of a P680A DGP-6 pump; always direct them to separate fluid systems.

### 3.5 Isocratic Pump

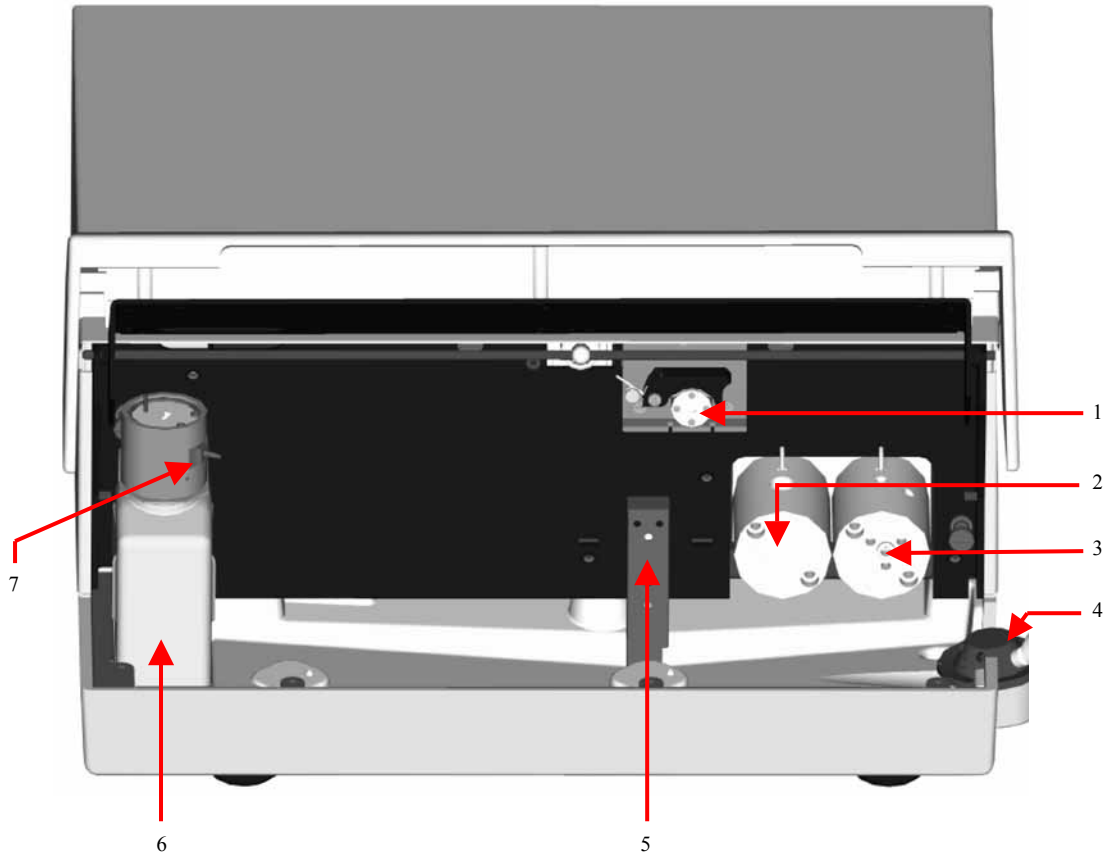


Fig. 31: Open **P680A ISO** pump (view from the front)

No.	Description	Part No.
1	Peristaltic pump	5030.4110
2	Working head without pressure sensor (P680A ISO, P680A LPG-4, P680A DGP-6)	5025.2001
3	Equilibration head with pressure sensor	-----
4	P680 purge block	-----
5	Central leak sensor	-----
6	Liquid reservoir of the rear-seal wash system (pack. unit: 12 reservoirs)	5810.9501
7	Detector of the rear-seal wash system	5030.4130

## Connections for an Isocratic System

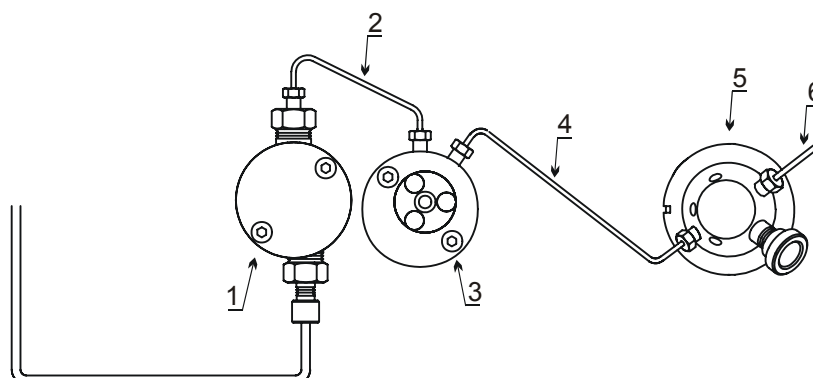


Fig. 32: Connections for an isocratic pump system

No.	Description	Part No.
1	Working pump head without pressure sensor (P680A ISO, P680A LPG-4, P680A DGP-6)	5025.2001
2	Capillary between the working and equilibration pump heads (all P680A pumps)	5030.3015
3	Equilibration pump head with pressure sensor	-----
4	Capillary between the equilibration pump head and the purge block (P680A ISO)	5030.3014
5	P680 purge block	-----
6	Pump outlet	-----

**i** **Please note:** A Solvent Rack with integrated 2-channel degasser (part no. 5030.9210, SOR-100A-2 Solvent Rack) is available from Dionex as an option for the P680A ISO pump.

## 3.6 Low-Pressure Gradient Systems (LPG)

### 3.6.1 P680 A LPG-4

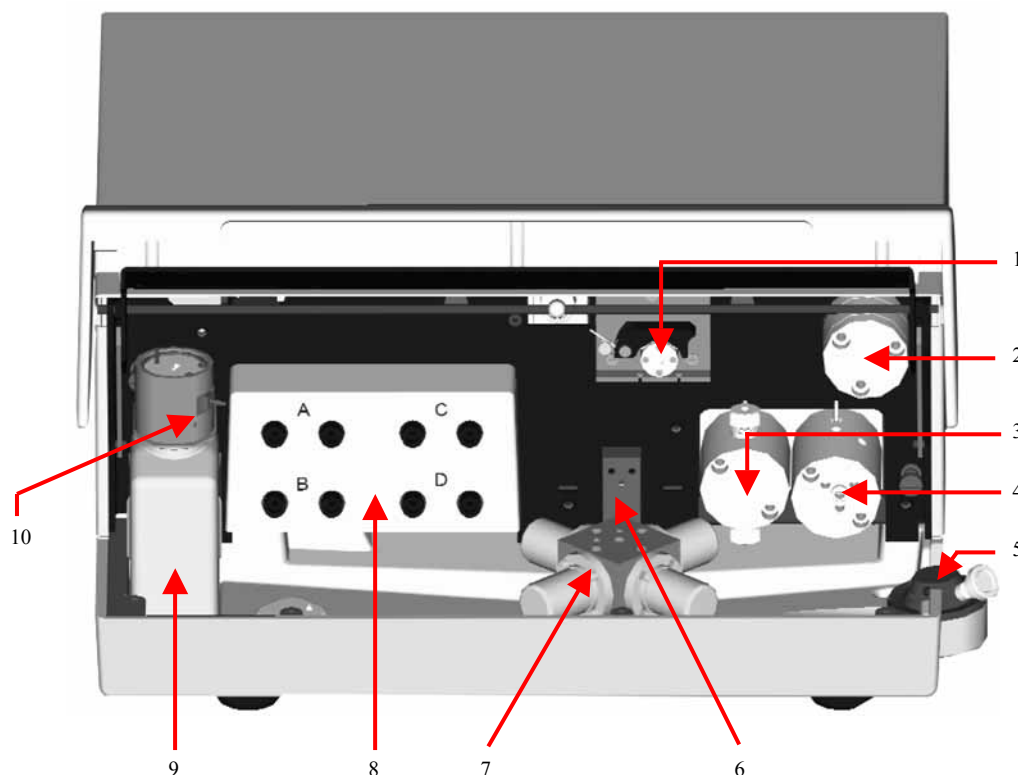


Fig. 33: Open **P680A LPG-4** pump (view from the front)

No.	Description	Part No.
1	Peristaltic pump	5030.4110
2	Mixing chamber	-----
3	Working pump head without pressure sensor (P680A ISO, P680A LPG-4, P680A DGP-6)	5025.2001
4	Equilibration pump head with pressure sensor	-----
5	Purge block and pump outlet	-----
6	Central leak sensor	-----
7	4-port proportioning valve	-----
8	Integrated online degasser with solvent connections	-----
9	Liquid reservoir of the rear-seal wash system (pack. unit: 12 reservoirs)	5810.9501
10	Detector of the rear-seal wash system	5030.4130

## Fluid Connections for a P680A LPG-4 Pump

The integrated online degasser is connected to the low-pressure side of the solvent delivery system, that is, the pump inlet.

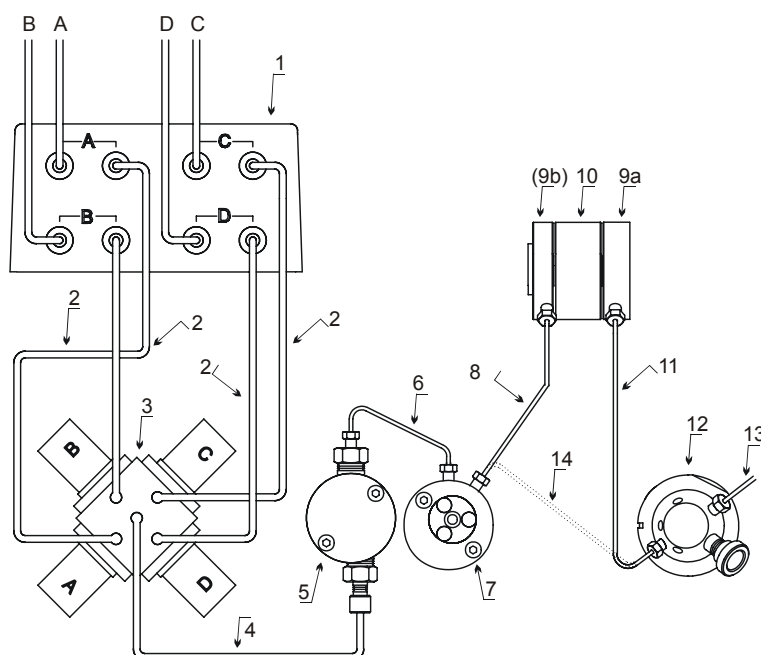


Fig. 34: Connections for a low-pressure gradient system

No.	Description	Part No.
1	Integrated online degasser with solvent connections	-----
2	Degasser A/B - proportioning valve connection tube Degasser C/D - proportioning valve connection tube	5030.2540* 5030.2541*
3	4-port proportioning valve	-----
4	Tube between the proportioning valve and the working pump head (P680A LPG-4, P680A DGP-6)	5030.2514
5	P680A working pump head without pressure sensor (P680A ISO, P680A LPG-4, P680A DGP-6)	5025.2001
6	Capillary between the working and equilibration pump heads (all P680A pumps)	5030.3015
7	P680A equilibration pump head with pressure sensor	-----
8	Capillary between equilibration pump head and mixing chamber (P680A LPG-4)	5030.3013
9a	Mixing chamber outlet (top)	-----
9b	Mixing chamber inlet (base)	-----
10	Mixing chamber extension (option)	→ page 123
11	Capillary between the mixing chamber and the purge block (P680A LPG-4, P680A HPG-2, and P680A HPG-4)	5030.3016
12	Purge block	-----
13	Pump outlet	-----
14	Direct connection to the pump outlet valve if no mixing chamber is installed.	→ page 127

\* The part nos. 5030.2540 and 5030.2541 do not include the degasser fittings. Please order the fittings separately, if necessary (part no. 715.2801.1252)



**⚠ Important:** Do not connect the pump outlet to the solvent lines connected to the degasser channels. This may puncture the degasser membrane!

**ℹ Please note:** When connecting the solvent lines, make sure that the connectors are free of contaminants. Even minute particles can allow air to enter the degasser, and thus reduce the instrument's effectiveness.

**ℹ Please note:** The flow rate increases considerably when the pump is being purged (→ Purging the Pump, page 34)! If the maximum flow rate is exceeded, the increased vacuum may cause gas bubbles to form.

**ℹ Please note:** After turning on the pump, the integrated online degasser requires approximately 12 minutes to reach the optimum vacuum. The run time must be long enough to ensure that the pump delivers with maximum degassing performance.

**ℹ Please note:** A Solvent Rack without degasser (part no. 5030.9200, SOR-100 Solvent Rack) is available from Dionex as an option for the P680A LPG-4 pump.

### 3.6.2 P680A DGP-6

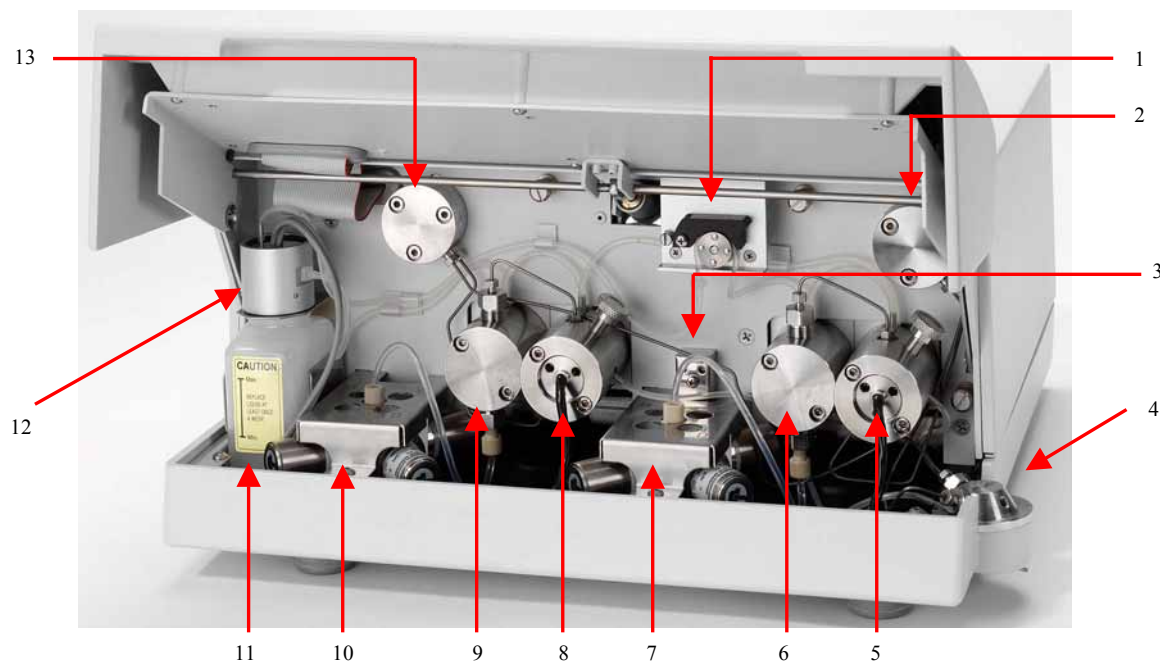


Fig. 35: Open P680A DGP-6 pump (view from front)

No.	Description	Part No.
1	Peristaltic pump	5030.4110
2	Mixing chamber for the right pump	-----
3	Central leak sensor	-----
4	Outlet block	-----
5	P680A DGP-6 equilibration pump head with pressure sensor and purge screw, for the right pump	-----
6	Working pump head without pressure sensor, for the right pump (P680A ISO, P680A LPG-4, P680A DGP-6)	5025.2001
7	3-port proportioning valve	-----
8	P680A DGP-6 equilibration pump head with pressure sensor and purge screw, for the left pump	-----
9	Working pump head without pressure sensor, for the left pump (P680A ISO, P680A LPG-4, P680A DGP-6)	5025.2001
10	3-port proportioning valve	-----
11	Liquid reservoir of the rear-seal wash system (pack unit: 12 reservoirs)	5810.9501
12	Detector of the rear-seal wash system	5030.4130
13	Mixing chamber for the left pump	-----

## Connections for a P680A DGP-6 Pump

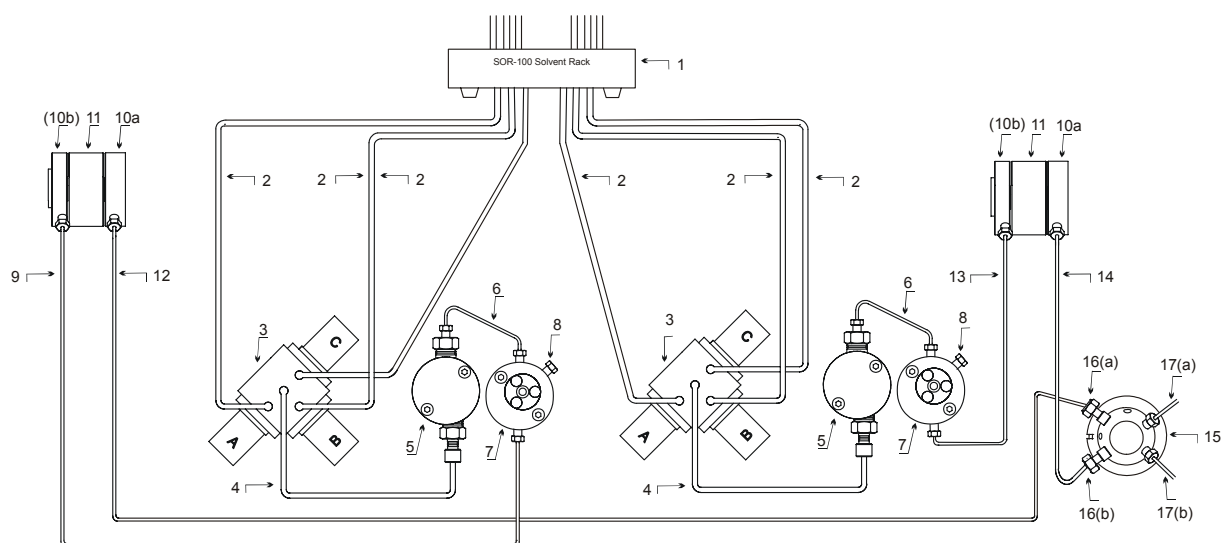


Fig. 36: Connections for a dual low-pressure gradient system

No.	Description	Part No.
1	Option: SOR-100A-6 Solvent Rack with 6-channel degasser (analytical) for P680A DGP-6 pumps	5030.9230
2	Connection lines P680A DGP-6 (proportioning valve - degasser)	-----*
3	3-port proportioning valve	-----
4	Capillary between the proportioning valve and the working pump head (P680A LPG-4, P680A DGP-6)	5030.2514
5	Working pump head without pressure sensor (all P680A pumps)	-----
6	Capillary between the working and equilibration pump heads (all P680A pumps)	5030.3015
7	P680A DGP-6 equilibration pump head with pressure sensor and purge screw	-----
8	Purge screw	-----
9	Capillary between the equilibration pump head and the mixing chamber (left pump, P680A DGP-6)	5030.3022
10a	Mixing chamber outlet (top)	-----
10b	Mixing chamber inlet (base)	-----
11	Mixing chamber extension (Option)	→ page 123
12	Capillary between the mixing chamber and the outlet block (left pump, P680A DGP-6)	5030.3042
13	Capillary between the equilibration pump head and the mixing chamber (right pump, P680A DGP-6)	5030.3021
14	Capillary between the mixing chamber and the outlet block (right pump, P680A DGP-6)	5030.3041
15	Outlet block	-----
16a	Inlet from the left pump	-----
16b	Inlet from the right pump	-----
17a	Outlet from the left pump	-----
17b	Outlet from the right pump	-----

\* To order these lines as spare part, use part no. 6030.2546 (= 1 connection lines plus four labels (A, B, C, and D))

**i** **Please note:** Do not interconnect the two outlets of a P680A DGP-6 pump; always direct them to separate fluid systems.

**i** **Please note:** For information about how to connect the tubing to the degasser of the Solvent Rack, refer to the *Operating Instructions for the SOR-100 Solvent Racks*.

### 3.7 High-Pressure Gradient System (HPG)

The **P680A HPG** and **P680P HPG-2** pump models are optimized for forming binary high-pressure gradients. The pumps deliver extraordinarily precise gradients. The pump enclosure contains two complete pressure pump blocks. If the solvent supply is controlled by selector valves, the pump can deliver two solvents on each pressure pump block in high-pressure gradient operation.

**i Please note:** You can rinse the two pressure pump blocks independently.

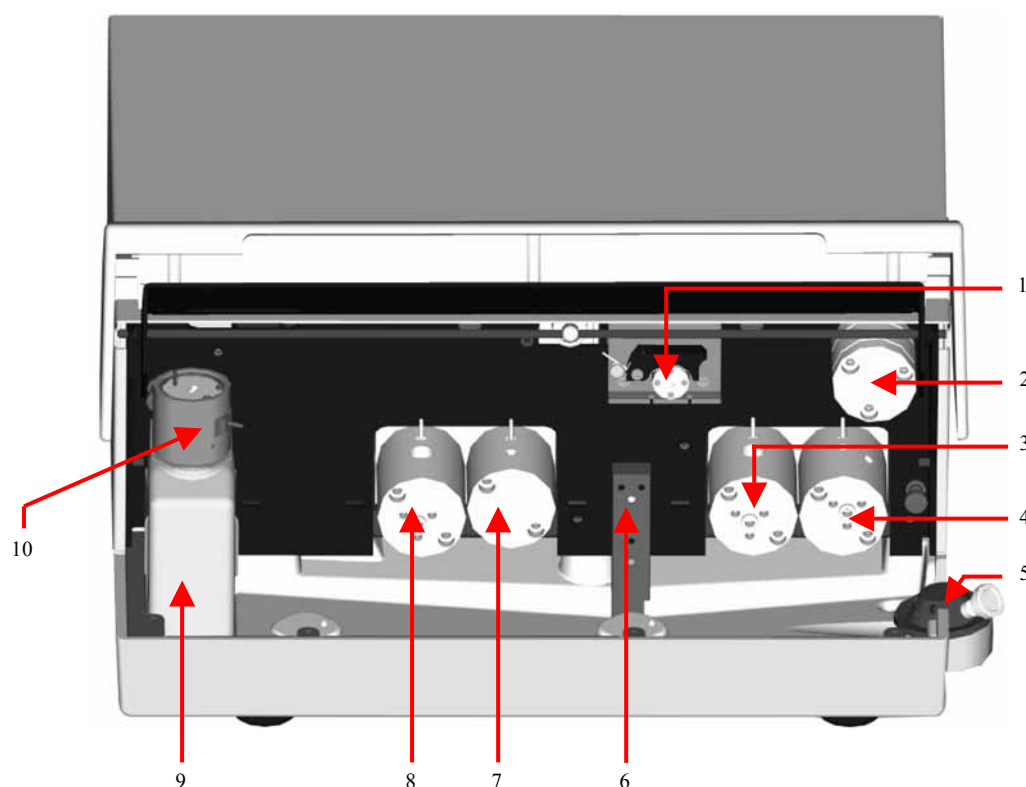


Fig. 37: Open **P680A HPG-2** and **P680P HPG-2** pumps (view from the front)

No.	Description	Part No.
1	Peristaltic pump	5030.4110
2	Mixing chamber	-----
3	Working pump head with pressure sensor	-----
4	Equilibration pump head with pressure sensor	-----
5	Purge block and pump outlet	-----
6	Central leak sensor	5810.2550
7	Equilibration pump head without pressure sensor (P680A HPG-2 and P680A HPG-4) Equilibration pump head without pressure sensor (P680P HPG-2)	5025.2005 5025.2205B
8	Working pump head with pressure sensor	-----
9	Liquid reservoir of the rear-seal wash system (pack. unit: 12 reservoirs)	5810.9501
10	Detector of the rear-seal wash system	5030.4130

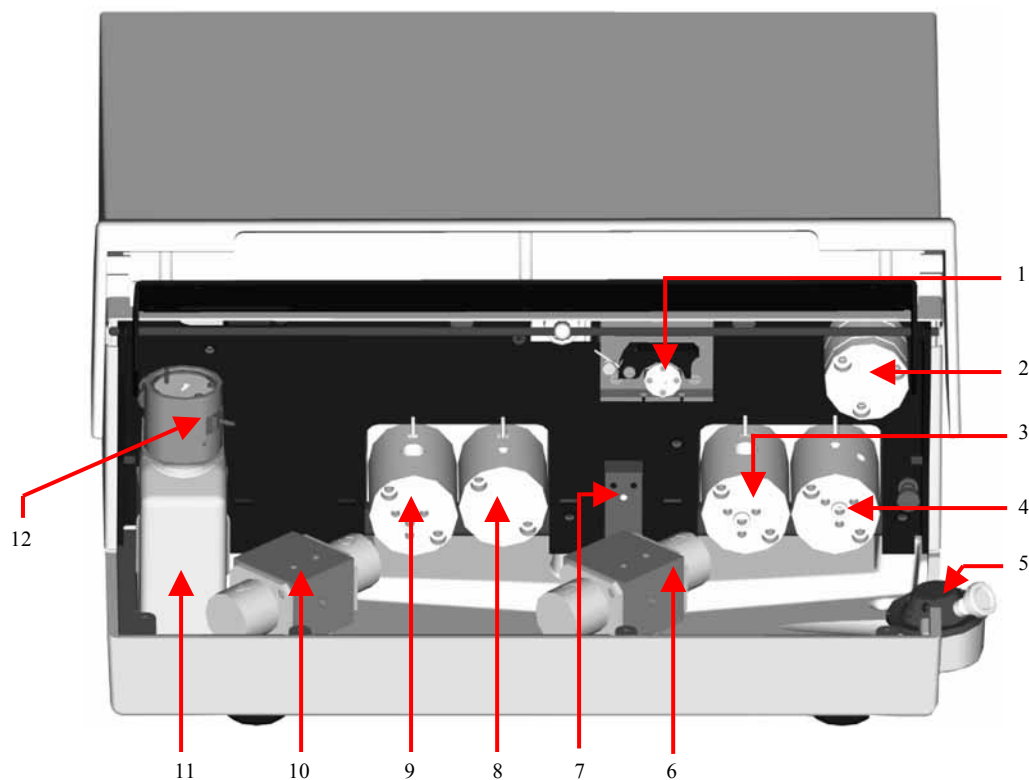


Fig. 38: Open **P680A HPG-4** pump (view from the front)

No.	Description	Part No.
1	Peristaltic pump	5030.4110
2	Mixing chamber	-----
3	Working pump head with pressure sensor	-----
4	Equilibration pump head with pressure sensor	-----
5	Purge block and pump outlet	-----
6	Solvent selector (right pump block)	5025.2612
7	Central leak sensor	-----
8	Equilibration pump head without pressure sensor (P680A HPG-2 and P680A HPG-4)	5025.2005
9	Working pump head with pressure sensor	-----
10	Solvent selector (left pump block)	5025.2611
11	Liquid reservoir of the rear-seal wash system (pack unit: 12 reservoirs)	5810.9501
12	Detector of the rear-seal wash system	5030.4130

## Fluid Connections in the High-Pressure Gradient System

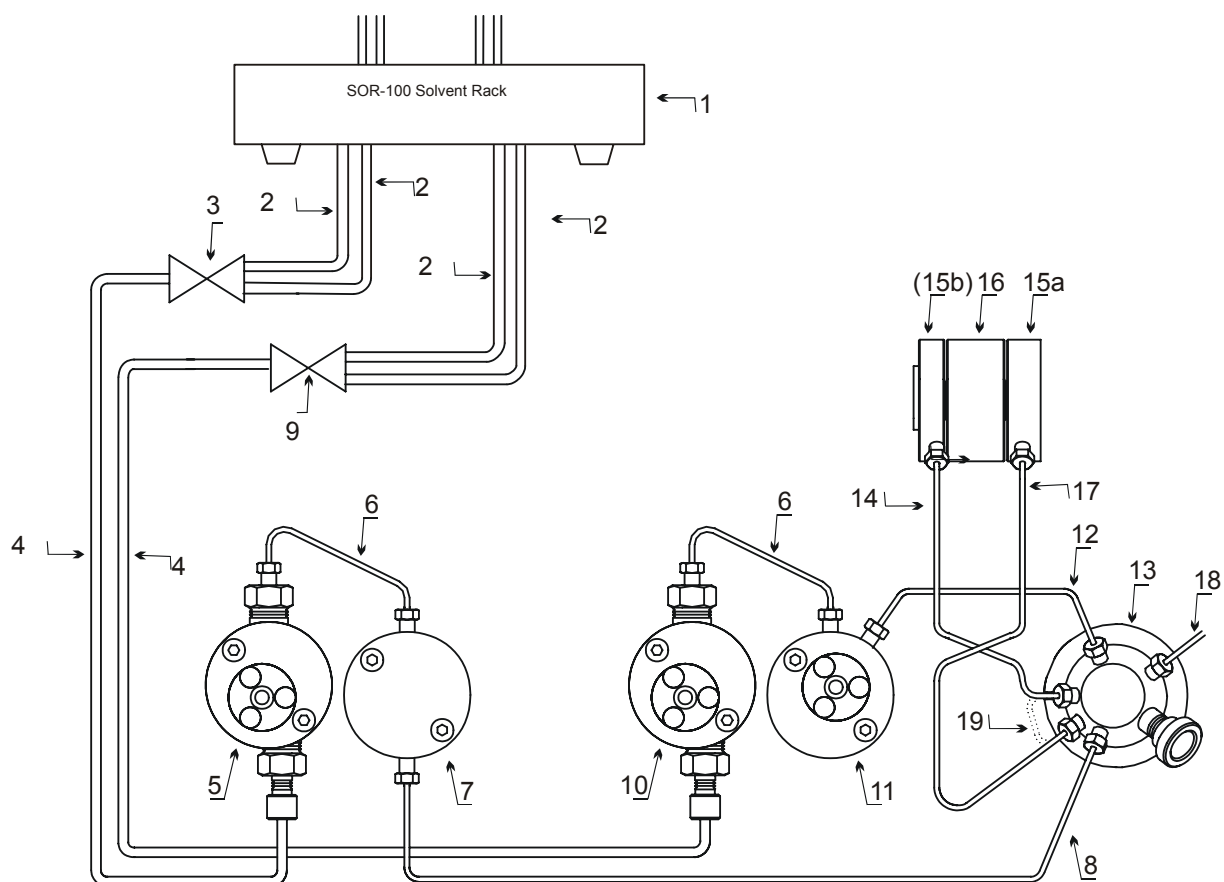


Fig. 39: Fluid connections in the HPG system  
here: with solvent selector option installed (only available for P680A HPG pumps)

No.	Description	Part No.
1	Options: - SOR-100A-2 Solvent Rack with 2-channel degasser (analytical) for P680A HPG-2 pumps - SOR-100A-4 Solvent Rack with 4-channel degasser (analytical) for P680A HPG-4 pumps	5030.9210 5030.9220
2	Solvent selector - SOR-100A-4 Solvent Rack connection tube (4 tubes per pump)	-----*
3	Solvent selector (left pump block) (only for P680A HPG-4)	5025.2611
4	Solvent selector - pump head connection tube (2 tubes per pump)	5030.2543
5	Working pump head with pressure sensor	-----
6	Capillary between the working and equilibration pump heads P680A or P680P (2 capillaries per pump)	5030.3015 or 5030.3025
7	Equilibration pump head without pressure sensor - P680A HPG-2 and P680A HPG-4 - P680P HPG-2	5025.2005 5025.2205B
8	Capillary between the equilibration pump head without pressure sensor and the purge block P680A HPG or P680P HPG-2	5030.3018 or 5030.3028
9	Solvent selector (right pump block) (only for P680A HPG-4)	5025.2612
10	Working pump head with pressure sensor	-----

No.	Description	Part No.
11	Equilibration pump head with pressure sensor	-----
12	Capillary between the equilibration pump head with pressure sensor and the purge block P680A HPG or P680P HPG-2	5030.3017 or 5030.3027
13	Purge block	-----
14	Capillary between the purge block (Tee) and the mixing chamber P680A HPG or P680P HPG-2	5030.3019 or 5030.3029
15a	Mixing chamber outlet (top)	-----
15b	Mixing chamber inlet (base)	-----
16	Mixing chamber extension (option)	→ page 123
17	Capillary between the purge block and the mixing chamber P680A HPG or P680P HPG-2	5030.3016 or 5030.3026
18	Pump outlet	-----
19	Direct connection to the pump outlet valve if no mixing chamber is installed.	→ page 127

\* To order these lines as spare part, use part no. 6030.2546 (= 1 connection lines plus four labels (A, B, C, and D))

**i** **Please note:** The "2 from 4" solvent selector is available as an option for the P680 A HPG-2 pump. It allows the pump to deliver specific combinations of binary high-pressure gradients. Follow the description under Special Aspects of a High-Pressure Gradient System (→ page 69).

**i** **Please note:** For information about how to connect the tubing to the degasser of the Solvent Rack, refer to the *Operating Instructions for the SOR-100 Solvent Racks*.



### 3.8 Installing the Manual Injection Valve

A manual injection valve (including installation kit) is available from Dionex as an option for the pump (injection valve plus installation kit; analytical: part no. 5030.0600; semi-preparative: part no. 5030.0610). The installation kit contains all parts required to mount the sample injector on the pump enclosure:

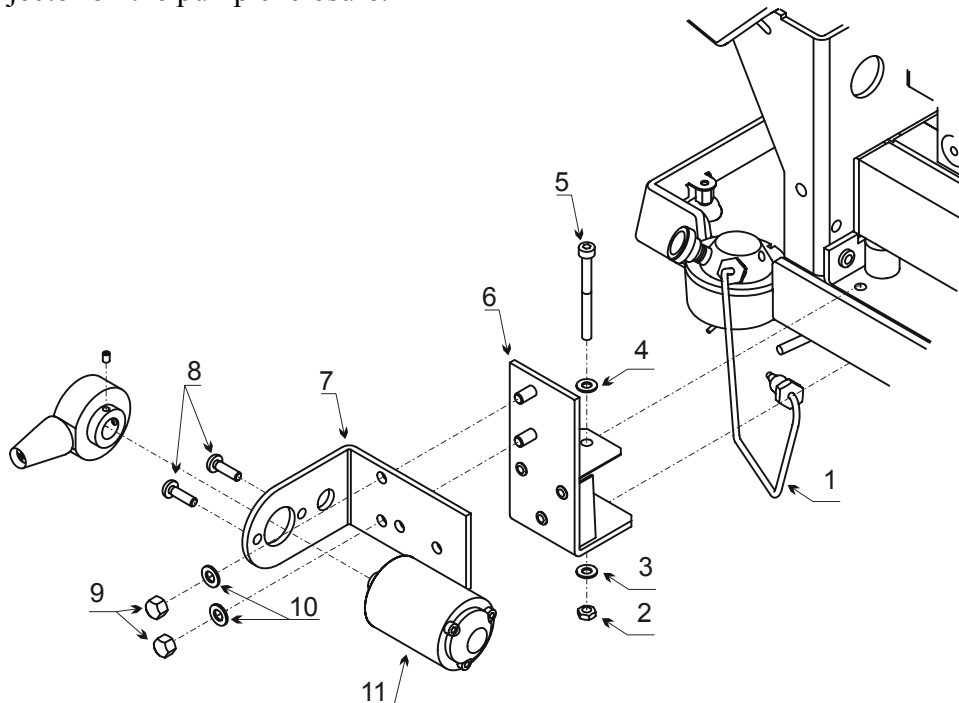



Fig. 40: Installing the manual injection valve

No.	Description	Part No.	Part No.
1	Capillary purge block - manual valve (analytical) Capillary purge block - manual valve (semi-preparative)	5030.3020 5030.3030	5030.0600 (analytical) <i>or</i> 5030.0610* (semi-prep.)
2	M4 locking nut	-----	
3	Washer	-----	
4	Washer	-----	
5	M4 attachment screw	-----	
6	Mounting bracket	-----	
7	Fixing bracket	-----	
8	Rheodyne mounting screws	-----	
9	Cap nut	-----	
10	Washer	-----	
11	Rheodyne manual injection valve, analyt., incl. 20- $\mu$ l loop <i>or</i> Rheodyne manual injection valve, semi-preparative	5030.0605 5030.0615	


\* Also includes a 2-ml sample loop.

Install the manual injection valve as follows:

- Turn off the pump and disconnect the power cord.
- Remove the cover of the enclosure. To do so, remove the four screws on the pump's rear panel and loosen the 4 large slotted-type screws on the pump's front panel (inner panel). You cannot remove these screws.
- Remove the attachment screw for the base plate from the pump's floor panel.
- Place the fixing bracket against the edge of the pump's floor panel (→ Fig. 40).
- To attach the fixing bracket, pass the attachment screw (→ Fig. 40, no. 5) (from above) through the fixing bracket and the pump's floor panel.
- Fasten the attachment screw (→ Fig. 40, no. 5) and tighten it using the locking nut (→ Fig. 40, no. 2).
- Tighten the fixing bracket to the mounting bracket.
- Remove the handle assembly from the injection valve.
- Fasten the injection valve to the fixing bracket. Make sure that the connection cable points to the pump enclosure. Tighten the injection valve onto the fixing bracket using two screws (→ Fig. 40, no.8).
- Set the handle assembly on the valve and tighten it, using the pin wrench.
- Fasten the capillary to the injection valve and to the pump outlet.
- Reinstall the pump's cover.

 **Important:** Do not use a fitting set other than the Rheodyne set to fasten the capillary to the injection valve.

- Connect the sample injector cable to the I/O output of the pump.

 **Important:** Use syringes with the correct needle (outer diameter 0.028", length 2"; for details, refer to the operating instructions manual injection valve).

### 3.9 Selecting Solvent Types for Automatic Pre-compression Control

Pre-compression control is **fully automatic** for all models in the P680 pump series (→ Principle of Operation, page 6). Therefore, you do **not** need to enter any numerical pre-compression values manually!

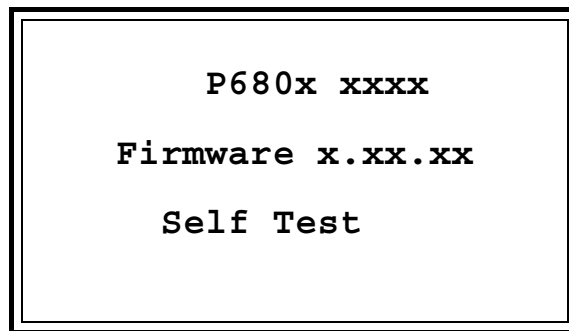
This is an important difference between the pumps in the P680 pump series and previous pump series, such as the P580 series.

## 4 Stand-Alone Operation

### 4.1 Power-Up

Please observe the information about the facility requirements (→ page 13) and the electrical connection (→ page 15). Use the power cord shipped with the P680 pump to connect the instrument to the mains. Turn on the pump by pressing the power switch on the rear panel.

When you turn on the pump, the LCD briefly displays the pump type, the firmware version and a "Self Test" message:



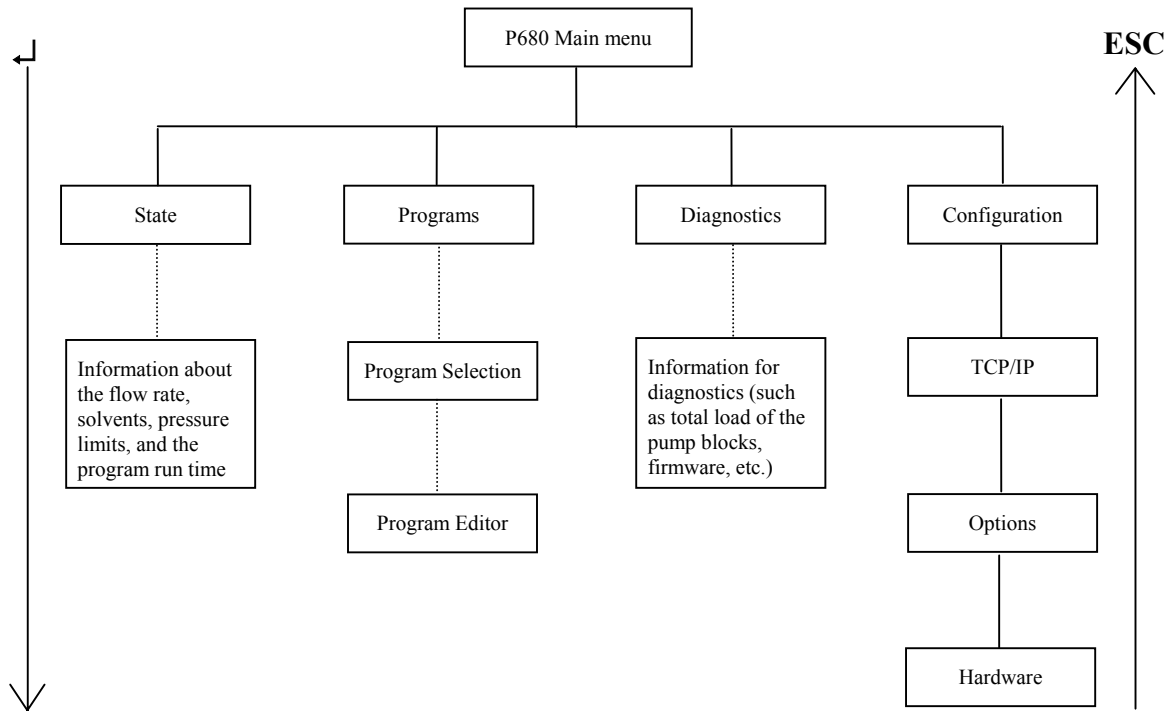
The pump immediately performs a self-test to check that all of the main components are functioning correctly.

**i** **Please note:** You may also initiate the self-test by pressing the **Self Test** key on the pump's keypad.

After the pump passes the self-test, the LCD displays the **Main** menu.

If an error is detected, an error message is displayed. Press **Esc** to confirm the error message and open the **Main** menu. However, the instrument is not ready for analysis yet. First, resolve the error (→ List of the Most Frequently Observed Error Messages, page 95) and then run the self-test again (by pressing the **Self Test** key on the instrument's front panel).

## 4.2 Menu Structure



Use the up/down cursor keys (→ Front Panel Display and Controls, page 7, keys no. 2) on the right of the LCD to select the desired option on the **Main** menu or the submenus. The selected submenu is underlined. Press the ↵ (**Enter**) key to confirm your selection and to access the underlined item. Alternatively, press the corresponding number key on the number keypad to directly access the selected submenu. **Esc** returns you to the superior menu.

In the program editor, the left/right cursor keys take you to the left or right column. Use the **Del** key to delete the selected program or to delete the line at the current cursor position in a program.

Use the arrow keys on the center keypad (→ Front Panel Display and Controls, page 7, keys no. 3) to change parameters and increment or decrement numerical values. Alternatively, enter numerical values directly on the center keypad. Press the ↵ (**Enter**) key to confirm your selection. Existing entries are automatically overwritten. Editable parameters are underlined.

**i** **Please note:** When working with a P680A DGP-6 pump, use the left/right cursor keys in the State menu to toggle between the user interface for the left and for the right pump.

## 4.3 Main Menu

When the pump is turned on and the model name and firmware version are no longer displayed on the LCD, the **Main** menu appears (also indicating the pump type, here: P680A LPG-4):

```
P680 LPG-4
Main Menu

1 State
2 Programs
3 Diagnostics
4 Configuration
```

Use the cursor keys to select the desired option. Press the ↵ (**Enter**) key to confirm your selection and open the underlined menu item. Alternatively, press the corresponding number key on the center keypad. **Esc** returns you from the submenus to the Main menu.

### 4.3.1 State Menu

On the **Main** menu, use the cursor keys to select the **State** menu and press the ↵ (**Enter**) key to confirm your selection. Or else, press **1** on the center keypad.

The **State** menu provides some basic information about the pump:

```
Flow: 0.570 ml/min
%A: 55.0 %C: 10.0
%B: 10.0 %D: 25.0

Time: 0.13 min
Press: 0 bar
Min: 1 Max: 149
```

**i** **Please note:** When working with a P680A DGP-6 pump, use the left/right cursor keys in the State menu to display the state information for the respective pump. The text at the top left, then reads **Fl. R** indicating that the information is displayed for the right pump or it reads **Fl. L** for the left pump.

You can enter the flow rate, the solvent composition as percentage (flow percentages of channels A, B, C, and D), and the upper and lower pressure limits. Use the up/down cursor keys to access these parameters.

Use the arrow keys on the center keypad:

- To change the flow rate in increments of 0.1 ml/min.
- To vary the solvent composition (%A, %B, %C, %D) in steps of 5%.
- To set the upper and lower pressure limits (Max and Min) to a value between 0 and 500 bar (7251 psi, 50 MPa) for analytical pumps and between 0 and 150 bar (2175 psi, 15 MPa) for the semi-preparative version, depending on the pressure unit selected on the Options menu (→ page 60).

Alternatively, you can enter the values for these parameters directly on the number keypad. Press the ↵ (**Enter**) key to confirm your selection. Existing entries are automatically overwritten. Values outside the permissible range are reset to the maximum or minimum permissible value. Example: If the pressure unit is bar and you enter and confirm 600 for either pressure limit, the value is reset to 500.

**i** **Please note:** With the P680A HPG-2 pump (two-channel high-pressure gradient pump), two different solvents can be mixed. It is not possible to combine channels A and C and channels B and D.

**i** **Please note:** With the P680A DGP-6 ternary dual low-pressure gradient pump three solvents can be mixed.

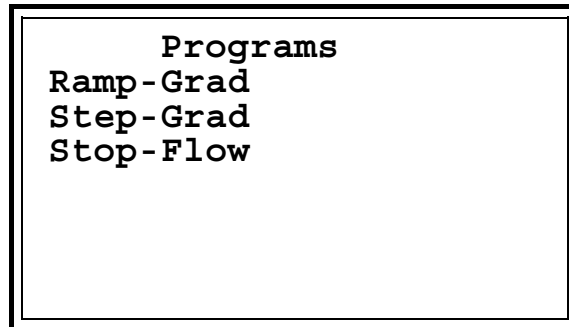
In addition, the time of the currently running program (pump program or program controlled via Chromeleon) and the system pressure (Press) are indicated. This information is read-only and cannot be changed.

If a pump program from the **Programs** submenu is running, the line between the solvent composition and the time reads as follows: Program:<program name>. If the pump is controlled via Chromeleon, the line remains empty.

### 4.3.2 Programs Menu

On the **Main** menu, use the cursor keys to select the **Programs** menu and press the ↵ (**Enter**) key to confirm your selection. Or else, press **2** on the center keypad.

Three program examples are available (for information about the contents and structure of these programs, refer to Program Examples (→ page 65):



You can edit, delete, or overwrite each program at any time or create new programs for linear or step-shaped flow or percentage. The programs remain stored in memory after the pump is turned off.

How to create a new program:

- Edit an existing program.
- Create a new program.

Use the cursor keys to select an existing program, press the ↵ (**Enter**) key to confirm your selection, and edit the program as desired. To create a completely new program, press the **Ins** key. The program editor opens, displaying the line: **Time: 0.00**.

Use the up/down cursor keys to access the individual program steps. Use the left/right cursor keys to access the left and right column, respectively. In the columns, use the arrow keys on the center keypad to page through the commands that are available for selection, to change the parameters, or to increment and decrement the numerical values. Alternatively, you can enter the numerical values directly on the center keypad. Press the ↵ (**Enter**) key to confirm your selection. Editable elements are underlined. Existing entries are automatically overwritten.

With the cursor in the left column, press the **Ins** key to insert a new program step above the selected line. (The key is not active in the right column.) Use the arrow keys to select the desired command and make the corresponding setting in the right column.

The following commands are available:

Command	Description
Time	Default: 0.00
%B C D	Solvent composition (Default: %B: 0.0 C: 0.0 D: 0.0)
Flow	Flow rate (Default: 1.000) (The permissible input range depends on the pump head type: Analyt = 0.00 - 10.00 ml/min, Prep = 0.00 - 50.00 ml/min. Values above the permissible range are reset to the maximum permissible value.)
Max	Upper pressure limit, range: 0 - 500 bar (50 MPa, 7251 psi); (Default depending on the pressure unit selected on the Options menu, page 60: 150 bar, 15.0 MPa, or 2175 psi)
Min	Lower pressure limit, range: 0 - 500 bar (50 MPa, 7251 psi); (Default: 0)
Msv	Switches the motorized switching valve to Load or Inject (Default: Load)
Relay4	Turns pump relay 4 on or off (Default: Off)
Relay3	Turns pump relay 3 on or off (Default: Off)
Relay2	Turns pump relay 2 on or off (Default: Off)
Relay1	Turns pump relay 1 on or off (Default: Off)

Press the **Del** key (in the left column) to delete the program step at the cursor position.

After making your changes, press **Esc** to exit the edited program or the program editor. The following dialog box opens:

**Name :**

**1 Save**

**2 Save as**

**3 Continue Editing**

**4 Cancel Edit**

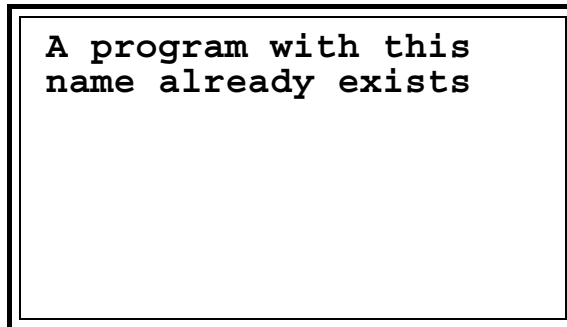
If you edited an existing program, the program name is displayed at the top right.

Use the cursor keys to select the desired function and press the **↵ (Enter)** key to confirm your selection. Alternatively, press the corresponding number key on the center keypad.

Select **Save** to save an edited program including the changes under the displayed name. If you created a new program, using the **Ins** key, the cursor is flashing at the top right. Enter the name for the new program. Press the corresponding key on the center keypad once to enter the first letter indicated on the key. To enter the second letter, quickly press the key twice. For the third letter, press the key three times. To enter the numerical value, quickly press the key four times. Press the **←** key to delete the character at the cursor position. Press the **↵ (Enter)** key to confirm the name.



Select **Save as**. The cursor now appears behind the program name. Use the ← key to delete any existing name character by character. Enter the new name as described above, and then press the ↵ (**Enter**) key to confirm the name. If you did not change the existing name, the following message is displayed:




A program with this  
name already exists

Press **Esc** to return to the previous menu. Save the program under the existing name or enter a new name.

**Continue Editing** returns you to the program.

**Cancel Edit** returns you to the **Programs** menu without saving the changes.

 **Please note:** Use the **Del** key on the center keypad to delete a program selected on the **Programs** menu. The **Confirm Delete** dialog box opens and prompts you to confirm the action. Select **Delete** to delete the selected program. Select **Cancel** to return to the **Programs** menu.

For details on starting, holding, and stopping programs, refer to Starting, Holding, and Stopping a Program on page 63. This section also provides information about how to assign a program to the left or right pump when you are working with a P680A DGP-6 pump.

### How to define default programs

On the **Programs** menu, you can define two programs as default programs:

**i** **Please note:** For a P680A DGP-6 pump, the default programs are executed for the right pump.

- Select the desired program, using the cursor keys, and press the "." key. An asterisk (\*) displays in front of the program name. This program is started via digital input 3 (signal name: START IN, → Digital I/O Port, page 19).
- Select the desired program, using the cursor keys, and press the 0 key. An exclamation mark (!) displays in front of the program name. This program is started via digital input 2 (signal name: STOP IN, → Digital I/O Port, page 19).

**i** **Please note:** You can add an asterisk and an exclamation mark, respectively, to one program each. To mark another program, define the program as described above. This action removes the mark in front of the original program. To delete a mark in front of a program, select the program and press the key for the corresponding mark once again.

### 4.3.3 Diagnostics Menu

On the **Main** menu, use the cursor keys to select the **Diagnostics** menu and press the ↵ (**Enter**) key to confirm your selection. Or else, press **3** on the center keypad.

The **Diagnostics** menu provides information about the current pump state:

```

Diagnostics

Workload R: 0.00300 MJ
Workload L: 0.00500 MJ
Rev. Right: 425
Rev. Left: 510
Firmware: 2.0
Serialno.: 10
    
```

The parameters are read-only and cannot be changed by the user.

Parameter	Description
Workload R:	Applies to the pump block of the P680A ISO and P680A LPG-4 pumps, to the right pump block of the P680A HPG and P680P HPG-2 pumps, and to the right pump of a P680A DGP-6: Indicates the workload of the pump block. The workload is calculated from the flow, pressure, and time parameters and is indicated in MegaJoule [MJ].
Workload L:	Applies to the left pump block of the P680A HPG and P680P HPG-2 pumps and to the left pump of a P680A DGP-6: Indicates the workload of the pump block.

Parameter	Description
Rev. Right:	Applies to the pump block of the P680A ISO and P680A LPG-4 pumps, to the right pump block of the P680A HPG and P680P HPG-2 pumps, and to the right pump of a P680A DGP-6: Indicates the number of revolutions of the cam.
Rev. Left:	Applies to the left pump block of the P680A HPG and P680P HPG-2 pumps and to the left pump of a P680A DGP-6: Indicates the number of revolutions of the cam of the pump block.
Firmware:	Indicates the pump's firmware version.
Serialno.:	Indicates the pump's serial number.

#### 4.3.4 Configuration Menu

On the Main menu, use the cursor keys to select the **Configuration** menu and press the ↵ (**Enter**) key to confirm your selection. Or else, press **4** on the center keypad.

Configuration	
<u>1</u>	TCP/IP
2	Options
3	Hardware

Use the cursor keys to select the desired option. Press the ↵ (**Enter**) key to confirm your selection and open the underlined menu item. Alternatively, press the corresponding number key on the center keypad. **Esc** returns you to the **Configuration** menu.

##### 4.3.4.1 TCP/IP

On the **Configuration** menu, use the cursor keys to select the **TCP/IP** option and press the ↵ (**Enter**) key to confirm your selection. Or else, press **1** on the center keypad.

The pump can communicate with the Chromeleon data system via a LAN connection (→ LAN Installation, page 72). The values to enter (IP address, subnet mask, and gateway) depend on the settings for the adapter for the instrument LAN (→ page 76).

TCP/IP	
IP-Adr	192.168.60.51
Mask	255.255.0.0
Gatew.	192.168.60.51

Use the cursor keys to access the individual parameters. The editable value is underlined. Enter the desired value on the center keypad and confirm your entry by either pressing the ↵ (**Enter**) key or accessing a different line via the cursor keys. Existing entries are automatically overwritten.

Use the ← key to delete any existing entry, character by character. **Esc** restores the overwritten value if you are still on the same entry line and if you have not yet confirmed your entry by pressing the ↵ (**Enter**) key.

**i** **Please note:** It is only possible to change the entries on the **TCP/IP** menu if the pump is not controlled by the Chromeleon data system. The **Remote** LED (→ Front Panel Display and Controls, No 5, page 7) does not light. First, select the **Disconnect** command in Chromeleon to terminate communication with the data system. Change the entries as desired. Turn the pump off and on. In the Chromeleon **Server Configuration** program, click **Browse** and select the pump according to its IP address (→ Installing the Pump in Chromeleon, page 79). Restore communication, using the **Connect** command in Chromeleon.

**!** **Important:** Verify that a unique IP address has been assigned to all Summit HPLC devices that are connected to the Chromeleon server PC. Select the same subnet mask as used for the Chromeleon server PC. In the **Gateway Address** field, enter a valid gateway address (if known) or the IP address of the device to configure.

#### 4.3.4.2 Options

On the **Configuration** menu, use the cursor keys to select the **Options** option and press the ↵ (**Enter**) key to confirm your selection. Or else, press **2** on the center keypad.

Options	
Rearseal Wash:	Auto
Op. Out:	No
LPG Sync Out:	No
Start/Stop/Hold:	Yes
Degasser:	Yes
Language:	English
Press. Unit:	bar
Rearseal Leak:	5
Purge Time L(s):	300
Purge Time R(s):	300
Purge Flow L(s):	6.000
Purge Flow R(s):	6.000
Flow Acc. L:	6
Flow Acc. R:	6
Timezone:	1
2002-01-14	13:42:14

Use the arrow keys on the center keypad to change the options:

Option	Description
Rearseal Wash	Turns the rear-seal wash system on or off. Select Auto/Interv./Off <b>Interv.</b> activates rear-seal washing once per hour for five minutes. However, the drop sensor on the liquid reservoir is not active, i.e., monitoring the piston seals for tightness is disabled. <b>Auto</b> periodically activates rear-seal washing once per hour until the drop sensor has counted 50 drops. The drop sensor on the liquid reservoir is active, i.e., the piston seals are monitored for tightness. <b>Off</b> turns the rear-seal wash system off.
Op. Out	Select <b>Yes</b> or <b>No</b> . If the setting is <b>Yes</b> , the <b>Operable Out</b> relay output is closed if the pump is not ready to operate, that is, if an error occurred or if the pump was turned off. If the setting is <b>No</b> , the relay does not have the special function described above. In this case, it is freely programmable.
LPG Sync Out	Select <b>Yes</b> or <b>No</b> . If the setting is <b>Yes</b> , the gradient is synchronized with the Inject of the autosampler (only for LPG and DGP-6 pumps; for a DGP-6, the setting relates to the right pump). If the setting is <b>No</b> , the relay does not have the special function described above. In this case, it is freely programmable.
Start/Stop/Hold	Select <b>Yes</b> or <b>No</b> . The <b>Yes</b> setting corresponds to the functionality of the digital inputs: START IN, STOP IN, and HOLD (→ Digital I/O Port, page 19). If the setting is <b>No</b> , you can use these inputs as desired.
Degasser	Turns the degasser of a P680A LPG-4 or an SOR-100 Solvent Rack with integrated degasser on or off. Select <b>Yes</b> or <b>No</b> . For P680A LPG-4 pumps and pumps operated with an SOR-100 Solvent Rack with integrated degasser, the setting should be <b>Yes</b> . For P680 pumps that are operated without degasser or with an external third-party degasser, select <b>No</b> . (Also, see section 4.3.4.3, page 62).
Language	Selects the language: German or English.
Press. Unit	Selects the unit for the pressure display on the <b>State</b> menu: bar, psi, or mega Pascal.
Rearseal Leak	Specifies the leak detection threshold. Range: 2-100 drops/h. For P680A pumps, the default value is 10 drops per hour; for P680P pumps, it is 20 drops. If more drops than specified reach the liquid reservoir (→ Fig. 23, page 31) although the peristaltic pump of the rear-seal wash system is not running, the LCD displays the message "Possible piston seal leak detected" or "The rear seal leak count is xx (= number of counted drops) and has exceeded the limit of yy (= leak threshold value)". On the other hand, if no liquid reaches the liquid reservoir although the peristaltic pump is running, the LCD displays the message "Rear-seal wash system has run out of wash solution". In both cases, press Esc to confirm the error message. Also, refer to Active Rear-Seal Wash System (→ page 31) and the List of the Most Frequently Observed Error Messages (→ page 95).
Purge Time L(s)	P680A DGP-6: Specify the time for purging the left pump. The time unit is seconds. (This value is not considered for all other pump types.)
Purge Time R(s)	Specify the time for purging the pump. The time unit is seconds. P680A DGP-6: The entry refers to the right pump.
Purge Flow L	P680A DGP-6: Specify the flow for purging the left pump. The flow unit is ml/min (maximum permissible flow rate for an analytical pump: 10 ml/min). (This value is not considered for all other pump types.)

Option	Description
Purge Flow R	Specify the flow for purging the pump. The flow unit is ml/min (maximum permissible flow rate for an analytical pump: 10 ml/min; for a semi-preparative pump: 50 ml/min). P680A DGP-6: The entry refers to the right pump.
Flow Acc. L	P680A DGP-6: Specify the maximum flow acceleration for the left pump. Range: 0.1 to 10000 ml/min <sup>2</sup> . For P680A pumps, the default is 6. If the default value is accepted, it takes 10 seconds until the flow rate is 1 ml/min. This setting is not relevant for purging the pump. (This value is not considered for all other pump types.)
Flow Acc. R	Specify the maximum flow acceleration. Range: 0.1 to 10000 ml/min <sup>2</sup> . For P680A pumps, the default is 6; for P680P pumps, the default is 30. If the default value is accepted, it takes 10 seconds until the flow rate is 1 ml/min. This setting is not relevant for purging the pump. P680A DGP-6: The entry refers to the right pump.
Timezone	Enter a value for the time zone. The time displayed in the Date and Time line is automatically corrected according to the selected time zone.
Date and Time	Real-time clock. Use the ← key to delete the existing entry, character by character. Change the date and/or time as desired. Confirm your entry by either pressing the ↵ ( <b>Enter</b> ) key or accessing a different line via the cursor keys. <b>Esc</b> restores the overwritten value if you are still in the Date and Time line and if have not yet confirmed your entry by pressing the ↵ ( <b>Enter</b> ) key.

#### 4.3.4.3 Hardware

On the **Configuration** menu, use the cursor keys to select the **Hardware** option and press the ↵ (**Enter**) key to confirm your selection. Or else, press **3** on the center keypad.

<b>Flow System:</b>	<b>LPG-4</b>
<b>Pump Head L:</b>	<b>Analyt</b>
<b>Pump Head R:</b>	<b>Analyt</b>
<b>Cal. Press L:</b>	<b>142</b>
<b>Cal. Press R:</b>	<b>142</b>
<b>Cam Zero L:</b>	<b>13075</b>
<b>Cam Zero R:</b>	<b>13075</b>
<b>Valve Delay:</b>	<b>8</b>
<b>L. X:</b>	<b>5250</b>
<b>R. X:</b>	<b>5250</b>
<b>L. Flow Adj:</b>	<b>100.300</b>
<b>R. Flow Adj:</b>	<b>100.500</b>
<b>Degasser:</b>	<b>External</b>

All data are read-only and cannot be changed by the user:

Option	Description
Flow System:	Indicates the pump type: ISO, LPG-4, HPG-2, HPG-4, DGP-6
Pump Head L	Indicates the pump head: P680A, P680P, or None. For an "ISO" or "LPG-4" pump, the setting is None. For all other pump types, the setting is the same as for Pump Head R.
Pump Head R	Indicates the pump head: P680A or P680P.

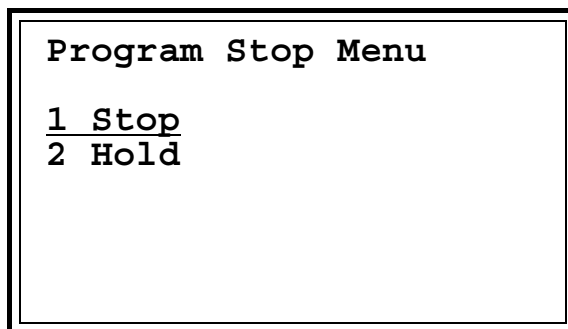
Option	Description
Cal. Press L	Only applies to the left pump of a P680A DGP-6: Indicates the calibration of the pressure sensor and indicator. After the calibration has been performed, the current system pressure is displayed.
Cal. Press R	Indicates the calibration of the pressure sensor and indicator. After the calibration has been performed, the current system pressure is displayed. P680A DGP-6: Refers to the right pump.
Cam Zero L	Only applies to the <i>left</i> pump block of an HPG pump and to the <i>left</i> pump of a P680A DGP-6: Indicates the compensation value for the opto sensor's zero passage of the camshaft.
Cam Zero R	Applies to the pump block of the P680A ISO and P680A LPG-4 pumps, to the <i>right</i> pump block of the P680A HPG and P680P HPG-2 pumps, and to the <i>right</i> pump of a P680A DGP-6 pump: Indicates the compensation value for the opto sensor's zero passage of the camshaft.
Valve Delay	Indicates the response time of the proportioning valve in milliseconds. The valve switches earlier by the indicated time to compensate the valve delay (for LPG pumps only).
L. X	P680A DGP-6: Indicates the value for the 50% step height for the left pump.
R. X	P680A LPG-4: Indicates the value for the 50% step height. P680A DGP-6: Indicates the value for the 50% step height for the right pump.
L. Flow Adj	Only applies to the <i>left</i> pump block of an HPG pump and to the <i>left</i> pump of a P680A DGP-6: Indicates the flow calibration.
R. Flow Adj	Applies to the pump block of the P680A ISO and P680A LPG-4 pumps, to the <i>right</i> pump block of the P680A HPG and P680P HPG-2 pumps, and to the <i>right</i> pump of a P680A DGP-6 pump: Indicates the flow calibration.
Degasser	For a P680A LPG-4 pump, the setting must be <b>Internal</b> . If your system includes an SOR-100 Solvent Rack with integrated degasser or if you use another external degasser, the setting must be <b>External</b> .

#### 4.4 Starting, Holding, and Stopping a Program

**i** **Please note:** When working with a P680A DGP-6 pump, first determine whether the program shall be executed for the left pump or for the right pump. Open the State menu and select the pump by pressing the left or right cursor key (also refer to State Menu, page 53).

On the **Programs** menu, use the cursor keys to select the program to start and press the **Start** key.

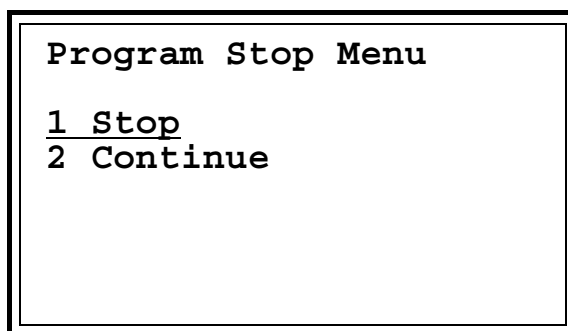
After a program has been started, the **State** menu opens. The **Program** line indicates the name of the currently running program. On the **Programs** menu, the name of the running program is displayed in bold letters. Press the **Stop** key to hold or stop a program. The following dialog box is opened:



Use the cursor keys to select the desired option and confirm your selection by pressing the ↵ (**Enter**) key. Alternatively, press the corresponding number key on the center keypad.

Select **Stop** to stop the running program. The conditions (= flow and solvent composition) do not change. The **State** menu no longer displays the program name.

Select **Hold** to hold the running program. The conditions (= flow and solvent composition) do not change. The program is still active and the program name is still displayed on the **State** menu. Press the **Start/Stop** key to stop or continue the program. The following dialog box opens:



Select **Stop** to finally stop the program.

Select **Continue** to continue the program. The **State** menu opens again indicating the name of the running program on the **Program** line.



## 4.5 Program Examples

When the pump is shipped from the factory, the **Programs** menu includes three program examples (**Ramp-Grad**, **Step-Grad**, and **Stop-Flow**). You can edit or delete these programs as described above (→ Programs Menu, page 55).

**i** **Please note:** Be sure that the system is equilibrated at the start time of the analysis (= injection time). Always reset the conditions to the start values after completing an analysis.

### Program example: Ramp-Grad

The program example results in a ramp gradient:

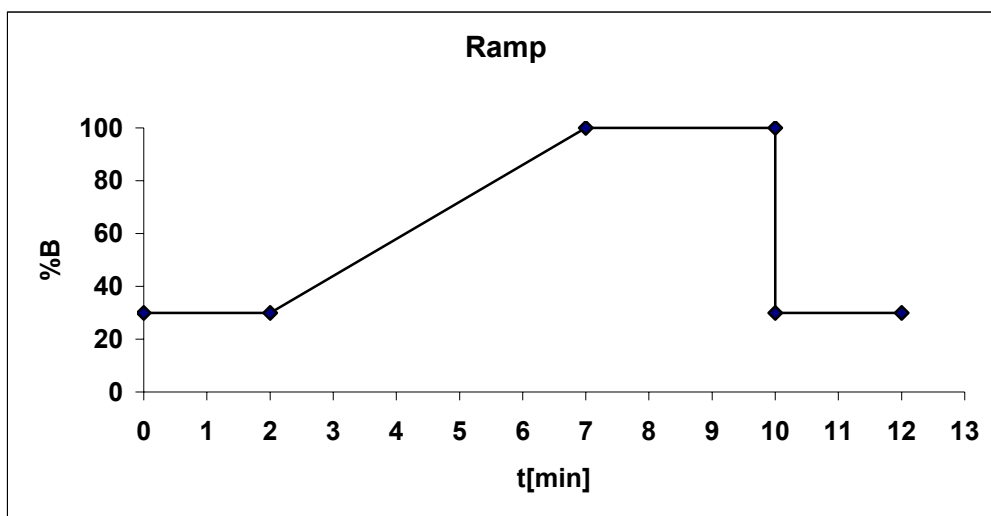
```
Program: Ramp-Grad
Min:      10
Time:     0.00
Flow:     0.500
%B: 30.0 C: 0.0 D: 0.0
Time:     2.00
%B: 30.0 C: 0.0 D: 0.0
Time:     7.00
%B:100.0 C: 0.0 D: 0.0
Time:    10.00
%B:100.0 C: 0.0 D: 0.0
%B: 30.0 C: 0.0 D: 0.0
Time:    12.00
%B: 30.0 C: 0.0 D: 0.0
```

### What it does:

First, the lower pressure limit (Min: 10), the time for starting the analysis (Time: 0.000 min), and the flow rate (0.500 ml/min) are defined. The pressure limit and the flow rate do not change during the analysis.

The analysis starts at 0.00 minutes. For two minutes, the pump delivers 70% solvent A and 30% solvent B. Two minutes after starting the analysis, the solvent composition starts changing until the pump delivers 100% solvent B seven minutes after the analysis started. The pump continues delivering 100% solvent B for the next three minutes. Ten minutes after the analysis started, the solvent composition changes, and the pump delivers 70% solvent A and 30% solvent B. The composition does not change until the analysis is complete twelve minutes after being started.

The gradient looks as follows:



Program example: Step-Grad

The program example results in a step gradient:

```

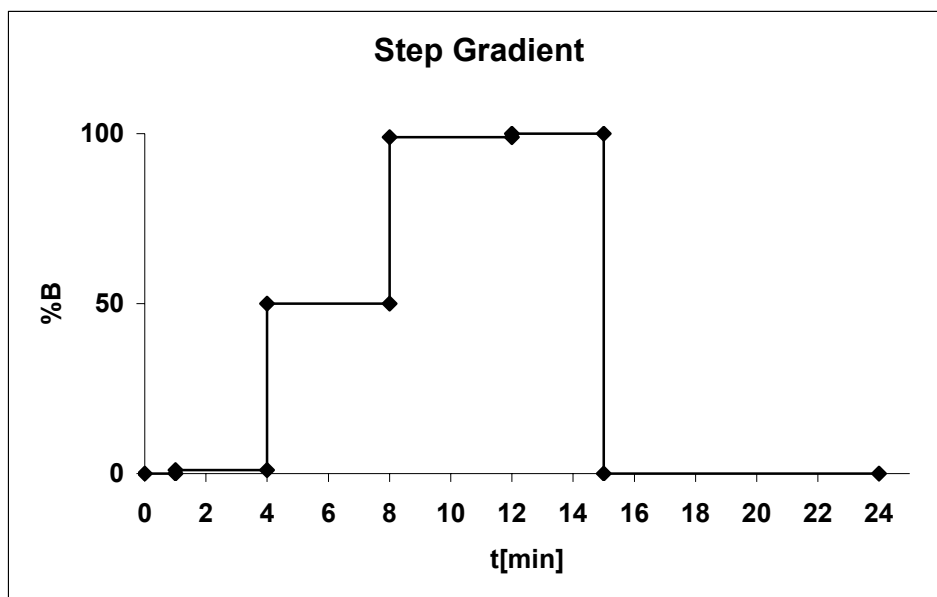
Program:  Step-Grad
Min:      10
Time:     0.00
Flow:     2.000
%B:  0.0 C: 0.0 D: 0.0
Time:     1.00
%B:  0.0 C: 0.0 D: 0.0
%B:  1.0 C: 0.0 D: 0.0
Time:     4.00
%B:  1.0 C: 0.0 D: 0.0
%B:  50.0 C: 0.0 D: 0.0
Time:     8.00
%B:  50.0 C: 0.0 D: 0.0
%B:  99.0 C: 0.0 D: 0.0
Time:    12.00
%B:  99.0 C: 0.0 D: 0.0
%B: 100.0 C: 0.0 D: 0.0
Time:    15.00
%B: 100.0 C: 0.0 D: 0.0
%B:  0.0 C: 0.0 D: 0.0
Time:    24.00
%B:  0.0 C: 0.0 D: 0.0
    
```

What it does:

First, the lower pressure limit (Min: 10), the time for starting the analysis (Time: 0.00 min), and the flow rate (2.000 ml/min) are defined. The pressure limit and the flow rate do not change during the analysis.

The analysis starts at 0.00 minutes. For one minute, the pump delivers 100% solvent A. One minute after starting the analysis, the solvent composition changes. The pump now delivers 99% solvent A and 1% solvent B. The composition does not change for the next three minutes. Four minutes after starting the analysis, the solvent composition changes to 50% solvent A and 50% solvent B and remains unchanged for the next four minutes. Eight minutes after starting the analysis, the solvent composition changes to 1% solvent A and 99% solvent B. It remains at this level for the next four minutes. Twelve minutes after the analysis started, the solvent composition changes to 100% solvent B and remains unchanged for another three minutes. Fifteen minutes after starting the analysis, the solvent composition changes again. The pump now delivers 100% solvent A and 0% solvent B. The solvent composition does not change again until the analysis is complete (24 minutes after the analysis started).

The gradient looks as follows:



Program example: Stop-Flow

The program example allows the pump to be shut down in a controlled way by resetting the flow rate to 0.000 ml/min:

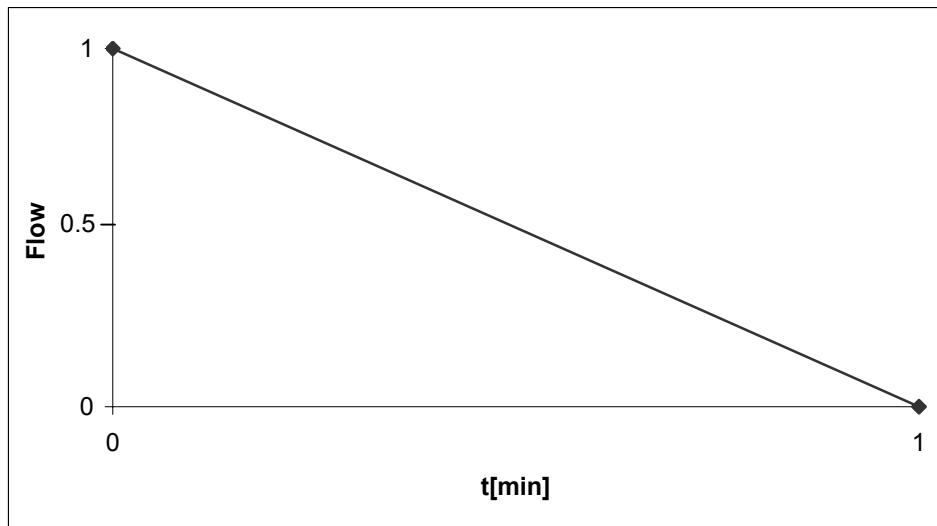
```
Program:  Stop-Flow
Min:      0
Time:     0.00
Flow:     1.000
%B: 0.0 C: 0.0 D: 0.0
Time:     1.00
Flow:     0.000
%B: 0.0 C: 0.0 D: 0.0
```

What it does:

First, the lower pressure limit (Min: 0) and the time for starting the analysis (Time: 0.00 min) are defined. These parameters do not change during the program run.

The program starts at 0.00 minutes. The flow rate is 1.000 ml/min. For one minute, the pump delivers 100% solvent A. During this minute, the flow is continuously reset to 0.000 ml/min. The solvent composition remains unchanged.

The flow gradient looks as follows:



## 4.6 Special Aspects of a High-Pressure Gradient System

The **P680A HPG** and **P680P HPG-2** high-pressure gradient pumps operate with two pump blocks that are integrated in a single enclosure. Operation of the high-pressure gradient pump is identical to the low-pressure gradient pump (LPG). However, consider the following:

### 4.6.1 Supported Gradient Combinations

When "2 from 4" solvent selector option is installed, channels A and C are connected to pump block 1 (left), while channels B and D are connected to pump block 2 (right). The integrated solvent selector supports the following combinations of binary high-pressure gradients:

Pump block 1 (left)	Pump block 2 (right)
Solvent A	Solvent B
Solvent A	Solvent D
Solvent C	Solvent B
Solvent C	Solvent D

In a specific time step, each pressure pump block delivers only one of the two channels (100%). It is not possible to specify a mixing ratio for the two channels connected to the same pump block (A and C; B and D).

If you enter a portion for solvent C while solvent A is already set, the portion for solvent A is automatically reduced to 0%. The same applies to channels B and D on the second pump block. For example, if you enter a portion for solvent D (D = 20%), while the portions for solvents B and C are already set (B = 40%, C = 60%), solvent C is automatically increased to 80%. The same applies to all other channels.

### 4.6.2 Double Flow Mode

HPG models support the double flow mode. This mode enables maximum flow rates of 20 ml/min (analytical version) or 100 ml/min (semi-preparative pump version). In stand-alone operation, the double flow mode is available for each solvent combination and composition supported by the HPG-pump. The pump automatically calculates the flow rate maximum considering that none of the two pump blocks delivers more than 10 ml/min (analytical pump version) or 50 ml/min (semi-preparative pump version).

Example A:

Both pump blocks of an analytical pump deliver 50 %. Each block then delivers 10 ml/min thus, reaching the flow maximum of 20 ml/min.

Example B:

Pump block A of an analytical pump delivers 60% and block B delivers 40%. Block A then delivers 10 ml/min while block B delivers correspondingly less, that is, 6.67 ml/min. In this case, maximum flow rate is 16.667 ml/min.

### 4.6.3 P680P HPG-2 Semi-Preparative Pump

Please observe the following when working with a **P680P HPG-2** pump:

- Only use the solvent lines (part no. 6007.9300) from the pump's accessories kit. These lines have an inner diameter of 2.0 mm.
- Only use the filter frits (part no. 2268.3110) from the accessories kit.
- Do not prolong the solvent lines.
- Especially for applications with high flow rates, make sure that the solvent reservoirs are located near the pump; they should be on the same level or higher.
- We recommend using a preparative degasser. Do not connect an analytic degasser to the P680P HPG-2 pump.

## 4.7 Operation after a Power Failure

After a power failure, instruments operating in stand-alone mode return to a reliable condition; all functions in progress when the power loss occurred are aborted. For example, the pump flow is stopped. As soon as the power is restored, the pump performs a self-test. If an error is detected, the corresponding message appears on the front panel of the instrument.

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

---

## 5 Automated Control by Chromeleon

### 5.1 General

If desired, the P680 pump can be controlled by the Chromeleon Chromatography Management System. To control the pump by the data system, make sure that the following license is available under Chromeleon. (If you have any questions, please contact your Dionex Sales Representative.)


- for Chromeleon  $\leq$  6.40: Device Control license
- for Chromeleon  $\geq$  6.50: Class 1 license

We generally recommend connecting the pump to the Chromeleon server PC via USB (Universal Serial Bus). Almost all PCs provide at least one USB port. However, if this is not possible, use a network connection (LAN) for communication between the pump and the Chromeleon server. For example, Windows NT 4.0 does not support USB. If you are using a LAN connection, please observe the recommendations for network operation ( $\rightarrow$  page 78). For information about how to install the TCC-100 via USB and LAN, refer to USB Installation (see below) and LAN Installation ( $\rightarrow$  page 72), respectively.

#### 5.1.1 USB Installation

** Please note:** Install Chromeleon software ( $\rightarrow$  page 79) before connecting the pump to the USB port on the Chromeleon server PC.

Please observe the information about the facility requirements ( $\rightarrow$  page 13) and the electrical connection ( $\rightarrow$  page 15). Use the power cord shipped with the P680 pump to connect the instrument to the mains. Turn on the pump by pressing the power switch on the rear panel. Use the USB cable from the P680 accessories kit ( $\rightarrow$  page 133) to connect the P680 to the USB port on the Chromeleon server PC.

** Please note:** The USB connection to the PC or the USB hub must not exceed 5 m. A special USB extension cable (Dionex part no. 8911.0004) is available if a longer connection is required. Up to five extension cables may be connected in series. For system reasons, the overall connection length must not exceed 30 m.

For Chromeleon versions 6.20, 6.30 and 6.40, install the P680 driver via the Setup program on the software CD provided in the accessories kit. Insert the CD into the CD drive of your Chromeleon server PC. Double-click Setup.exe in the root directory. Click **Next** to have the Setup program check which Chromeleon version is installed on your PC. Follow the on-screen instructions as they appear to install the driver. If a version is found for which no driver is available, the setup aborts.

For Chromeleon versions higher than 6.40, the USB installation of the pump is handled automatically during the Chromeleon setup and you do not have to take any other action.

### 5.1.2 LAN Installation

**ⓘ Please note:** Install the LAN connection under Windows NT 4.0 only. For any other operating systems, we recommend installing a USB connection.

Please observe the information about the facility requirements (→ page 13) and the electrical connection (→ page 15). Use the power cord shipped with the pump to connect the instrument to the mains. Turn on the pump by pressing the power switch on the rear panel. Use the LAN cable from the pump's accessories kit (→ page 133) to connect the pump to the LAN port on the Chromeleon server PC.

To ensure reliable communication between the pump and the Chromeleon server with a LAN connection, we recommend using a LAN connection that is independent of the office LAN, i.e., an instrument LAN, between the pump and the Chromeleon server PC. This type of connection requires that you install a separate 10Mbit network interface card in the Chromeleon server PC and assign unique IP addresses to all connected devices. For information about how to install the separate network interface card in the Chromeleon server PC, refer to page 73.

If your PC already contains a separate network interface card for operating Summit HPLC devices, the pump can be connected to this card. For details on how to connect the pump using an instrument LAN under Windows NT 4.0, refer to below.

**⚠ Important:** Dionex cannot guarantee reliable communication when operating the pump on an office LAN because the load of the office LAN is a decisive factor. Overload of the office LAN may result in timeouts and loss of data and thus disturb automatic operation of the data system. Therefore, we advise against operating the pump on an office LAN.

#### Connecting the pump via an instrument LAN under Windows NT 4.0

If the Chromeleon server PC is running Windows NT 4.0, the pump must be connected to the server PC via a LAN. Windows NT 4.0 does not support USB.

If you wish to connect no other instrument but a single pump, you can connect the server PC and the pump via a **crossover** cable, a special network cable with crossed-over data lines. These lines are usually marked by colors (red, yellow) to distinguish the cable from standard network cables.

Thus, the structure of the instrument LAN is as follows (peer-to-peer connection):

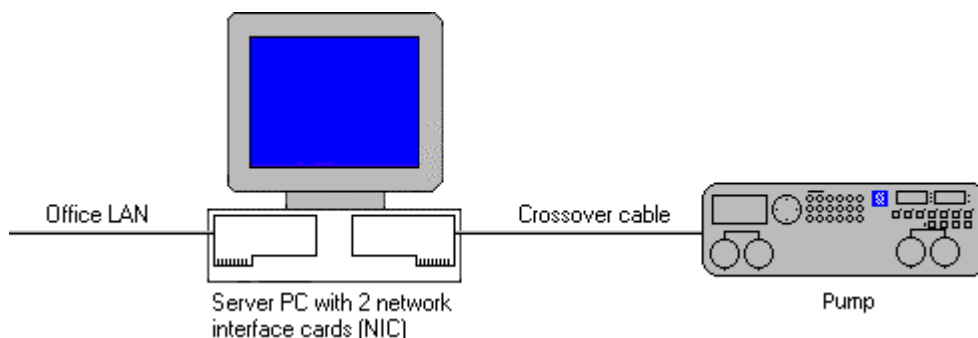


Fig. 41: Peer-to-peer connection



If you wish to connect several TCP/IP-enabled Summit HPLC devices to the server PC, you must use a hub (10 Mbit) to establish the connection to the instrument LAN. In this case, use standard network cables instead of the crossover cable (One standard network cable, part no. 8906.2038, is provided in the accessories kit.)

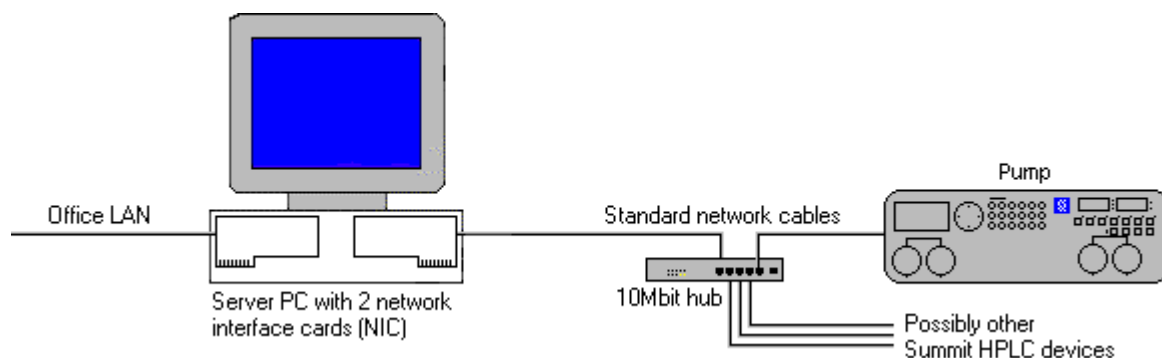


Fig. 42: Hub connection

### Separate Network Interface Card (NIC)

A network connection that is independent of the office LAN is called an instrument LAN. This kind of connection between the pump and the Chromeleon server requires the installation of a separate 10 Mbit network interface card (NIC, in the operating system = adapter) in the Chromeleon server PC.

Install the card according to the manufacturer's instructions, via **Start** → **Settings** → **Control Panel** → **Network** → **Adapters** → **Add**.

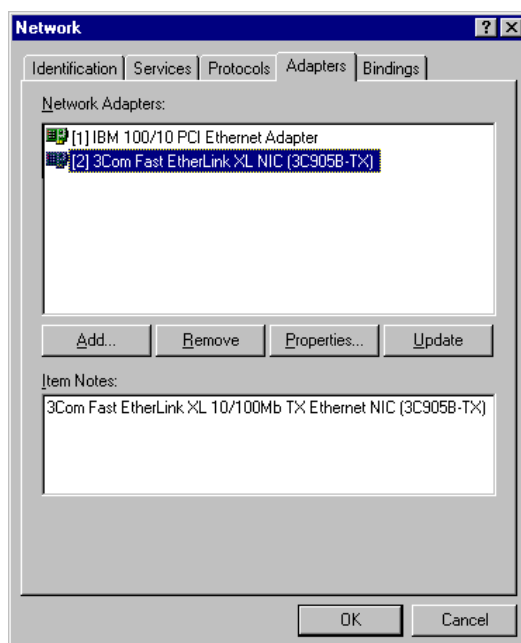


Fig. 43: Installing the separate network interface card

Configure the network adapter for the instrument LAN (here: [2] 3Com Fast EtherLink XL NIC (3C905B-TX)) on the **Bindings** tab page. First, select **all protocols** in the **Show Bindings for** field to verify that the TCP/IP protocol is installed. Install the TCP/IP protocol, if necessary:

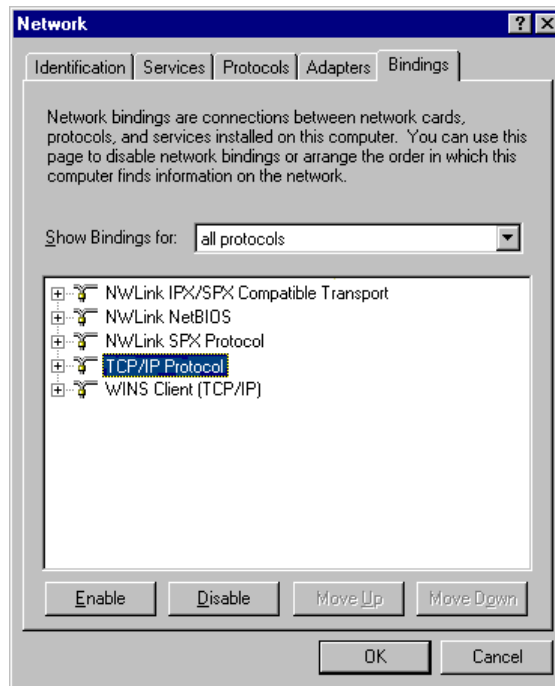


Fig. 44: Show bindings for all protocols

Then, select **all adapters** in the **Show Bindings for** field and disable all protocols for the adapter for the instrument LAN except the TCP/IP protocol:

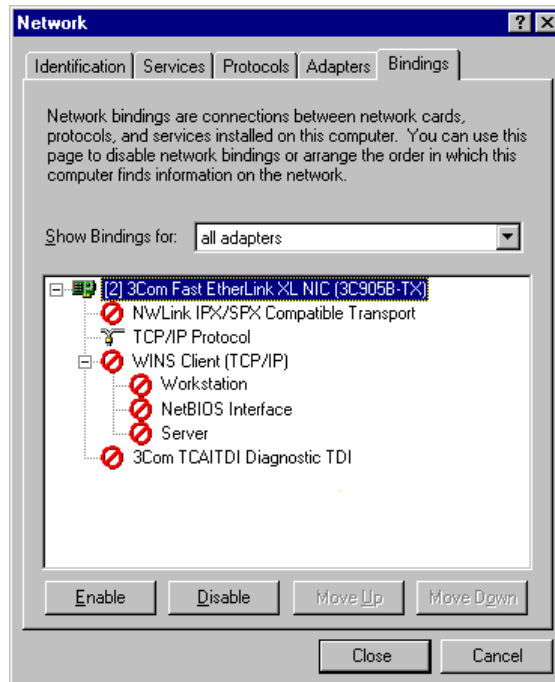


Fig. 45: Show bindings for all adapters

An IP address and a subnet mask are required for the separate network adapter because the TCP/IP protocol is used for the instrument LAN. The dialog box for entering the IP address and the subnet mask is opened automatically during installation.

**i** **Please note:** You can reopen this dialog box later to change the IP address and the subnet mask if necessary. Select the properties of the TCP/IP protocol via **Start → Settings → Control Panel → Network → Protocols**. Then, select the TCP/IP protocol and open the **Properties of Microsoft TCP/IP** dialog box, using the **Properties** command on the context menu.

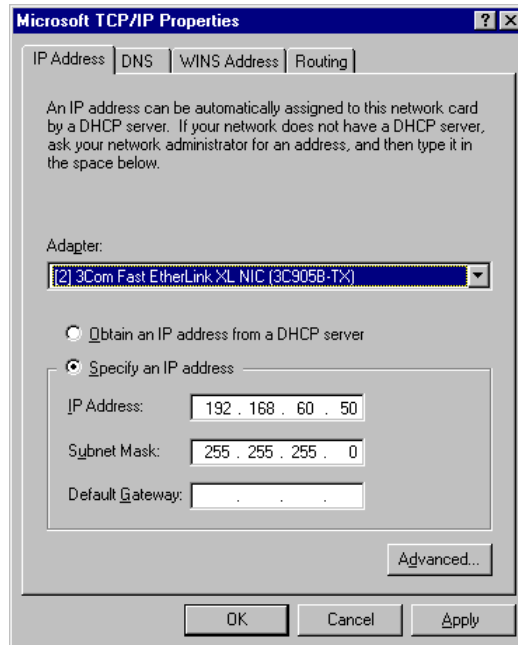


Fig. 46: Assigning the IP address and subnet mask

In the **Adapter** field, select the network adapter for the instrument LAN and enable the **Specify an IP address** option.

**⚠ Important:** Do not change the settings for the office LAN network interface card!

**⚠ Important:** For the adapter for the instrument LAN, disable all other network protocols and services (see above).

Assign a fixed IP address to the adapter for the instrument LAN.

First, identify which IP range is already used. To do so, open a DOS command box via **Start → Programs → Command Prompt** and enter: **ipconfig /all**. Differentiate between the two following cases:

Case A: Already used IP address  $\neq$  192.168.60.xxx

Case B: Already used IP address = 192.168.60.xxx

**Note:** The subnet mask determines which part of the IP address describes the network and which part defines the individual devices connected to the network. Independent LANs have different network addresses. Based on the subnet mask 255.255.255.0 in the above example, the term "192.168.60" describes the network, while "xxx" defines the individual modules connected to the network

**Case A:**

Select the address from the range given below and enter the subnet mask specified below:

IP Address: 192.168.60.xxx (xxx can be any number between 1 and 254)  
Subnet Mask: 255.255.255.0

Do not enter a gateway address; no gateway is available for the instrument LAN and the above addresses cannot be routed. Communication between the pump and the Chromeleon server is always direct.

**Case B:**

If the range 192.168.60.xxx is already used, use a different network range for the instrument LAN, e.g., use 192.168.61.

**⚠ Important:** In this case, make sure that the addresses assigned to the individual Summit HPLC modules also start with 192.168.61.

For information about the appropriate value for your individual configuration, contact your system administrator.

Do not enter a gateway address; no gateway is available for the instrument LAN and the above addresses cannot be routed. Communication between the pump and the Chromeleon server is always direct.

**Applies to both, case A and case B**

It may happen that the pump that you want to control via the separate 10Mbit network adapter may already have an IP address and subnet mask assigned. In this case, when selecting the IP address of the network adapter of the server PC, be sure that only the last digit differs from the IP address of the pump. Otherwise, it may not be possible to address the connected Summit HPLC devices.

Example for a valid configuration for case A:

P680 pump:	IP address	192.168.60. <b>51</b>
	Subnet mask	255.255.255.0

Server:	IP address	192.168.60. <b>50</b>
	Subnet mask	255.255.255.0

Example for a valid configuration for case B:

P680 pump:	IP address	192.168.61. <b>51</b>
	Subnet mask	255.255.255.0

Server:	IP address	192.168.61. <b>50</b>
	Subnet mask	255.255.255.0

**⚠ Important:** Every device on the same network must have a unique IP address. Selecting duplicate IP addresses may cause conflicts on the network.

**⚠ Important:** Do not use 0 or 255 as the last numbers in IP addresses.

To check the selected settings, enter the following commands at the DOS level:

```
ipconfig /all
```

What it does: Lists the configuration of all network adapters. The newly installed 10Mbit network adapter has been configured successfully if this command also returns its IP address and subnet mask.

```
route print
```

What it does: Checks whether you can address the pump with the network adapter used for the instrument LAN. The new network adapter is correctly configured if the indicated network (here, for example, 192.168.60.0) is displayed under **Target** and its subnet mask under **Net mask**.

```
ping 192.168.60.51
```

What it does: Checks the connection to the pump with the IP address 192.168.60.51. If the installation is correct, the pump will reply to the ping command.

### 5.1.2.1 Assigning IP Properties to the Pump

In order to operate the pump on a network, assign an IP address and subnet mask on the pump itself on the **Configuration** menu (→ TCP/IP, page 59). The parameter values to enter depend on the settings for the adapter for the instrument LAN (→ page 76).

### 5.1.2.2 Recommendations for Network Operation

Unlike USB connections, Ethernet LAN connections have limited real-time capabilities. Data transmission can occur only when no other connected user is using the network. In order to take full advantage of the real-time capabilities of the pump, select the instrument LAN connection (→ page 72). This ensures that other network users do not delay the server communication.

If the pump is connected to the data system via a LAN, it is not advisable to use the digital inputs of the pump for remote inject synchronization. This is because the timing of LAN communication varies, depending on the current LAN traffic.


If the pump is connected to the data system via USB, all remote inputs are polled after 0.1 seconds and they can be used without restrictions.

**i** **Please note:** Dionex cannot guarantee reliable communication when operating the pump on an office LAN because the load of the office LAN will be a decisive factor. Overload of the office LAN may result in timeouts and loss of data, and thus disturb automatic operation of the data system. We therefore advise against operating the pump on an office LAN.

## 5.2 Installing the Pump in Chromeleon

Follow the steps below to install the pump in the Chromeleon installation program (= Server Configuration):

- Start the Server Monitor program by selecting **Server Monitor** on the **Start** → **Programs** → **Chromeleon** menu on the task bar. Start the server and close the Server Monitor window. The Server Monitor icon appears on the task bar.

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

- Start the **Server Configuration** program by selecting Server Configuration on the **Start** → **Programs** → **Chromeleon** menu on the taskbar.
- If necessary, click the "+" character beside the server name to display the items underneath.
- Select the timebase to which to add the pump.
- Select **Add Device...** on the **Edit** or context menu.
- The **Add device to timebase** dialog box is opened. Select **Dionex** from the left list box, and then select **P680 Pump** from the right list box. (For Chromeleon < 6.50, select the **Dionex P680 Pump** driver from the list.) Click **OK** to confirm your selection.

A wizard guides you through the installation of the pump (starting with Chromeleon 6.60 SP1, Chromeleon 6.50 SP5 and Chromeleon 6.40 SP7).

Clicking **Next>** takes you to the next wizard page; clicking **<Back** takes you to the previous wizard page.

## General Page

Use the **General** tab page to define the general instrument parameters.

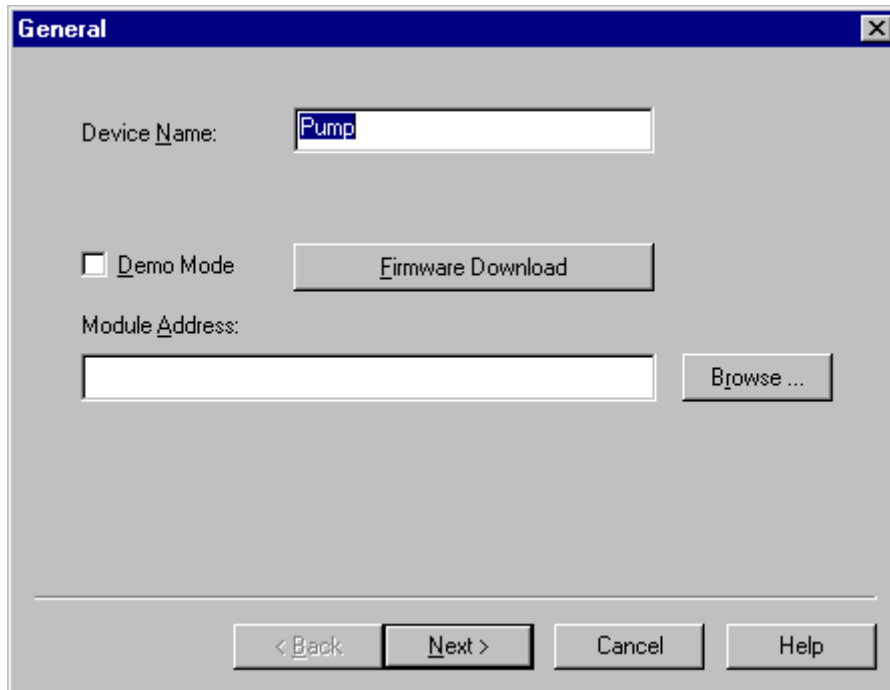


Fig. 47: General wizard page

- The **Device Name** field indicates the name under which the pump is identified in the installation environment. Do not change the default device name (**Pump**).

**i** **Please note:** If the default is changed, the links to the corresponding control panels may no longer be available.

- Verify that the **Demo Mode** check box is cleared. If the Demo Mode is enabled, the Module Address input field is disabled.
- Click the **Browse** button to select the **Module Address** of the desired pump. This opens a window showing information about all available installed pumps (USB and LAN connections).

Address	S/N	Server Name	Ethernet
USB-01610103	01610103@CLABOR_NT		00-E0-EF-DE-00-01
192.168.60.52	01610105	0.0.0.0	00-E0-EF-DE-00-02

Fig. 48: Device list




The **Address** column lists all available modules. The entry that is available via Ethernet (TCP/IP) includes the module's IP address. The entry for a module that is available via USB (identified by the prefix "USB") includes the module's Ethernet address or serial number.


If a module listed here is already connected to a Chromeleon server via a LAN connection, the server name appears in the **Server Name** column. If a module is available for connection, the column shows 0.0.0.0 or is empty.

The **S/N** column lists the module's serial number and the name of the computer to which the module is connected while the Chromeleon server is running. The **Ethernet** column shows the module's Ethernet address.


Select the desired pump by double-clicking. The module's address is automatically entered in the **Module Address** field of the **General** tab page.


 **Please note:** If you change the IP address on the pump's TCP/IP menu (→ page 59), you must also select this address in the **Module Address** field. Turn the pump off and on so that Chromeleon "sees" the new address. Only then will it be available in the Device List.

- Click the **Firmware Download** button to download the current firmware version of the pump driver from the data system to the pump. (The button is disabled if the Demo Mode is enabled.) The current firmware version is displayed here as well as the version of the file that is available in the **\Bin** directory of your Chromeleon installation (P680.HEX).

 **Please note:** It is not possible to overwrite a pump firmware revision 2.0 or higher with a firmware prior to revision 2.0.

Click **OK** to start the firmware download. Please note that the Chromeleon server needs to be in **running idle** mode for the download. The download can take several seconds.

 **Important:** During the download, make sure that the communication between the pump and Chromeleon is not interrupted and do not turn off the pump. Problems or errors during the download may lead to malfunction of the pump or to boot errors. In this case, turn off the pump. Turn on the pump again while holding the Esc key on the pump's front panel. The message "Bootloader active" shall appear on the pump's LCD display. Repeat the download as described above.  
If the download is not successful, contact Dionex Service.

 **Please note:** Make sure that the pump is unpressurized (e.g., the purge valve is open) and that the flow is turned off. Immediately after the new firmware has been downloaded from Chromeleon to the instrument, the pump performs a reset. For about 15 seconds, the pump's internal bootloader is updated; a corresponding message is displayed on the pump. Therefore, do not turn off the pump while the bootloader is updating.

Clicking **Next>** takes you to the next wizard page.

- When you install the pump for the first time, the following message appears (when Demo Mode is disabled):



Fig. 49: Message when the pump is installed for the first time

Chromeleon attempts to connect to the pump, to retrieve the settings from the pump's firmware and set the options (pump type and installed pump head) on the corresponding wizard pages. Click **OK** to confirm this message.

## Devices Page

The settings on this page depend on the pump type:

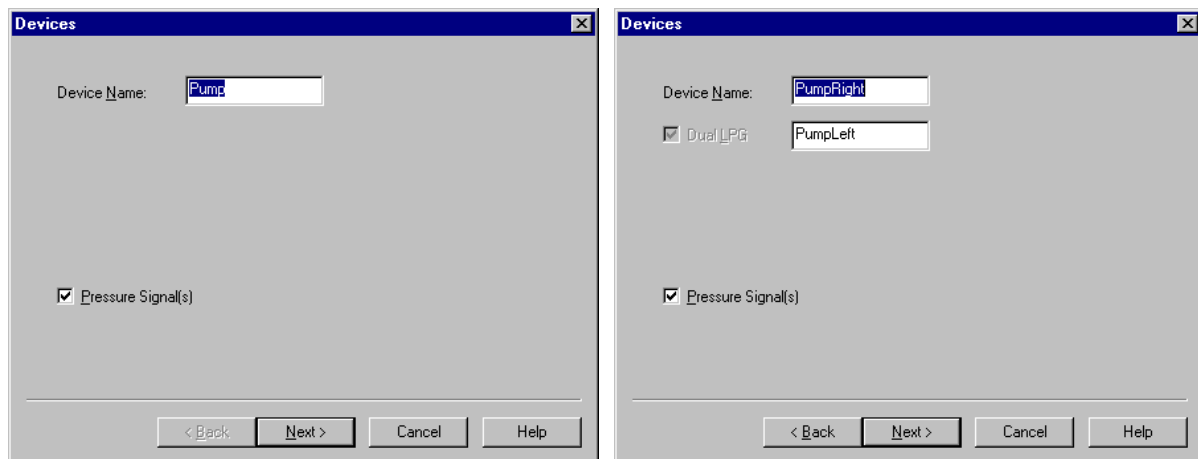


Fig. 50: Devices page  
(left: for all pumps except P680A DGP-6; right: for P680A DGP-6 pumps)

For P680A DGP-6 pump, the Dual LPG check box is selected by default. In the **Device Name** fields, **PumpRight** appear for the right pump and **PumpLeft** for the left pump. For all other pump types, the entry is **Pump**.

The **Pressure Signals** check box is selected by default. Accept this setting if you want to record the pump pressure. Chromeleon generates the appropriate channels for data acquisition. For a P680A DGP-6, Chromeleon generates the **PumpRight\_Pressure** and **PumpLeft\_Pressure** channels; for all other pumps, the channel is named **Pressure**.

Clicking **Next>** takes you to the next wizard page.

## Pump, Right Pump, and Left Pump Pages

- i** **Please note:** When installing a P680A DGP-6 pump, Chromeleon provides a **Right Pump** and a **Left Pump** wizard page. Use the **Right Pump** page to make the settings for the right pump. Use the **Left pump** page to make the settings for the left pump.  
For all other pump types, the page is named **Pump**.

The settings on the **Pump**, **Right Pump**, and **Left Pump** pages depend on the pump type:

Fig. 51: Pump wizard page (here: for P680 HPG pumps)

- On the top left, the installed pump head is indicated. The pump head affects the maximum allowed flow rate and pressure.

Pump Head	Description
Analytical	By default, the pump is fitted with analytical pump heads.
Semi-Preparative	Select this option from the drop-down list if the pump is fitted with semi-preparative pump heads.
Micro	Reserved for future use.
Analytical Bio and Micro Bio	Reserved for future use.

- The **High pressure gradient** check box is available only on the **Pump** page for P680 HPG pumps. It is selected by default. Only then, **Double flow** mode can be enabled.

- Determine the limits for the flow rate:

Flow	Description
Range	Shows the permissible flow rate range. The range depends on the pump type and the installed pump heads: 0.00..10.00 ml/min (Analytical), 0.00..50.00 ml/min (Semi-Preparative).
Minimum	Enter a new value to change the lower limit for the flow rate range.
Maximum	Enter a new value to change the upper limit for the flow rate range.
Double flow	The <b>Double Flow</b> option can be enabled for HPG pumps only. Select the <b>Double flow</b> check box for pump flows above the regular permissible range. As both pump blocks are used together for delivery, the maximum flow rate doubles. In this way, the maximum permissible flow is 20 ml/min for the analytical pump version and 100 ml/min for the semi-preparative pump version (also see: Double Flow Mode, page 69).

- Determine the limits for the system pressure and select the pressure unit:

Pressure	Description
Range	Shows the permissible pressure range. The range depends on the pump type and the installed pump heads: 0..500 bar (Analytical) oder 0..100 bar (for a short time: 150 bar) (Semi-Preparative).
Unit	Select the pressure unit (psi, bar, or MPa).
Minimum	Enter a new value to change the lower limit for the minimum pressure.
Maximum	Enter a new value to change the limit for the maximum pressure.

Clicking **Next>** takes you to the next wizard page.

## Solvents, Right Solvents, and Left Solvent Pages

- i** **Please note:** When installing a P680A DGP-6 pump, Chromeleon provides a **Right Solvents** and a **Left Solvents** wizard page. Use the **Right Pump** page to make the settings for the right pump. Use the **Left pump** page to make the settings for the left pump. For all other pump types, the page is named **Pump**.

Use these pages to determine the number and names of the solvents delivered by the pump:

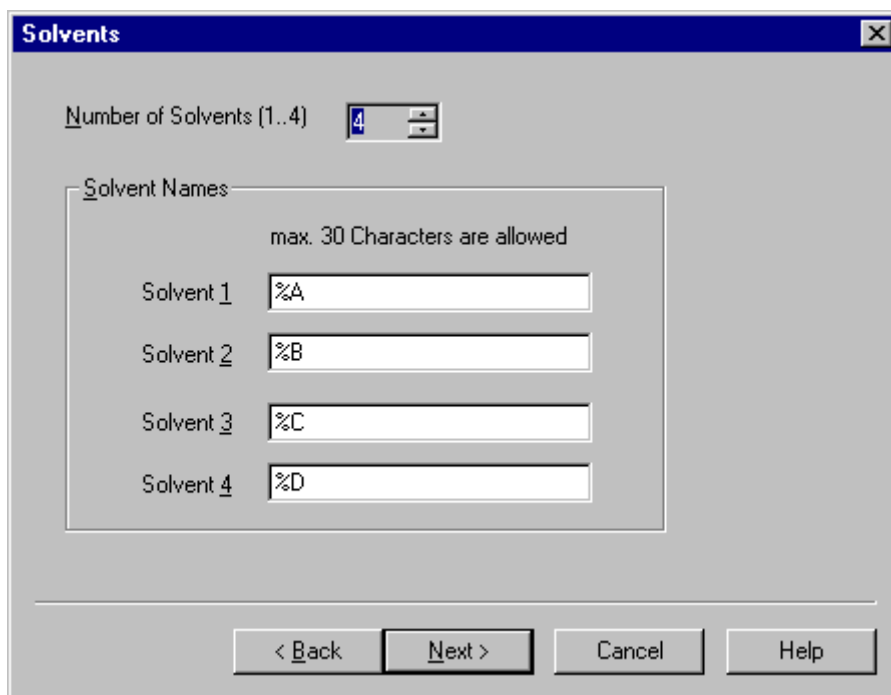


Fig. 52: Solvents page (here: for all pumps except P680A DGP-6)


- In the **Number of Solvents** field, use the arrows to indicate how many solvents are delivered by the pump. The maximum number of solvents for a P680A DGP-6 pump is three; the maximum number of solvents for all other pump types is four.
- Under **Solvent Names**, enter a name for each connected solvent in the corresponding input field. A maximum of 30 characters is permitted. The names of the solvents appear, for example, in the gradient display of the online control panel and in the report.

Clicking **Next>** takes you to the next wizard page.

## Relays Tab Page

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

Option	Description
P680_Relay1	Relay 1
P680_Relay2	Relay 2 / Left Cam Sync out
P680_Relay3	Relay 3 / Operable Out
P680_Relay4	Relay 4 / Right Cam Sync out
P680_MotorValve	Motorized switching valve


 **Please note:** The relays are either freely programmable in Chromeleon or they can have a special function. This depends on the settings made on the pump. Relays 1 and 2 are always freely programmable. To freely program relays 3 and 4, set the corresponding options (Op. Out for relay 3 and LPG Sync Out for relay 4) to **No** on the Options menu (→ page 60). If the setting is **Yes**, the relays have the special function described on page 61.

Clicking **Next**> takes you to the next wizard page.


## Inputs Tab Page

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

Option	Description
P680_Input1	Input 1 (Hold)
P680_Input2	Input 2 (Stop)
P680_Input3	Input 3 (Start)

 **Please note:** When using the remote inputs in Chromeleon as universal inputs without special function you have to set the **Start/Stop/Hold** option on the pump to **No** (→ Options menu, page 60).

Click **Finish** to complete installation of the pump. Save and close the changed server configuration.

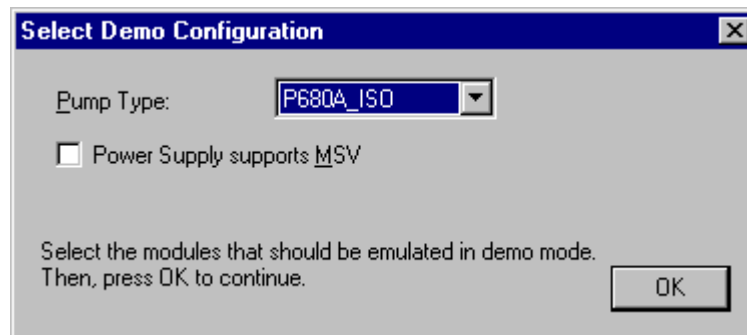
 **Important:** Before turning off the pump, always "**disconnect**" the unit in Chromeleon.

**Please note:** You may as well reopen these wizard pages later again to change the settings. Select the **Dionex P680 Pump** in the Chromeleon Server Configuration program, and then select **Properties...** on the context menu.

If you reopen the **General** tab page later again, Chromeleon provides a **Retrieve configuration from pump** button. Click this button to transfer the current pump configuration to Chromeleon.

In addition, Chromeleon then provides an **Error Levels** tab page. This tab page classifies the severity of any errors that occur. It is generally not necessary to change the default settings.

**Please note:** You may simulate the functions of a P680 pump, also. To do so, select the **Dionex P680 Pump** in the Chromeleon Server Configuration program, and then select **Properties...** on the context menu. On the **General** tab page, select the **Demo Mode** check box and click **OK**. The following dialog box appears:



*Fig. 53: Select Demo Configuration dialog box*

Select the desired pump from the **Pump Type** drop-down list. Select the **Power Supply supports MSV** check box to make the P680\_Motor\_Valve relays available on the **Relays** tab page. To confirm your settings, click **OK**.

### 5.3 Synchronizing the ASI-100 with a P680A LPG-4 or P680A DGP-6

If your HPLC system includes an ASI-100 or ASI-100T Autosampler with firmware version  $\geq 1.16$ , you can synchronize the injection command of the autosampler with the strokes of a P680A LPG-4 or P680A DGP-6 pump. Synchronization ensures that all injections are performed at the same phase of the pump cycle.

To enable synchronization:

- Right-click the ASI-100 Autosampler in the Chromeleon Server Configuration program.
- Select **Properties...** on the context menu.
- For a P680A LPG-4, select **P680\_STROKE** from the **Sync Inject with pump** drop-down list on the **Syringe & Stroke Sync** tab page.  
For a P680A DGP-6 pump, select **P680\_STROKE** for synchronization with the right pump; select **P680\_2\_STROKE** for synchronization with the left pump.

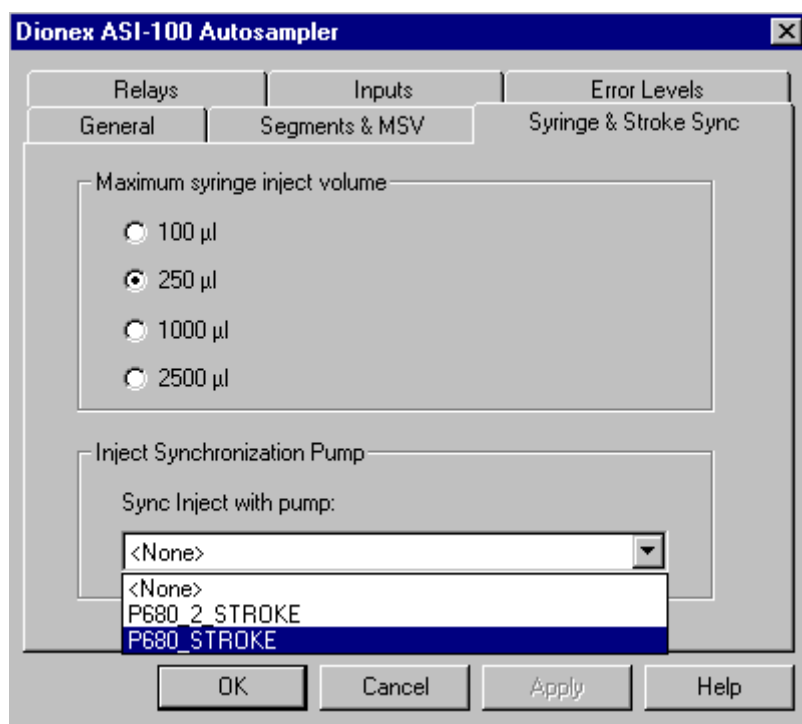


Fig. 54: Syringe & Stroke Sync tab page

**Please note:** To change the synchronization assignment for a specific application, use the **PumpDevice** property. This property is available in the "Commands" dialog box for the autosampler. You can use this property also in the program file (PGM File).

- To disable synchronization, return to **Syringe & Stroke Sync** tab page and select **<None>** from the **Sync Inject with pump** drop-down list.

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



## 5.4 Operation with Chromeleon

Chromeleon can control the pump in two ways:

- Directly, via the icon and menu commands or via the controls on the P680 control panel.
- Via time-based programs (PGM-File or programmable buttons).

The following commands, properties, signals, and relays are available under **Pump** in the **Commands** dialog box when **Expert** mode is enabled; some of them are displayed only if the corresponding check boxes have been selected in the Server Configuration program (for information about how to set the Expert mode, refer to the *Chromeleon online Help*). The order in which the entries appear in the table corresponds to their order in Chromeleon (here: for a P680A ISO or LPG pump).

 **Please note:** If you have a P680A DGP-6 installed, the entries **PumpRight** and **PumpLeft** appear in the **Commands** dialog box.

Chromeleon	Description	Firmware
<b>P680_Input1</b>	Indicates the status of the digital input 1 (On or Off). This input is available only if you have selected the corresponding check box on the <b>Inputs</b> tab page in the Server Configuration program.	Hold (Hold is triggered by signal on pin 22 of the 25-pin I/O port, if Start/Stop/ Hold = yes)
<b>P680_Input2</b>	Indicates the status of the digital input 2 (On or Off). This input is available only if you have selected the corresponding check box on the <b>Inputs</b> tab page in the Server Configuration program.	Stop (Stop is triggered by signal on pin 23 of the 25-pin I/O port, if Start/Stop/ Hold = yes)
<b>P680_Input3</b>	Indicates the status of the digital input 3 (On or Off). This input is available only if you have selected the corresponding check box on the <b>Inputs</b> tab page in the Server Configuration program.	Start (Start is triggered by signal on pin 24 of the 25-pin I/O port, if Start/Stop/ Hold = yes)
<b>P680_Relay1</b>	Relay 1. This relay is available only if you have selected the corresponding check box on the <b>Relays</b> tab page in the Server Configuration program. Click the "+" character beside the name to display the items underneath: <b>State</b> (indicates or sets the state of the relay), <b>Duration</b> (when set, the relay's state toggles after the specified time), <b>On</b> (turns the relay on), and <b>Off</b> (turns the relay off).	Relay 1
<b>P680_Relay2</b>	Relay 2/Left Cam Sync Out. This relay is available only if you have selected the corresponding check box on the <b>Relays</b> tab page in the Server Configuration program. Click the "+" character beside the name to display the items underneath: <b>State</b> (indicates or sets the state of the relay), <b>Duration</b> (when set, the relay's state toggles after the specified time), <b>On</b> (turns the relay on), and <b>Off</b> (turns the relay off).	Relay 2

Chromeleon	Description	Firmware
<b>P680_Relay3</b>	Relay 3/Operable Out. This relay is available only if you have selected the corresponding check box on the <b>Relays</b> tab page in the Server Configuration program. Click the "+" character beside the name to display the items underneath: <b>State</b> (indicates or sets the state of the relay), <b>Duration</b> (when set, the relay's state toggles after the specified time), <b>On</b> (turns the relay on), and <b>Off</b> (turns the relay off).	Relay 3 / Op. Out
<b>P680_Relay4</b>	Relay 4/Right Cam Sync Out. This relay is available only if you have selected the corresponding check box on the <b>Relays</b> tab page in the Server Configuration program. Click the "+" character beside the name to display the items underneath: <b>State</b> (indicates or sets the state of the relay), <b>Duration</b> (when set, the relay's state toggles after the specified time), <b>On</b> (turns the relay on), and <b>Off</b> (turns the relay off).	Relay 4 / LPG Sync Out.
<b>P680_MotorValve</b>	Motor valve relay. This relay is available only if you have selected the corresponding check box on the <b>Relays</b> tab page in the Server Configuration program. Click the "+" character beside the name to display the items underneath: <b>State</b> (indicates or sets the state of the relay), <b>Duration</b> (when set, the relay's state toggles after the specified time), <b>On</b> (turns the relay on), and <b>Off</b> (turns the relay off).	MSV
<b>Pump_Pressure or PumpRight_Pressure and PumpLeft_Pressure</b>	This signal is available only if you have selected the <b>Pressure Signal</b> check box in the P680's properties (on the <b>General</b> tab page in the Server Configuration program). (For a P680A DGP-6, <b>PumpRight_Pressure</b> refers to the right pump; <b>PumpLeft_Pressure</b> refers to the left pump). Using this command, you can then record the pressure as a separate channel. Click the "+" character beside the name to display the items underneath: <b>Signal</b> —indicates the current signal value. <b>Delta</b> —indicates the signal's slope, i.e., the difference between the current value and the value one second ago. This is useful for triggers. <b>AcqOn</b> —starts data acquisition. <b>AcqOff</b> —terminates data acquisition. <b>Retention</b> —indicates the retention time of the signal. <b>MaxAutoStep</b> = Maximum step rate for Auto Step Mode; range: 0.1...5.1 s; default: 5.1 s <b>Step</b> —sets the step for data acquisition; range: 0.01...4.80 s; <b>Auto</b> selects the best step dynamically <b>Average</b> —averages all measured values over the step interval. Default: <b>On</b> . <b>Off</b> records only the last point of each interval.	The current system pressure is displayed on the State Menu.
<b>FirmwareVersion</b>	Indicates the firmware version of the pump.	Firmware
<b>ModelNo</b>	Indicates the pump type.	P680
<b>ModelVariant</b>	Indicates the variant: <b>Isocratic</b> , <b>LPG</b> (= Low Pressure Gradient), <b>LPG2</b> (Dual Low Pressure Gradient), or <b>HPG</b> = (High Pressure Gradient).	Displayed on the Main menu (P680 xxx)

Chromeleon	Description	Firmware
<b>CamRevolutionsRight</b>	Indicates the number of revolutions of the cam of the pump block. For a P680 HPG pump, the value refers to the right pump block; for a P680A DGP-6, it refers to the right pump.	Rev. Right
<b>CamRevolutionsLeft</b>	Indicates the number of revolutions of the cam of the left pump block of an HPG pump. For a P680A DGP-6 pump, the value refers to the left pump.	Rev. Left
<b>WorkLoadRight</b>	Indicates the workload of the pump block. For a P680 HPG pump, the value refers to the right pump block; for a P680A DGP-6, it refers to the right pump. The workload is calculated from the flow, pressure, and time parameters and is indicated in MegaJoule [MJ].	Workload R
<b>WorkLoadLeft</b>	Indicates the workload of the left pump block of an HPG pump. For a P680A DGP-6 pump, the value refers to the left pump. The workload is calculated from the flow, pressure, and time parameters and is indicated in MegaJoule [MJ].	Workload L
<b>SerialNo</b>	Indicates the pump's serial number.	Serialno.
<b>RearSealLeakLimit</b>	Specifies the leak detection threshold for the rear seal wash system (2-100 drops/hour). If the limit is met, a message is displayed in the Audit Trail and on the pump.	Rearseal Leak
<b>RearSealLeakCounter</b>	Indicates the number of drops that passed the piston seal in the past hour.	Not available
<b>RearSealWashPump</b>	Indicates whether the peristaltic pump of the rear seal wash system is running ( <b>Active</b> ) or not ( <b>Idle</b> )	Not available
<b>RearSealWashSystem</b>	Turns the rear-seal wash system on ( <b>Interval</b> or <b>Automatic</b> ) or <b>Off</b> . <b>Interval</b> activates rear-seal washing once per hour for five minutes. However, the drop sensor is not active, i.e., monitoring the piston seals for tightness is disabled. <b>Automatic</b> periodically activates rear-seal washing once per hour until the drop sensor has counted 50 drops. The drop sensor is active, i.e., the piston seals are monitored for tightness. <b>Off</b> turns the rear-seal wash system off.	Rearseal Wash
<b>Degasser</b>	Turns the degasser of a P680A LPG-4 or an SOR-100 Solvent Rack with integrated degasser on or off. For P680A LPG-4 pumps and pumps operated with an SOR-100 Solvent Rack with integrated degasser, the setting should be <b>On</b> . For P680 pumps that are operated without degasser or with an external third-party degasser, select <b>Off</b> .	Degasser
<b>Leak</b>	Indicates the status of the central leak sensor: <b>Ok</b> or <b>Leak</b> . If a leak has been detected, the corresponding message is logged in the Audit Trail.	Not available
<b>HeadType</b>	Indicates the head type of the pump: <b>Analytical</b> or <b>Semi-Prep</b> . The pump head affects the flow and the system pressure.	Pump Head L/ Pump Head R
<b>MaximumFlowRamp</b>	Upper limit for the flow rate acceleration (0.1 - 10,000.00 mL/min <sup>2</sup> ) P680A DGP-6: Set this parameter under <b>Pump2</b> as well.	Flow Acc. L/ Flow Acc. R

Chromeleon	Description	Firmware
<b>Motor</b>	Indicates whether the pump is delivering (On or Off). P680A DGP-6: The entry under Pump refers to the right pump; the entry under Pump2 refers to the left pump.	Flow On/Off LEDs
<b>Flow</b>	Indicates the flow rate in ml/min (Range: 0.000 ... 10.000 ml/min for the analytical pump version (or 0.000 ... 20.000 ml/min in Double Flow mode) and 0.000 ... 50.000 ml/min for the semi-preparative version (or 0.000 ... 100.000 ml/min in Double Flow mode). For a P680A DGP-6 pump, set this parameter under <b>Pump2</b> as well.	Flow
<b>%A, %B, %C, %D</b>	Indicates the partial flow of the corresponding component in percent of the total flow (availability depending on the pump model). Click the "+" character beside the name to display the items underneath: <b>Value</b> (= partial flow; read only), <b>Equate</b> (= name, can be selected by the user). For a P680A DGP-6 pump, set this parameter under <b>Pump2</b> as well.	%B, %C, %D
<b>Pressure</b>	Indicates the pump pressure (Range: 0...500 bar). Click the "+" character beside the name to display the items underneath: <b>Value</b> (= pump pressure, read only), <b>LowerLimit</b> (= lower pressure limit) and <b>UpperLimit</b> (= upper pressure limit). If the pressure is outside these limits, the system aborts the batch and starts an emergency program, if necessary. For a P680A DGP-6, set this parameter under <b>Pump2</b> as well.	Max. and Min.
<b>%A/B/C/D_Level</b>	Indicates the solvent level (range: 0.000 ... 100.000 l). Click the "+" character beside the name to display the items underneath: <b>Value</b> (Enter the amount of solvent available when you start the sequence.) and <b>LowerLimit</b> (Enter the minimum filling level for the associated solvent. An error message appears in the Audit Trail if the filling level reaches the lower limit. Enter "0" or <b>Disable</b> to disable solvent level checking.)	Not available
<b>WasteLevel</b>	Indicates the waste level (range: 0.000 ... 100.000 l). Click the "+" character beside the name to display the items underneath: <b>Value</b> (Enter the actual waste level before starting a sequence.) and <b>UpperLimit</b> (Enter the capacity of your waste container before starting a sequence. An error message appears in the Audit Trail if the filling level reaches the lower limit. Enter "0" or <b>Infinite</b> to disable waste level checking.)	Not available
<b>%A/B/C/D_RemainTime</b>	Indicates the approximate time until the level of the associated solvent has reached the lower limit (see <b>%A/B/C/D_Level</b> )	Not available
<b>WasteRemainTime</b>	Indicates the approximate time until the associated waste level has reached the upper limit (see <b>WasteLevel</b> )	Not available

Chromeleon	Description	Firmware
<b>%A/B/C/D_WarningLimit</b>	A warning appears in the Chromeleon Audit Trail when the level of the associated solvent is a specified percentage above the lower limit (→ <b>%A/B/C/D_Level</b> ). Specify the percentage here. The default percentage is 10%.	Not available
<b>Waste_WarningLimit</b>	A warning appears in the Chromeleon Audit Trail when the waste level has reached a specified percentage of the upper limit the lower limit (→ <b>Waste_Level</b> ). Specify the percentage here.	Not available
<b>Connected</b>	Indicates whether the pump is connected to Chromeleon, that is, under computer control (also, refer to <b>Connect, Disconnect</b> )	<b>Remote</b> LED lights
<b>Disconnect</b>	Disconnects the pump from Chromeleon (also, refer to <b>Connected, Connect</b> )	Not available
<b>Connect</b>	Connects the pump to Chromeleon (also, refer to <b>Connected, Disconnect</b> )	Not available

For information about individual commands and parameters and the command syntax, refer to the corresponding Chromeleon control panel. Select **Command...** on the **Control** menu. The **Commands** dialog box is opened. You can also open this box by pressing the F8 key. In the left list box, click the "+" character beside **Pump**, **PumpRight** and/or **PumpLeft** to display the items underneath.

For more information (also about any parameter or command that might not be listed here), refer to the *Chromeleon online Help*.

**i** **Please note:** When the pump is connected to data system, the front panel **Remote** LED is lighted and the P680 is completely controlled and programmed via Chromeleon. When the pump is controlled by Chromeleon, all front panel keys are locked.

In this case, you can enter the pump's menus nevertheless but entries will not be accepted. Please note the following exception: You can edit or create programs on the **Programs** menu while the pump is controlled by Chromeleon.



## 6 Troubleshooting

### 6.1 List of the Most Frequently Observed Error Messages

The following table contains a summary of the most frequently observed error messages, lists possible causes, and suggests appropriate remedial actions.

**Note:** To clear an error message, press Esc. If several error messages appear, press Esc to clear them one by one.

Problem	Cause	Remedial action
Upper pressure limit exceeded.	<p>The column is contaminated. Minute parts from vial septa block the system.</p> <p>The resistance to flow is so high in the system that the defined upper pressure limit is exceeded for the selected flow.</p>	<p>Rinse or replace the column. Find and clean the blocked spot. Use different septa. Check the crimper setting. Inspect the system, especially the capillaries, for indications of blockage. Other possible causes are a blocked sampler, broken capillaries, or incorrectly mounted valves. If the problem occurs due to column ageing, it may be sufficient to increase the setting for the upper pressure limit.</p>
Pressure fallen below lower limit.	<p>The solvent supply is used up.</p> <p>There are air bubble in solvent line. The solvent emits gas when mixing. There is a leak in the system.</p> <p>The check valve is defective.</p> <p>The lower pressure limit cannot be reached for the specified flow.</p>	<p>Refill the solvent and purge the system (→section 3.4.5, page 34). Check the filter frit, purge the system. Degas the solvent and check the degasser. Find and eliminate the leak; tighten loose fitting connections. Clean or replace the valve and purge the system (→section 3.4.5, page 34), as necessary. The main task of the lower pressure limit is to monitor the system for leakage. Leakage may occur at the fittings and or screw joints, the sampler's needle port or high-pressure switching valve, or the pump's piston seals.</p>
Invalid flow value.	The entered value is invalid for this pump version configuration.	Enter a flow value that it is within the permissible range.
Invalid partial flow setting.	The entered partial flow setting is not valid.	Enter a partial flow setting that is within the permissible range and is logically correct.

Problem	Cause	Remedial action
Rear-seal wash system has run out of wash solution.	Rear-seal washing is enabled and the peristaltic pump lights, but no liquid reaches the seal-washing detector.	Make sure the liquid reservoir contains sufficient liquid. Verify that the peristaltic tubing is connected correctly (→ Fig. 23, page 31).
Rear-seal wash system has run out of wash solution. (cont'd)		The peristaltic tubing may be permanently blocked, or is may be drawing air. Replace the tubing as necessary. Clean the sensor on the liquid reservoir. Make sure the seal washing liquid is sufficiently conductive (→ section 3.4.4, page 31).
One of the piston seals is leaking!	Rear-seal washing is enabled but the peristaltic pump is not running. Nevertheless, liquid reaches the seal-wash detector.	Solvent is leaking through the main piston seal of one or more pistons. If this leakage does not affect your analysis, increase the value set for the piston leak (→ section 4.3.4.2, page 60). If the leakage affects your analysis, replace the piston seals (→ section 7.5.2.3, page 114).
Leak detected.	The pump's central leak sensor (→ Fig. 55, page 106) has detected a leak. The flow is automatically turned off.	Find and eliminate the leak. Dry the central leak sensor and the tray (→ section 7.3, page 106).
Motor switching valve error.	The connection to the external motorized switching valve (MSV) is interrupted or the valve is defective.  MSV switching is included in program steps, but no motorized switching valve is connected.	Check the electrical connection to the motorized switching valve. If the valve is contaminated, it may be blocked. (Inspect and replace the rotor seal as necessary.)  Remove the MSV parameter from the corresponding program on the Programs menu.
Motor switching valve timeout.	The connection to the external motorized switching valve (MSV) is the interrupted or the valve is defective.	Check the electrical connection to the motorized switching valve. If the valve is contaminated, it may be blocked. (Inspect and replace the rotor seal as necessary.)
A program with this name already exists.	You selected the <b>Save as</b> option to save a changed program but did not enter a new name.	Save the change program under a new name or select the <b>Save</b> option to keep the name (→ section 4.3.2, page 55).
This function cannot be adjusted by the user.	You tried to change a parameter that cannot be changed by the user.	Only a Dionex Service Representative can change this parameter.



Problem	Cause	Remedial action
Right hand pump block carryover pressure is too high.	The pressure in the right working head (HPG) exceeded the permissible range.	<p>Make sure that the capillary between the working head and the equilibration head and the capillary leading to the purge/outlet block are not blocked.</p> <p>Inspect the outlet valve for indications of blockage.</p> <p>Replace the components as necessary.</p>
Left hand pump block carryover pressure is too high.	The pressure in the left working head (HPG) exceeded the permissible range.	<p>Make sure that the capillary between the working head and the equilibration head and the capillary leading to the purge or outlet block are not blocked.</p> <p>Inspect the outlet valve for indications of blockage.</p> <p>Replace the components as necessary.</p>
The system pressure exceeded the safety limit.	<p>The resistance to flow is so high in the system that the defined upper pressure limit is exceeded for the selected flow.</p> <p>The column is contaminated. Minute parts from vial septa block the system.</p>	<p>Inspect the system, especially the capillaries, for indications of blockage. Other possible causes are a blocked sampler, broken capillaries, or incorrectly mounted valves.</p> <p>If the problem occurs due to column ageing, it may be sufficient to increase the setting for the upper pressure limit.</p> <p>Rinse or replace the column.</p> <p>Clean the blocked spot.</p> <p>Use different septa.</p> <p>Check the crimper setting.</p>
The pressure in the left hand working cylinder exceeded the safety limit.	<p>The resistance to flow is so high in the system that the defined upper pressure limit is exceeded for the selected flow.</p> <p>The column is contaminated. Minute parts from vial septa block the system.</p>	<p>Inspect the system, especially the capillaries, for indications of blockage. Other possible causes are a blocked sampler, broken capillaries, or incorrectly mounted valves. If the problem occurs due to column ageing, it may be sufficient to increase the setting for the upper pressure limit.</p> <p>Rinse or replace the column.</p> <p>Clean the blocked spot.</p> <p>Use different septa.</p> <p>Check the crimper setting.</p>

Problem	Cause	Remedial action
The pressure in the right hand working cylinder exceeded the safety limit.	<p>The resistance to flow is that high in the system that the defined upper pressure limit is exceeded for the selected flow.</p> <p>The column is contaminated. Minute parts from vial septa block the system.</p>	<p>Inspect the system, especially the capillaries, for indications of blockage. Other possible causes are a blocked sampler, broken capillaries, or incorrectly mounted valves.</p> <p>If the problem occurs due to column ageing, it may be sufficient to increase the setting for the upper pressure limit.</p> <p>Rinse or replace the column.</p> <p>Clean the blocked spot.</p> <p>Use different septa.</p> <p>Check the crimper setting.</p>
The degasser vacuum is insufficient for proper degassing.	The vacuum level monitoring function either of the internal degasser of a P680A LPG-4 pump has responded.	If the vacuum pump of the degasser is running continuously, check the system for possible leakage. If necessary, the degasser module needs to be replaced. Contact Dionex Service.
Degasser malfunction	The vacuum level monitoring function of either the internal degasser of a P680A LPG-4 pump or the Solvent Rack degasser has responded.	<p>If the vacuum pump of the internal degasser for a P680A LPG-4 pump is running continuously, check the system for possible leakage.</p> <p>If an SOR-100 Solvent Rack with integrated degasser is connected to a P680 pump, turn the rack off and on again. To do so, either turn the pump off and on again or turn the degasser off and on again, using the <b>Degasser</b> option on the <b>Options</b> menu (→ section 4.3.4.2, page 60).</p> <p>Contact Dionex Service if the message appears again.</p>
Relay 4 is configured for inject synchronization. Please change pump configuration.	You tried to use relay 4 as a standard relay in a program, although it has been set to synchronize the gradient with the Inject of the autosampler	On the <b>Options</b> menu, define the relay as a standard relay (→ section 4.3.4.2, page 60 ;LPG Sync Out = No) or use a different relay in the program.
Motor malfunction.	Internal error in the driving unit.	Turn the pump off and on again. If the error message appears again, contact Dionex Service.
Camshaft sensor missing or dark.	Internal error in the driving unit.	Turn the pump off and on again. If the error message appears again, contact Dionex Service.
Camshaft sensor always alight.	Internal error in the driving unit.	Turn the pump off and on again. If the error message appears again, contact Dionex Service.

Problem	Cause	Remedial Action
Motor position error. The motor is overloaded.	The pump's motor is overloaded.	Inspect the system for indications of blockage. This message can also appear if the upper pressure limit is exceeded (→ page 95).
Camshaft index too early or too late.	Internal error in the driving unit.	Turn the pump off and on again. If the error message appears again, contact Dionex Service.
The pressure sensors have detected a disturbance.	The internal onlinebalancing of the pressure sensor failed (applies to a high-pressure pumps).	The error can be due to large amounts of air in the pump heads, for example, during initial installation. Purge the system (both pump blocks) thoroughly (→ section 3.4.5, page 34).
Excessive drive current. Camshaft xx°.	One or more capillaries are blocked. Note: When this message appears, the pump stops running.	Inspect and check the capillaries for signs of blockage. Replace the capillaries if necessary.
Drive current too large. Camshaft xx°.	One or more capillaries are blocked. Note: When this message appears, the pump continues running.	Inspect and check the capillaries for signs of blockage. Replace the capillaries if necessary.
The motor switching valve connector is not available in this pump.	You attempted to connect an external motorized switching valve (MSV).	This pump type does not support connection of an external motorized switching valve.
The rear-seal leak sensor is malfunctioning.	The sensors on the liquid reservoir are very dirty. The rear-seal leak sensor is defective	Clean the electrodes of the sensor, using water or solvent. Contact Dionex Service.
The rear-seal leak count is xx (counted drops) and has exceeded the limit of yy (leak detection threshold).	More drops that specified under "Rearseal leak" reach the liquid reservoir.	Visually inspect the piston seals for leakage (→ section 7.5.1, page 111). Replace the piston seals and support rings as necessary (→ section 7.5.2, page 112) or increase the default value for the rear seal leak on the Options menu (→ page 61).
Possible piston seal leak detected.	More drops that specified under "Piston Leak" reach the liquid reservoir.	Visually inspect the piston seals for leakage (→ section 7.5.1, page 111). Replace the piston seals and support rings as necessary (→ section 7.5.2, page 112) or increase the default value for the piston leak on the Options menu (→ page 61).

Problem	Cause	Remedial Action
Abnormal drive current for xx seconds (time).	The capillary between the working pump head and the equilibration pump head is blocked.	Inspect the capillary for indications of blockage. Replace the capillary if necessary. If the message appears again, contact Dionex Service.
The maximum purge pressure was exceeded.	After you have pressed the "Purge" key, a pressure of more than 50 bar built up.	Check whether the purge valve is open. Open the purge valve if necessary.

**i** **Please note:** In addition to the error messages mentioned above, other messages can appear. In this case, please note the exact wording of the message and contact Dionex Service.

**i** **Please note:** If an SOR-100 Solvent Rack with integrate degasser is connected to the pump, any error messages referring to the rack are displayed on the pump displayed. For more information about these messages, refer to the *Operating Instructions for the SOR-100 Solvent Racks*.

## 6.2 List of the Most Frequently Observed Problems


The following table provides a summary of the most common operating problems, lists probable causes, and suggests remedial actions:


Problem	Probable Cause	Remedial Action
No function	The pump is not connected properly to mains. The power is turned off. The fuses blow.  Replacement fuse blows immediately.	Connect the power cable.  Turn on the power. Replace the fuse (→ section 3.2.2, page 17). Verify that the voltage selection is appropriate for the installation site (→ section 3.2.1, page 15). If the replacement fuse blows although the voltage is correctly set, contact Dionex Service.
No flow	The system is leaking. The check valves are incorrectly installed (not in direction of flow) or defective.	Find and eliminate the leak. Correctly install or replace the check valves (→ section 7.4, page 108).
The baseline drift is too strong	The column is contaminated. The system is not sufficiently equilibrated. The environmental conditions are unstable. Solvent is contaminated.  The detector is not warmed up.  Detector problem.	Rinse or replace the column. Rinse the system until equilibrated. Make sure that the temperature and the humidity are constant. Replace the solvent and check the filter frits. In aqueous solvents, growth of microorganisms (→section 3.4.1, page 23) is possible! Allow the full detector warm-up time. → <i>Detector manual</i> .
Strong noise	The solvent is contaminated. The lamp is too old. There are air bubbles in the system. There are pressure fluctuations or pulsation in the pump.	Replace the solvent. Replace the detector lamp. Purge the system (→section 3.4.5, page 34). Check and replace check valves as necessary (→ section 7.4, page 108). Degas the solvents and check the degasser.
Peak broadening	The capillary to the detector is too long or its internal diameter is too large. Column is overloaded or contaminated. The solvent is degraded.	Shorten or replace with the appropriate capillary.  Rinse or replace the column.  Use fresh solvent.

Problem	Probable Cause	Remedial Action
The analysis is not reproducible.	The sample is unstable and decomposes. The gradient is not reproducible.  The environmental conditions are unstable.	Use new sample or change the conditions. Check the pump function and degassing. Check the suction frits for obstruction and exchange as necessary. Make sure that the temperature and air humidity are constant. (Use a column thermostat.)
Poor degassing	There is a leak in the capillaries or solvent lines or there are loose connections. The flow rate is too high.	Inspect the capillary and solvent tube connections for leakage; tighten loose fitting connections. Reduce the flow rate.
The degasser motor runs without intervals	There is a leak in the system.  The degasser is defective.	Find and eliminate the leak; tighten loose fitting connections.  Check the degasser. Contact Dionex Service if necessary.
The central leak sensor detects leak (The pump displays the error message: "Leak detected".)	There is a leak in the system.	→ section 7.3, page 106.

### 6.3 Chromeleon Error Messages

If communication between the data system and the pump cannot be established, an error message is displayed in the Chromeleon Audit Trail. The following table lists the most important error messages, along with possible causes and the corresponding remedial actions.

 **Important:** Please keep in mind that for up to 30 seconds after a change to the server configuration, messages referring to the previous configuration may still be displayed. These messages can be ignored. Thus, always note the device name (P680@...) indicated in the message.

 **Please note:** The error messages below may also read either **P680@ + serial number** (= P680@USB-01610103) or **P680@ + IP address** (= P680@192.168.50.1), depending on the connection type (USB or LAN) specified for the pump in the Server Configuration.

Message	Probable Cause	Remedial Action
Error opening P680 - Connection refused.	<p>Another Dionex Data System server already uses the indicated pump.</p> <p>The existing connection is not yet completely cleared.</p> <p>The pump's subnet mask and gateway address are incorrect.</p> <p>A gateway may maintain an unintended connection to the pump as soon as the Dionex Data System server is stopped in an uncontrolled way.</p>	<p>Check that the correct pump was selected or terminate the pump's communication with the other Dionex Data System server.</p> <p>Wait for 30 seconds and repeat the procedure.</p> <p>Make sure that the correct parameters are specified (→ section 4.3.4.1, page 59).</p> <p>Restart the pump.</p>
Error opening P680 - Connection timed out.	<p>The Dionex Data System server failed to connect to the indicated pump.</p> <p>The network connection is interrupted during firmware download.</p> <p>The network connection is interrupted during firmware download.</p>	<p>Verify that the pump is turned on and that the network connection is working.</p> <p>Note the name of the indicated pump. It is possible that Chromeleon server is trying to connect to a pump that is no longer part of the server configuration. Make sure the Module Address is correct and retry.</p> <p>Check the network connection.</p> <p>Check the mains connection of the pump.</p>
P680 - Connection reset by peer.	The power supply to the pump is interrupted for a short period.	Check the mains connection of the pump.
P680 - Host not found.	Network problems: no connection to the pump.	Check the network settings for the pump and network interface card. The network connection between the Dionex Data System server and the pump might be inappropriate (→ section 5.1.2.2, page 78). (Contact your network administrator.)
P680 - Permission denied.		
P680 - Network is unreachable.		
P680 - No route to host.		
P680@ USB-00-E0-EF-DE-XX-XX - Device not found on the USB.	<p>The USB connection between the pump and the Dionex Data System server is interrupted.</p> <p>The power supply to the pump is interrupted.</p>	<p>Check the USB connection.</p> <p>Check the mains connection of the pump.</p>
Error opening P680@ USB-00-E0-EF-DE-XX-XX – The System cannot find the file specified	<p>The USB connection between the pump and the Dionex Data System server is interrupted.</p> <p>The power supply to the pump is interrupted.</p>	<p>Check the USB connection.</p> <p>Check the mains connection of the pump.</p>

Message	Probable Cause	Remedial Action
Error issuing control request to P680	The Dionex Data System server cannot connect to the specified pump.	<p>Check the USB or LAN connection.</p> <p>Check the mains connection of the pump.</p> <p>Remove the pump specified in the message from the server configuration or else select a different pump from the list of available pumps in the server configuration (via Properties/Browse).</p>
Error reading from P680 @ USB-00-E0-EF-DE-XX-XX Data error (cyclic redundancy check)	There is a transmission error between the pump and the Dionex Data System server.	<p>Check the USB connection. The connection to the next hub must not exceed 5 m. The overall connection length, including the hub connections must not exceed 30 m (→ page 71).</p> <p>Replace any defective USB cable or hub.</p>
Error reading from P680 @ USB-00-E0-EF-DE-XX-XX	<p>The connection between the pump and the Dionex Data System server is interrupted.</p> <p>The power supply to the pump is interrupted.</p>	<p>Check the USB connection.</p> <p>Check the mains connection of the pump.</p>

For a list of all Chromeleon error messages, refer to the Chromeleon installation program (= **Server Configuration**). Double-click the pump in the left window section and select the **Error Levels** tab page in the dialog box. You can also open the dialog box by clicking the pump on the left pane and then selecting **Properties** on either the **Edit** menu or context menu.



## 7 Maintenance

### 7.1 General Notes

All P680 pumps are made of high-quality components and materials to minimize maintenance requirements. The painted surfaces, as well as the keypad and display, are relatively resistant to weak acids, alkali, and organic solvents. Nevertheless, immediately wipe up all liquids spilled onto the pump's surface, using a lint-free cloth or paper. If surfaces are exposed for longer periods, these liquids can cause damage!

The following sections describe all maintenance procedures that can be carried out by the user. Dionex personnel should perform any additional servicing, as well as annular inspections to detect contamination, wear, etc. This is, for example, to prevent the camshaft from running dry. If unexpected problems occur, please contact Dionex Service.



**Warning:** Do not operate the pump when the enclosure is open unless instructed to do so. Strictly observe all warning notes!



**Warning:** Keep in mind that the fluid components of the pump may be filled with toxic solvents. Therefore, purge the pump with an appropriate solvent and put on protective clothing before starting maintenance or repair work.



**Important:** Before returning any instrument to Dionex for repair, contact Dionex Service or your local distributor. An RMA (Return Material Authorization) number is required for the return in order to track and account for your instrument. Always use the original packaging when shipping the P680. Shipping the pump in anything other than the original packaging will void the warranty. Refer to the warranty statement in the terms of sale for more information.



**Important:** Use original Dionex spare parts only. Substituting non-Dionex parts or using non-Dionex accessories may impair the performance of the instrument, thereby voiding the product warranty. Refer to the warranty statement in the terms of sale for more information.



**Please note:** Do not forget to test the pump for leakage after you have carried out maintenance or repair work on the fluid connections (→ Testing the Pump for Leakage (Leak Rate), Seite 121).



**Please note:** The **SOP (Standard Operating Procedure) to Perform Maintenance of HPLC System** provides information about the wear and/or wetted parts you might want to keep in stock for maintenance purposes. The document (PDF file) is available from Dionex on request.

For instructions on shutting down the pump, refer to page 122.

## 7.2 Maintenance Intervals

When using buffer solutions, we recommend inspecting the pump for leakage at least once a month (→ Visually Inspecting the Piston Seals for Leakage, page 111).

**i** **Please note:** Regularly check the filling level in the liquid reservoir, making sure that the level is always between the min. and max. markers on the label.

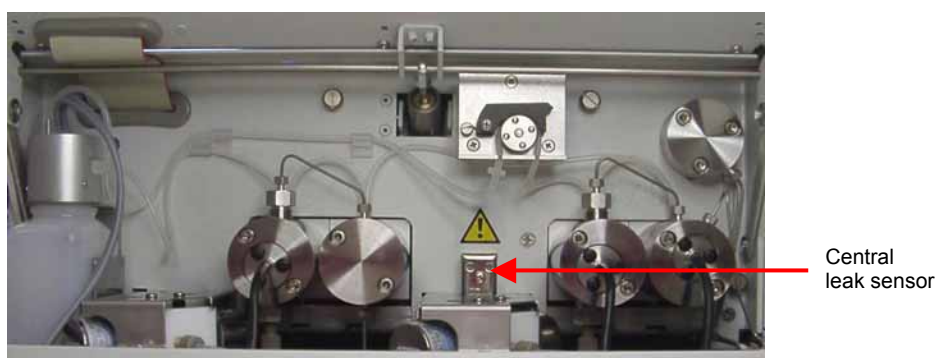
**i** **Please note:** Also, replace the liquid in the liquid reservoir in regular intervals. To avoid salt concentration in the reservoir and thus, to prevent damage to the piston seals when using solvents with a high salt content, replace the liquid in the reservoir **at least** once a week.

**i** **Please note:** Regularly inspect the inline filters in the outlet block of a P680A DGP-6 (→ Fig. 30, page 36) pump for contaminants. Replace the filters if necessary.

In addition, have a Dionex Service Representative check the pump once a year for contamination, excessive wear, etc.

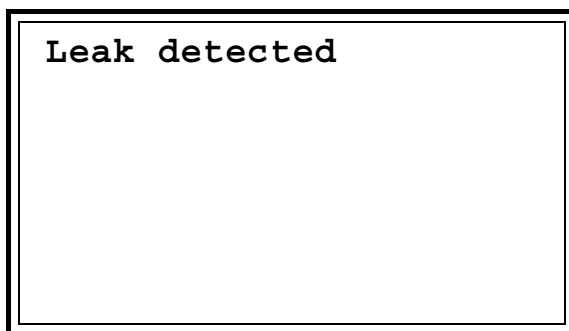
## 7.3 Leak Sensor

**i** **Please note:** Check the pump for leaks every day. Tighten leaking tubing and capillary connections.



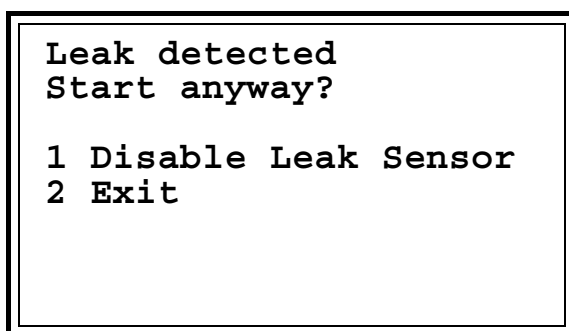
*Fig. 55: Central leak sensor (here: P680 HPG)*

If the central leak sensor detects a leak, an acoustic beep sounds and the pump stops the flow (the **Flow Off** LED is flashing). The following error message appears on the LCD:



Confirm the message by pressing Esc. This action turns off the beep. To resume operation, dry the sensor and press the **Flow on** key.

If you press the **Flow on** key without having dried the sensor first, the following message is displayed on the LCD:



Use the cursor keys to select the desired option and confirm your selection by pressing the ↵ (**Enter**) key. Alternatively, press the corresponding number key on the center keypad.

Select **Disable Leak Sensor** to disable the leak sensor. Press the **Flow on/off** key to continue the flow and resume operation despite the leak. The leak sensor is disabled as long as it is exposed to moisture. Dry the sensor, wearing appropriate protective clothing, to enable its function again.

Select **Exit** to eliminate the leak first. You cannot continue the flow by pressing the **Flow on/off** key. (If you press the **Flow on/off** key, the above error message will be displayed again.) To find and eliminate the leak, follow the steps below wearing appropriate protective clothing:

- Wait until the pressure is down to zero.
- Turn off the pump and disconnect the power cord.
- Inspect the pump heads for solvent leaks. If there is any leakage, tighten the tubing and capillary connections. Dry the components. If the pump head continues to leak, replace the piston seals.
- Remove the liquid and dry the leak sensor. To do so, use a cloth to absorb any liquid that has accumulated on the lower end of the sensor in the tray. On a P680A LPG-4 or P680A DGP-6 pump, the best way to access the sensor tray is from the left and from below the proportioning valve.
- Connect the power cord and turn on the pump.
- If no errors are reported after turning on the pump, operation can be resumed.

## 7.4 Replacing the Check Valves

The working pump head contains two double check valves: an inlet valve and an outlet valve (the P680P HPG-2 pump has two single check valves). The inlet valve is mounted on the bottom side of pump head; the outlet valve is mounted on its top side. When removed, you can recognize the inlet valve by the inner thread that ends in a planar surface, while the outlet valve has a conical cavity for the capillary connection. Remove one or both valves:

- If necessary, rinse the pump to remove toxic solutions.
- Set the pump flow rate to 0. Wait until the pressure in the system is down to zero.
- Undo the solvent line at the pump inlet and the U-tube at the outlet.
- Undo the corresponding valve cartridge using a 13 mm wrench.
- For all P680 pumps except the P680P HPG-2 pump: Insert the new valve cartridge. Make sure you insert the cartridge in the direction of solvent flow direction, as indicated by the arrow on the cartridge (→ Fig. 56). Tighten the valve. This step is not required for the P680P HPG-2 pump because the valve cartridge is already part of the valves. With semi-preparative valves, it is always necessary to replace or clean the entire valve.
- Attach the removed U-tube to the outlet valve. First, tighten this hand-tight and then tighten it an additional one-quarter turn, using a wrench.
- Screw the solvent line onto the inlet valve again. Take care to avoid cross-threading.
- To prevent contaminants from entering the HPLC system, thoroughly rinse the pump (using at least 30 ml HPLC-grade water or purely organic solution). Open the purge valve to prevent the rinsing liquid from entering the HPLC system.
- Test the pump for leakage (→ Testing the Pump for Leakage (Leak Rate), Seite 121). Tighten any leaking connections.

## 7.5 Pistons and Piston Seals

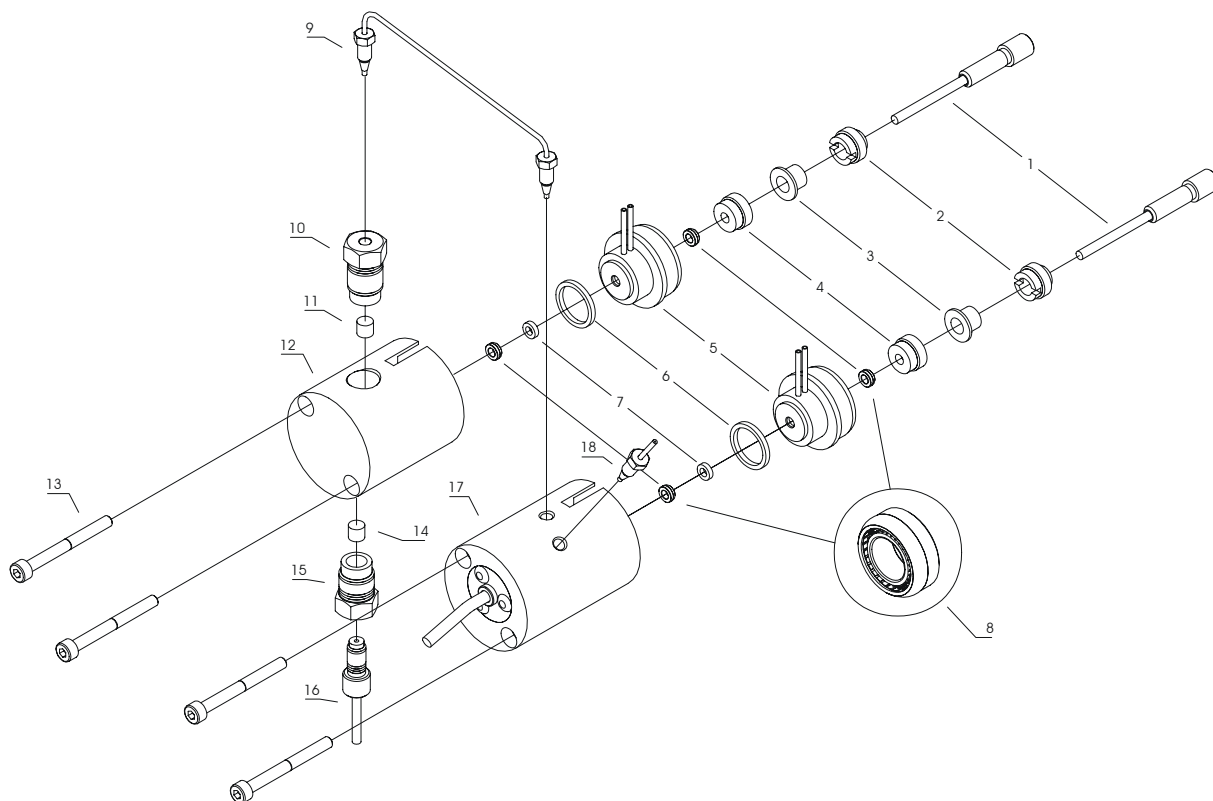


Fig. 56: Fluid system of P680 pumps; here: P680A ISO and P680A LPG-4 modes

- i Please note:** P680A ISO and P680A LPG-4:
- The working pump head does not include a pressure sensor.
  - The equilibration pump head includes a pressure sensor.
- (→ Fig. 31, page 37 and Fig. 33, page 39)
- i Please note:** P680A DGP-6:
- The working pump head does not include a pressure sensor.
  - The equilibration pump head includes a pressure sensor and a purge screw (→ Fig. 35, page 42)
- i Please note:** One equilibration pump head of the P680 high-pressure gradient pumps (P680A ISO HPG-2, P680A HPG-4, and P680P HPG-2) includes a pressure sensor; the other head does not (→ Fig. 37, page 45 and Fig. 38, page 46).
- i Please note:** Depending on the pump version (analytical or semi-preparative), the design of some parts may differ from the representation above (for part number information, refer to the tables below). However, the position of the parts is the same for both pump versions.

**Analytical pump version:**

No.	Description	Part No.
1	Piston unit	2267.0032
2	Piston retaining screw	5001.0105
3	Bushing with draining device (pack. unit: 5 bushings)	2090.6082
4	Retaining screw (DR)	Included in 5025.2010*
5	Rear-seal wash system (piston head bushing)	Included in 5025.2010*
6	Ring seal (pack. unit: 10 seals)	2266.0082
7	Support ring	} 6025.2010A (for reversed phase) } 6025.2011A (for normal phase)
8	Piston seal (1/8")	
9	Capillary between working head and equilibration head (top) (all P680A pumps)	5030.3015
10	Outlet valve (incl. valve cartridge)	5020.2200 (also includes no. 11)
11	Valve cartridge (identical to no. 14)	5020.2300
12	Working pump head with pressure sensor (P680A HPG-2 and P680A HPG-4) without pressure sensor (P680A ISO/LPG-4/DGP-6)	----- 5025.2001
13	Allen screw (I-M4x40)	-----
14	Valve cartridge (identical to no. 11)	5020.2300
15	Inlet valve (includes valve cartridge)	5020.2100 (also includes no. 14)
16	Connecting tube	(Depends on the model)
17	Euilibration pump head without pressure sensor (P680A HPG-2, P680A HPG-4) with pressure sensor (P680A ISO, P680A LPG-4, P680A HPG) with pressure sensor and purge screw (P680A DGP-6)	5025.2005 ----- -----
18	Capillary connection to the mixing chamber/purge block or outlet block	(Depends on the model, → Operating Instr., Section 3.4.3)

\* Part no. 5025.2010 (rear-seal wash system) includes one piston seal, piston head bushing, and retaining screw each.

**Semi-preparative pump version:**

No.	Description	Part No.
1	Piston unit	2267.0802A
2	Piston retaining screw	5004.8104
3	Bushing with draining device (pack. unit: 5 bushings)	2090.8083
4	Retaining screw (DR)	Included in 5025.2210A*
5	Rear-seal wash system (piston head bushing)	Included in 5025.2210A*
6	Ring seal (pack. unit: 10 seals)	2266.0082
7	Support ring	} 6030.9010 (for reversed phase) } 6030.9011 (for normal phase)
8	Piston seal with flange	
9	Capillary between working head and equilibration head (top)	5030.3025
10	Outlet (single check) valve	5005.3100
11	Not included in the semi-preparative pump version.	
12	P680P working pump head with pressure sensor	-----
13	Allen screw (I-M4x40)	-----
14	Not included in the semi-preparative pump version.	
15	Inlet (single check) valve	5005.3200
16	Connecting tube	(Provided in the accessory kit)
17	P680P equilibration pump head with pressure sensor without pressure sensor	----- 5025.2205B
18	Capillary between the left equil. head and the purge block or Capillary between the right equil. head and the purge block	5030.3028 or 5030.3027

\* Part no. 5025.2210A (complete rear-seal wash system) includes one piston seal, piston head bushing, and retaining screw.

### 7.5.1 Visually Inspecting the Piston Seals for Leakage

Each piston has two piston seals. The seals prevent solvent from leaking either into the rear seal chamber or over the piston and into the instrument. During normal operation, the detector on the liquid reservoir automatically checks the main piston seals for leakage.

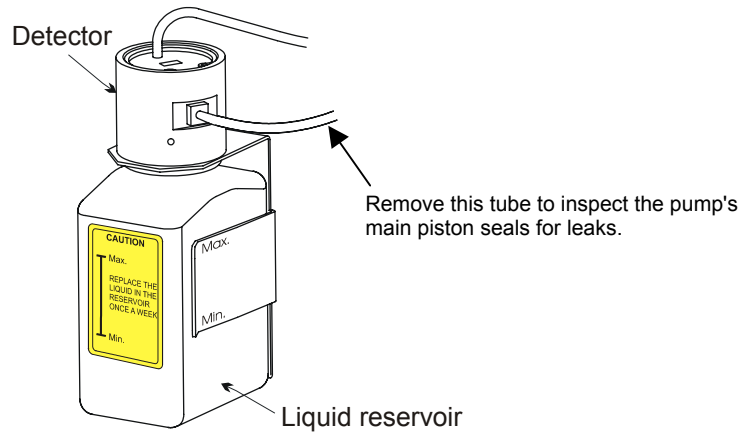


Fig. 57: Liquid reservoir of the rear-seal wash system

To inspect the pump visually for possible leaks from the main piston seals, follow the steps below:

- Under Options (→ page 60) on the **Configuration** menu, disable active rear-seal washing (Rear Seal Wash = No) first, and then enable seal washing again (Rear Seal Wash = Yes). The peristaltic pump starts pumping, delivers approximately 2 ml of liquid, and then stops.
- Remove the silicone tube from the detector of the rear-seal wash system (→ Fig. 57). Remove some of the liquid by shaking the tube.
- Reinstall the silicone tube on the detector.
- Set the flow rate. Arrange the system in such a way that approximately 300 bar (30 MPa, 4350 psi) of backpressure is generated.
- Observe the air/liquid level in the silicone tube to evaluate possible leakage. If the level travels in the tube, this indicates leakage.

**i Please note:** The peristaltic pump will start a new washing cycle after one hour. Therefore, be sure to finish your observation before that time.

If the level remains unchanged, the piston seals seal tightly. If the level rises or falls, it indicates a leak from one or more of the main piston seals. In this case, replace all piston seals and the supporting rings as described in Removing the Piston Seals (→ page 114).

## 7.5.2 Replacing the Piston Seals

The procedure for replacing the piston seals consists of the following main steps (for details, refer to the sections below):

- Remove the pump heads and pistons.
- Clean the pistons.
- Remove the piston seals.
- Reinstall the piston, piston seal, and pump head.

**i Please note:** By default, all pumps are equipped with piston seals made of UHMW-PE. Please note that using chloroform, trichlorobenzene, methylene chloride, tetrahydrofuran, or toluene as solvents chemically damages the UHMW-PE seals. Chemical reactions may also occur when using tetrachloromethan, diethyl ether, ethyl ether, di-isopropyl ether, ketones, methylbenzene, methycyclohexane, and monochlorobenzene. If you use these solvents, please contact your Dionex Sales Representative.

**i Please note:** As standard, the pumps are fitted with reversed phase piston seals. However, normal phase seals can be installed instead if required. For information about the installation procedure and the corresponding part numbers, refer to Removing the Piston Seals (→ page 114).

### 7.5.2.1 Removing the Pump Heads and Pistons

To reach the piston heads and pistons, it is not necessary to open the pump enclosure. Tilt the front cover upward. The pistons are freely accessible via the pump heads.

- If necessary, purge the pump to remove toxic solvents.
- Set the pump flow rate to 0. Wait until the system pressure is down to zero.
- Disconnect all fluid connections from the pump heads.

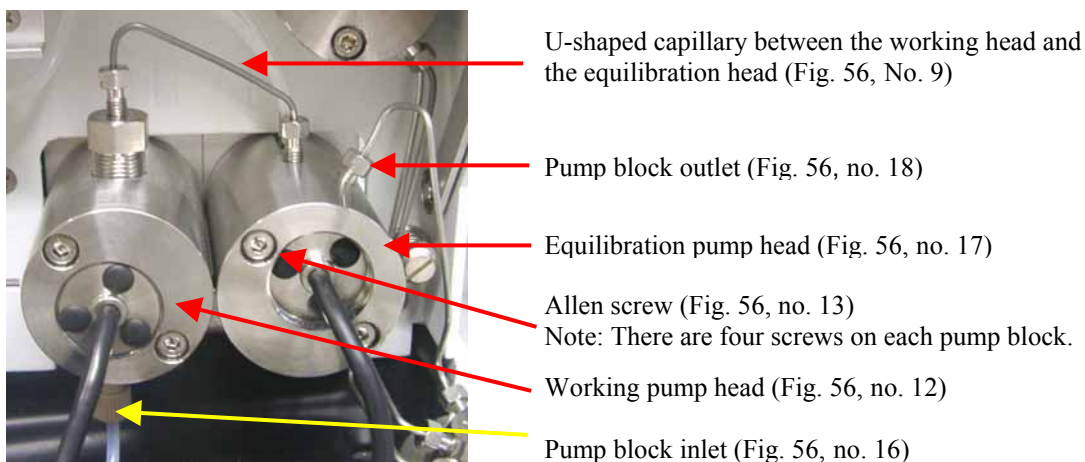


Fig. 58: Installed pump heads



- Loosen the Allen screws on the two pump heads (→ Fig. 58) and carefully remove the pump heads.

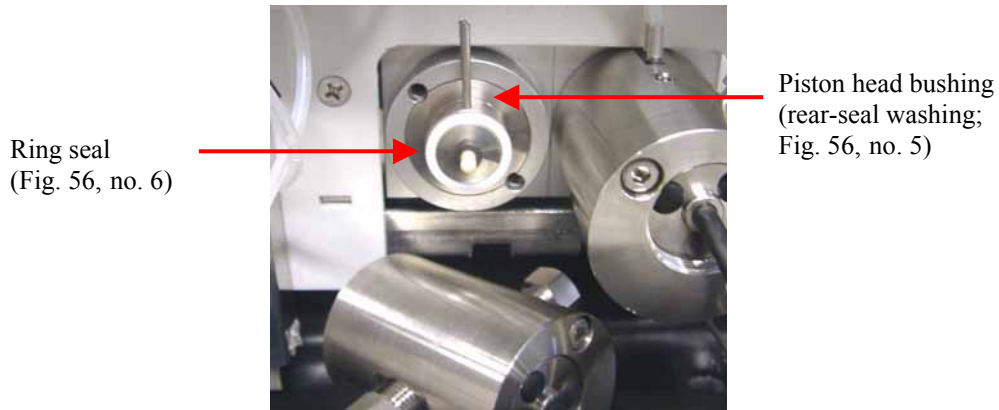


Fig. 59: Pump head removed

- Carefully remove the bushing of the seal-washing chamber from the piston (including the seal, → Fig. 59).
- Remove the bushing with draining device (→ Fig. 56, no. 3) from the piston unit (→ Fig. 56, no. 1), using the extractor from the pump's accessories kit (→ Fig. 60 to Fig. 62).



Fig. 60: Extractor for bushing with draining device

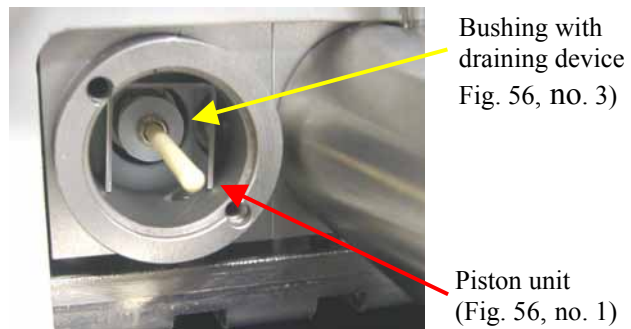


Fig. 61: Piston and bushing with draining device (here: P680A ISO)



Fig. 62: Removing the bushing with draining device (here: P680A ISO)

- Loosen the piston retaining screw (→ Fig. 56, no. 2), using the flat-blade screwdriver (provided in the accessories kit). Move the piston forward, toward the front cover of the pump, and remove it from the enclosure.

### 7.5.2.2 Cleaning the Pistons

- Remove the pump head and, if necessary, the piston as described above under Removing the Pump Head.
- Clean the piston.
- Carefully rinse the piston, and then rub it several times with a dry, lint-free paper towel.
- Apply some thin-bodied, resin-free oil or a thin film of e.g., Klüber Isoflex Fett (part no. 2182.5051) **only** to the **metal** part of the piston unit.

### 7.5.2.3 Removing the Piston Seals

Each piston has two piston seals. One seal is located in the pump head and the other is in the rear seal chamber. Replace the seals approximately every 4 months.

**i** **Please note:** Do not use sharp tools such as tweezers, etc.

- Use a disassembled piston to remove the piston seal from the pump head (→ Fig. 56, no. 8). On the working pump head (with valve cartridges), use a dummy plug (FS-8, part no. 2261.1100) to close the outlet valve. On the equilibration pump head, close the boreholes with dummy plugs. Insert the piston tip into the piston seal. The pressure loosens the seal. If you cannot remove the piston seal in this way, use an M4 screw; for example, the one used for holding the pump heads. Insert the screw into the seal. Remove the seal. This procedure destroys the piston seal!

**⚠ Important:** When replacing the piston seal in the pump head, always replace the support ring as well (For part number information, refer to the table below)! This is to prevent leakage.

Part No.	Description
6025.2010A*	P680A support ring/piston seal spare parts kit (reversed phase)
6025.2011A*	P680A support ring/piston seal spare parts kit (normal phase)
6030.9010*	P680P support ring/piston seal spare parts kit (reversed phase)
6030.9011*	P680P support ring/piston seal spare parts kit (normal phase)

\* All spare part kits comprise one support ring and two piston seals.

- To remove the piston seal that is installed in the rear seal chamber, remove the retaining screw (→ Fig. 56, no. 4) on the rear of the pump head bushing first, using the flat-blade screwdriver that is provided in the accessories kit. Then, remove the seal. Use the piston to push the piston out of the bushing.

### 7.5.2.4 Reinstalling the Piston, Piston Seal, and Pump Head

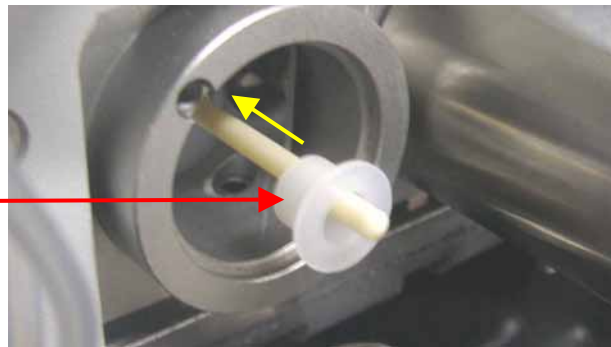
**i Please note:** We recommend that you always install new piston seals. However, you may still install piston seals that were removed from a head pump in the rear-seal wash system.

- Assemble the rear seal chamber. To do so, take the piston in one hand and slide the new piston seal over the piston. Insert the piston seal together with the piston into the pump head bushing. The piston is used to facilitate centering. Remove the piston so that the piston seal remains in the piston head bushing. Install and tighten the pump head bushing retaining screw hand-tight.

**⚠ Important:** When mounting the piston seals, make sure that the "open" sides of both piston seal springs point away from the pump enclosure (→ Fig. 56, no. 8).

- Install the piston in the pump block and tighten the piston retaining screw using the flat-blade screwdriver provided in the accessories kit.
- Slide the bushing with the draining device (→ Fig. 56, no. 3) onto the shaft. Make sure the orientation is correct (→ Fig. 63).

Slide the bushing onto the piston in this direction; make sure that the orientation is correct.



*Fig. 63: Correct orientation of the bushing with draining device*

- Slide the complete pump head bushing over the piston unit. Then, slide the piston unit into the pump block.
- Slide the new support ring and the piston seal onto the piston. Make sure the orientation of the piston seal is correct (→ Fig. 56, no. 8).
- Slide the ring seal (→ Fig. 56, no. 6; part no. 2266.0082, pack. unit: 10 seals) onto the pump head bushing (→ Fig. 56, no. 5).
- Slide the pump head onto the piston (turn and push as necessary) until the second piston seal is correctly in place.

**⚠ Important:** If you do not insert the piston seal in the way described above, but into the disassembled pump head, it may get jammed and thus become useless!

**⚠ Important:** The working head is installed on the left side of the pump block (inlet). You can identify the head by the two large boreholes for the inlet and outlet valves.

**i** **Please note:** To avoid damage to the piston seal during installation, we recommend moistening the piston seal, the piston, and the pump head with HPLC-grade water immediately before you install them.

- Tighten the pump heads with the Allen screws (→ Fig. 56, no. 13).
- Insert the inlet and outlet valves into the working pump head. The outlet valve (top) has a conical cavity for the capillary connection. The inlet valve (bottom) has a planar surface for the solvent line connection.
- Attach the capillary connections. Tighten them hand-tight, and then tighten them an additional one-quarter turn, using a ¼" wrench.
- Attach the solvent line to the inlet valve. Take care to avoid cross-threading.
- Attach the silicone lines of the piston seal wash system to the corresponding capillaries (→ Fig. 23, page 31).
- To prevent contaminants from entering the HPLC system, rinse the pump thoroughly (using at least 30 ml HPLC-grade water or pure organic solution). Open the purge block to prevent rinsing liquid from entering the HPLC system.
- Test the pump for leakage (→ Testing the Pump for Leakage (Leak Rate), Seite 121). Tighten any leaking connections.

**i** **Please note:** Never run the pump dry. Damage to the pistons or piston seals could result.

**i** **Please note:** When exchanging the piston seals, always exchange the liquid in the reservoir of the rear-seal wash system and rinse the fluidics, too.

**i** **Please note:** After you have installed normal phase piston seals, we recommend that you condition the pump with isopropanol, applying a backpressure of 20 to 30 MPa (2900 to 4350 psi) for at least 15 minutes. Bypass the column during this procedure by installing a backpressure capillary.

**i** **Please note:** In rare cases, it may happen that new seals show an increased leakage rate during the first hours of operation. In this case, exchange the liquid in the reservoir of the rear-seal wash system once again and rinse the fluidics.

## 7.6 Mixing Chamber

All pump versions, except the P680A ISO isocratic pump, are equipped with a dynamic mixing chamber.

The volume of the mixing chamber can be increased by installing one of the mixing chamber extensions (+ 600 $\mu$ l or + 1250 $\mu$ l) that are available from Dionex. For low flow rates (less 100  $\mu$ l/min) the mixing chamber can be bypassed and adapted to your requirements.

The gradient delay volume is 150  $\mu$ l for standard high-pressure gradient pumps and 390  $\mu$ l for low-pressure gradient pumps. The pump's gradient delay volume is defined as the volume that must be delivered until a spontaneous change in the mixture (100% jump) is detected (start of the signal change).

For more information about these options, refer to *Optimizing the Pump for Special Applications* ( $\rightarrow$  page 123).

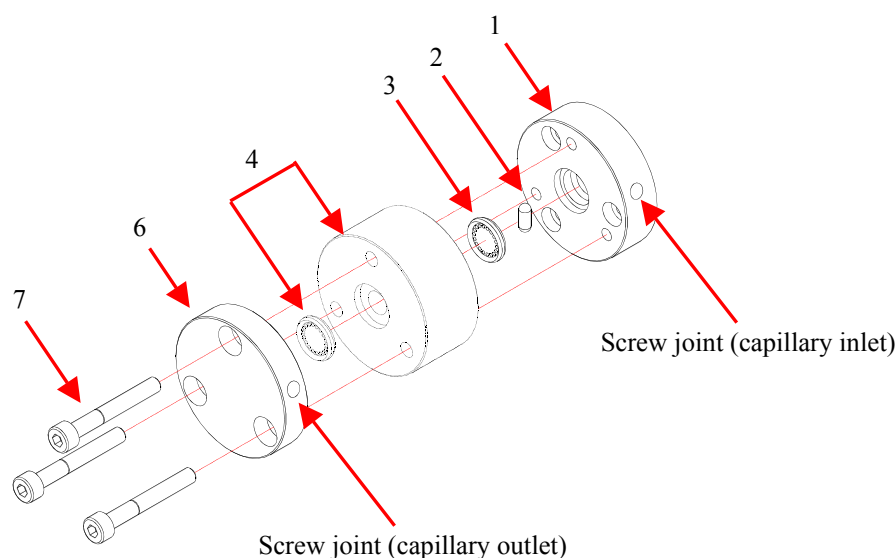


Fig. 64: Mixing chamber with optional mixing chamber extension

No.	Description	Part No.
1	Mixing chamber inlet (base)	-----
2	Solenoid stirrer	1384.0308
3	Standard mixing chamber ring seal	2266.1814
4	Option: Extended mixing chamber (The ring seal corresponds to the seal in no. 3)	$\rightarrow$ page 123
6	Mixing chamber outlet (top)	-----
7	Mixing chamber attachment screws	-----

**i** **Please note:** A P680A DGP-6 pump is fitted with 2 mixing chambers ( $\rightarrow$  Fig. 66).

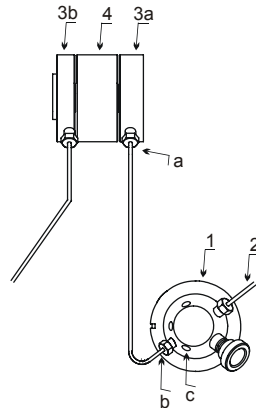


Fig. 65: Connections between mixing chamber and purge block (all pumps except P680A DGP-6)

No.	Description
1	Purge block
2	Pump outlet
3a	Mixing chamber outlet (top)
3b	Mixing chamber inlet (base)
4	Optional mixing chamber extension
5	Direct connection between the pump head and the purge block if no mixing chamber is installed.
a	Capillary fitting screw on the mixing chamber outlet (top)
b	Capillary fitting screw on the purge block inlet
c	LPG pump: Dummy plug on the purge block tee HPG pump: Capillary between the purge block and the equilibration head of the left pump block

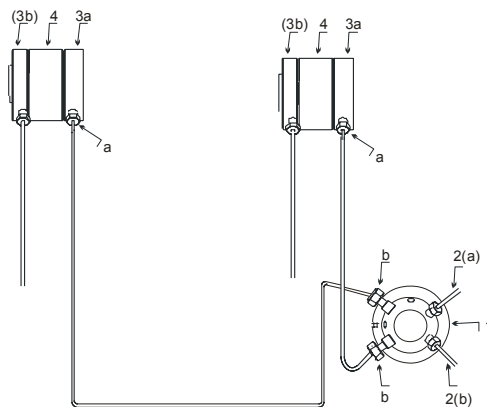



Fig. 66: Connections between the two mixing chambers and the outlet block on a P680A DGP-6


No.	Description
1	Outlet block
2a	Outlet from the left pump
2b	Outlet from the right pump
3a	Mixing chamber outlet (top)
3b	Mixing chamber inlet (base)
4	Optional mixing chamber extension
a	Capillary fitting screw on the mixing chamber outlet (top)
b	Capillary fitting screw of the capillary on the inlet of the outlet block

To open the mixing chamber, follow the steps below:

- If necessary, purge the pump to remove toxic solvents.
- Turn off the pump and disconnect the power cord.
- Tilt the front cover upward.
- On the mixing chamber outlet, **loosen** the fitting screw of the capillary that connects the mixing chamber outlet to the purge block/outlet block inlet (→ Fig. 65 and/or Fig. 66, screw **a**). Do not remove the capillary on the mixing chamber outlet completely!
- On the purge block/outlet block inlet, **loosen** the fitting screw of the capillary that connects the mixing chamber outlet to the purge block/outlet block inlet (→ Fig. 65 and/or Fig. 66, screw **b**). Do not remove the capillary on the purge block/outlet block inlet completely!
- Using an Allen key, undo the three attachment screws on the mixing chamber outlet (top).
- You may now install the mixing chamber extension (for installation details, refer to page 76) or replace the solenoid stirrer.

 **Please note:** Inspect the solenoid stirrer for contaminants and/or wear in regular intervals. Replace the stirrer if necessary.

- Install the mixing chamber top part to the mixing chamber base part, as illustrated in Fig. 64. When inserting the seal, you do not need to observe a special mouting direction. Make sure that the position of the capillary outlet screw joint in the mixing chamber outlet is correct.

 **Important:** When you install the mixing chamber outlet (top), avoid corss-threading. Screw in the first screw, and then align the others. Loosely screw in the other screws, and then tighten all screws in turn. We recommend applying a lubricant before inserting the screws.

- Tighten the capillary fitting screws on the mixing chamber outlet and on the purge block/outlet block inlet (→ Fig. 65 and/or Fig. 66, screws **a** and **b**).
- Connect the power cord and turn on the pump.
- Purge all channels (→ Purging the Pump, page 34).
- Test the mixing chamber for leakage at 400-500 bar. If necessary, retighten the screws and fitting screws.

## 7.7 Vacuum Online Degasser

Usually, a vacuum degasser is used to degas the solvents. The P680A LPG-4 pump is equipped with an in-built vacuum degasser. For the P680A DGP-6, P680A HPG and P680P HPG-2 pumps, and for the isocratic P680A ISO pump, we recommend using the appropriate SOR-100 Solvent Rack with integrated degasser or any other external vacuum degasser.

**i** **Please note:** When using a P680P HPG-2 pump, make sure to connect a preparative degasser (not an analytical degasser).

To avoid contamination of the degasser:

- Prepare fresh solvents at regular intervals.
- Rinse the degasser channels at regular intervals.  
This is especially important for the channel that degasses the aqueous solvent (for reverse-phase chromatography). Usually, it is sufficient to rinse all channels with organic solvent. (Please use a fresh bottle.) When you use water and acetonitrile or methanol, it is usually sufficient to rinse the degasser channels once per week. However, please adapt the rinsing intervals to the solvents in use. In persistent cases, e.g. reproducible ghost peaks in the chromatogram, follow the steps below:
  - Replace the column with a backpressure capillary.
  - Rinse the degasser channels for 1 hour with 20% nitrid acid at the flow rate normally used for your application. (Use fresh HPLC-grade water or a new bottle.)
  - Rinse the degasser channels with HPLC-grade water until the pH value is neutral. (Use fresh HPLC-grade water or a new bottle.)
  - Rinse the degasser channels for 2 hours, using HPLC-grade acetonitrile quality (use a new bottle) at the flow rate normally used for your application.
  - Prepare fresh solvents for your application using new bottles, and connect them to the degasser channels.
  - Reinstall the column and equilibrate the system.

**In addition, please note:**

- Clean the solvent lines at regular intervals.
- **Only P680A LPG-4:** Listen to the operating noise of the degasser. Upon reaching the operating vacuum, the vacuum pump automatically turns on and off at intervals. If the vacuum pump does not stop running when expected (or if it runs more than 50% of the time), the following error message appears on the pump display: "The degasser vacuum is insufficient for proper degassing". Check the system for possible leaks. If necessary, the degasser module needs to be exchanged. Please contact Dionex Service.
- When connecting the solvent lines, make sure that the connectors are free of contaminants. Even minute particles can allow air to enter the degasser, and thus reduce the unit's effectiveness.



- When replacing solvents, make sure that the solvents are miscible. Mix immiscible solvents with an intermediate solvent to replace them step-by-step.
- Thoroughly rinse the degasser with alcohol after operation. (The alcohol does not need to be removed afterwards.)
- For longer periods of inactivity and when using saliferous buffers (which may result in salt crystallization in the gas separation membrane, thereby impairing the degassing performance!), rinse with de-ionized water followed by either methanol or 2-propanol.

## 7.8 Testing the Pump for Leakage (Leak Rate)

After you have carried out any maintenance or repair work on the fluid system, test the pump for leakage. With this test, a pump pressure of > 300 bar (4350 psi) is build up.







- Close the pump outlet with a dummy plug (FS-8, part no. 2261.1100).
- Set the upper pressure limit to 450 bar (6525 psi).
- Select a flow rate of, for example, 50 µl/min.
- Decrease the flow as soon as the pressure builds up (typically between 100 and 200 bar (1450 and 2900 psi)).
- When the pressure is 350 bar (5075 psi), set the flow rate to 1 µl/min. The pressure should now increase or remain constant at least.
- In case of leakage, visually inspect the piston seals for leakage (→ page 111) and tighten leaking connections, if necessary.
- Reset the upper pressure limit to the value used before the test.

This test also provides information about the leak rate of the pump.

** Please note:** The two pumps of a P680A DGP-6 can be tested together or separately.

## 7.9 Shutting Down the Pump

Please observe the following precautions before interrupting the operation for more than one week or before shipping the pump:

-  **Important:** Fill the pump with methanol (or a similar alcohol such as 2-propanol or ethanol). If the solvents in the pump are not miscible with water, replace the solvents step-by-step. Do not forget to fill the rear-seal wash system (→ Active Rear-Seal Wash, page 31).
-  **Important:** Do not forget to empty the liquid reservoir of the rear seal wash system before shipping the pump (→ page 31).
-  **Important:** Rinse out buffers or solvents that form peroxide. This will reduce the equilibration time of the column as well the lamps in any of the connected UV or RI detectors connected to the pump when operation is resumed.
-  **Important:** Turn off the lamps in any UV or RF detectors that are connected to the pump. This will prevent evaporation of the solvents in the flow cell.
-  **Please note:** We recommend pulling the tubing out of the peristaltic pump (→ Fig. 25) if the pump is not running for more than five days. To remove the tubing, slightly press the lever upward, remove the tubing, and release the lever. This will prevent that the tubing remains compressed and does not relax, thus blocking the wash solution.
-  **Please note:** Ship the unit only in the original packaging. Shipping the unit in any other packaging automatically voids the warranty!

## 8 Optimizing the Pump for Special Applications

You may want to optimize your pump for special applications. To do so, the following kits are available from Dionex:

- Mixing Chamber Extension kits (600  $\mu$ l and 1250  $\mu$ l) for all P680 pumps except P680A ISO
- MicroFlow Kits for the P680A LPG-4, P680A HPG-2, and P680A HPG-4 pumps

### 8.1 Mixing Chamber Extensions

For poorly miscible solvents, higher flow rates, or special applications, you can install an optional mixing chamber extension to increase the volume of the mixing chamber by either 600  $\mu$ l or 1250  $\mu$ l. The following kits are available:

Part No.	Description
6030.0030	Extended Mixing Chamber Kit, 600 $\mu$ l, for all pumps except P680A ISO including: 1 extension ring, volume: 600 $\mu$ l 3 attachment screws (I-M4 x 30 DIN 912 V2A) 1 mixing chamber seal
6030.0040	Extended Mixing Chamber Kit, 1250 $\mu$ l, for all pumps except P680A ISO including: 1 extension ring, volume: 1250 $\mu$ l 3 attachment screws (I-M4 x 30 DIN 912 V2A) 1 mixing chamber seal

**i** **Please note:** Two extended mixing chamber kits are required for a P680A DGP-6 pump.

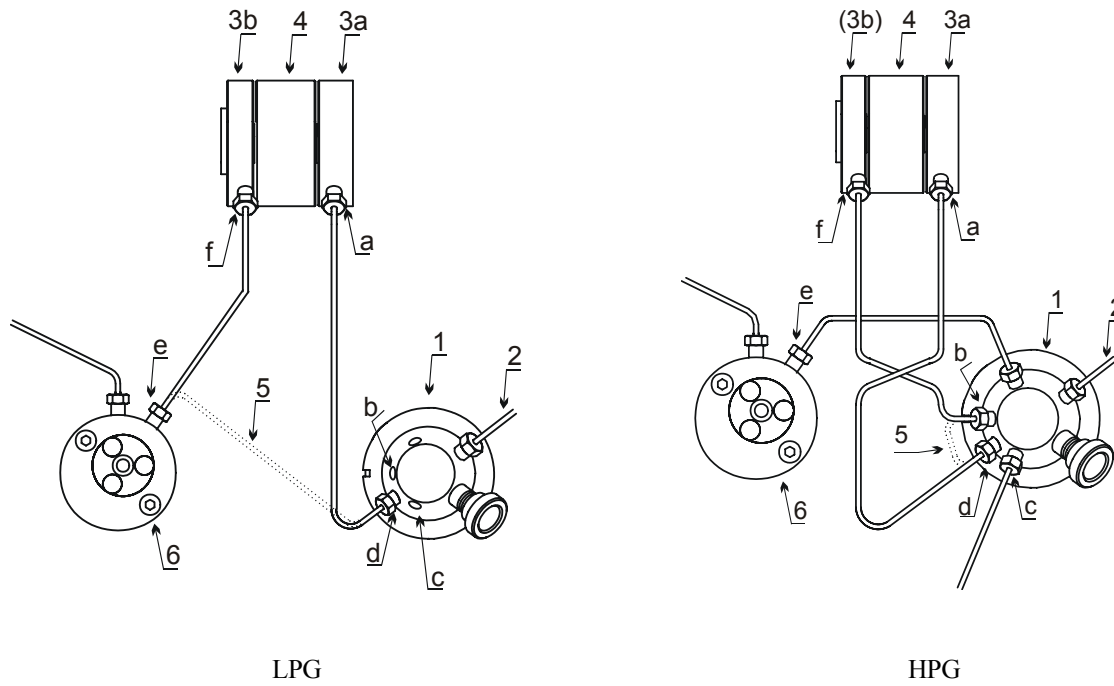


Fig. 67: Connections between pump head, mixing chamber, and purge block  
(all pump types except P680A DGP-6)

No.	Description
1	Purge block
2	Pump outlet
3a	Mixing chamber outlet (top)
3b	Mixing chamber inlet (base)
4	Optional mixing chamber extension
5	Direct connection between the pump head and the purge block if no mixing chamber is installed
6	LPG pump: Equilibration head HPG pump: Equilibration head of the right pump block
a	Capillary fitting screw on the mixing chamber outlet (top)
b	Fitting screw on the purge block tee (HPG pumps only)
c	LPG pumps: Dummy plug on the purge block tee HPG pumps: Capillary between the purge block and the equilibration head of the left pump block
d	Capillary fitting screw on the purge block inlet
e	Capillary fitting screw on the pump head outlet
f	Capillary fitting screw on the mixing chamber inlet (base)

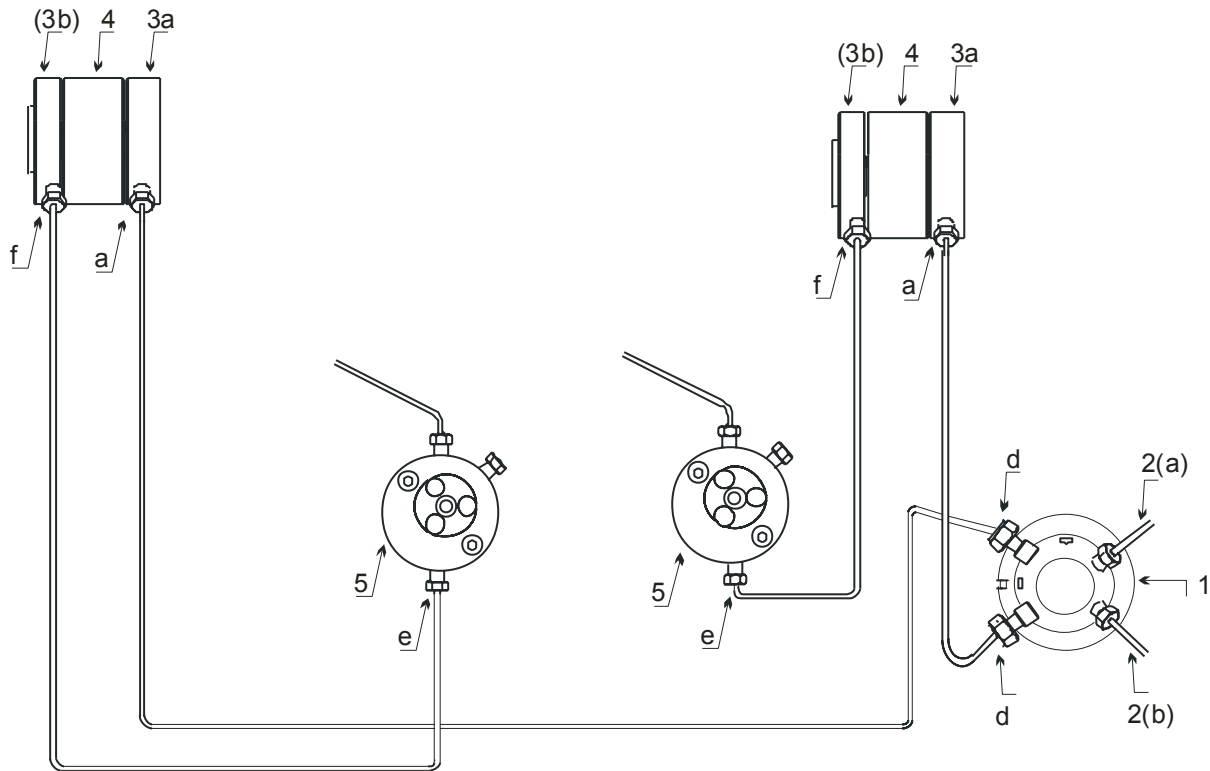



Fig. 68: Connections between pump head, mixing chamber, and purge block (P680A DGP-6)


No.	Description
1	Outlet block
2a	Outlet from the left pump
2b	Outlet from the right pump
3a	Mixing chamber outlet (top)
3b	Mixing chamber outlet (base)
4	Optional mixing chamber extension
5	Equilibration pump head with pressure sensor and purge screw
a	Capillary fitting screw on the mixing chamber outlet (top)
d	Capillary fitting screw on the purge block inlet
e	Capillary fitting screw on the pump head outlet
f	Capillary fitting screw on the mixing chamber inlet (base)


### How to install the mixing chamber extension

- If necessary, purge the pump to remove toxic solvents.
- Turn off the pump and disconnect the power cord.
- Tilt the front cover upward.
- For P680A LPG-4 pumps: Remove the dummy plug on the purge block tee (→ Fig. 67, plug **c**).
- On the mixing chamber outlet, **loosen** the fitting screw of the capillary that connects the mixing chamber outlet to the purge block/outlet block inlet (→ Fig. 67 or Fig. 68, screw **a**). Do not remove the capillary on the mixing chamber outlet completely!
- On the purge block/outlet block inlet, **loosen** the fitting screw of the capillary that connects the mixing chamber outlet to the purge block/outlet block inlet (→ Fig. 67 or Fig. 68, screw **d**). Do not remove the capillary on the purge block/outlet block inlet completely!
- Using an Allen key, undo the three attachment screws from the mixing chamber outlet (top).
- Insert the seal into the extension ring. Install the extension ring, plus the mixing chamber top part, onto the mixing chamber base part, as illustrated in Fig. 64. The mounting direction of the seal is not important. Make sure that the position of the capillary outlet screw joint in the mixing chamber outlet is correct. Mount the mixing chamber, using the three longer attachment screws (I-M4 x 30) that are shipped with the option.

 **Please note:** Keep the short screws (I-M4 x 10) in case you wish to remove the extension later.

Screw in the first screw, and then align the others. Loosely screw in the other screws, and then tighten all screws in turn.

 **Important:** When you install the mixing chamber outlet (top), avoid cross-threading. We recommend applying a lubricant before inserting the screws.

 **Please note:** We recommend loosely installing the capillary to the outlet part before mounting the top part of the mixing chamber.

- Tighten the capillary fitting screws on the mixing chamber outlet and on the purge block/outlet block inlet (→ Fig. 67 or Fig. 68, screws **a** and **d**).
- For P680A LPG-4 pumps: Reinstall the dummy plug on the purge block tee (→ Fig. 67, dummy plug **c**).
- Connect the power cord and turn on the pump.
- Purge all channels (→ Purging the Pump, page 34).
- Test the pump for tightness (→ Testing the Pump for Leakage (Leak Rate), page 121).

### How to uninstall the mixing chamber extension

If you wish to remove the mixing chamber extension, also follow the steps described above. Remove the extension including the seal, and then reinstall the top part of the mixing chamber onto its base part, using the short I-M4 x 10 screws.

## 8.2 MicroFlow Kits

MicroFlow kits are available to reduce the delay volume. Reducing the delay volume allows changes in the solvent concentration to become effective on the column much earlier.

Part No.	Description
6030.0010	MicroFlow Kit for the P680A LPG-4 pump, including: Capillary to connect the pump head outlet and the purge block inlet (ID = 0.5 mm, l = 160 mm) Capillary to connect the proportioning valve and the pump head inlet (PEEK) <b>Note:</b> This MicroFlow Kit is not intended for a P680A DGP-6 pump.
6030.0020	MicroFlow Kit for the P680A HPG-2 and P680A HPG-4 pumps, including: Capillary to connect the tee and the purge block inlet (ID= 0.5 mm, l = 60 mm)

### 8.2.1 Installing and Uninstalling on a P680A LPG-4 pump

**i** **Please note:** The MicroFlow Kit is not intended for a P680A DGP-6 pump.

#### How to install the MicroFlow option:

- If necessary, purge the pump to remove toxic solvents.
- Turn off the pump and disconnect the power cord.
- Tilt the front cover upward.
- Remove the dummy plug on the purge block tee (→ Fig. 67, plug **c**).
- Undo the capillary fitting screws on the mixing chamber outlet and on the purge block inlet (→ Fig. 67, screws **a** and **d**) and remove the capillary.
- Undo the capillary fitting screws on the mixing chamber inlet and on the pump head outlet (→ Fig. 67, screws **f** and **e**) and remove the capillary.

**i** **Please note:** Keep the two capillaries in case you wish to remove the Micro Flow option later.

- Install the capillary from the LPG MicroFlow kit between the pump head outlet and the purge block inlet and tighten the fitting screws (→ Fig. 67, screws **e** and **d**)
- Reinstall the dummy plug on the purge block tee (→ Fig. 67, plug **c**).
- For low-flow applications (< 1ml/min), you may also want to exchange the PTFE tubing for the PEEK capillary that is included in the MicroFlow kit. Proceed as follows:
  - Undo the fitting screw of the tubing on the pump inlet valve.
  - Undo the fitting screw of the tubing (the center connection) on the proportioning valve. If necessary, also loosen the fitting screws of the tubing leading to the degasser and the screw on the proportioning valve retaining plate.
  - Replace the connection tubing with the PEEK capillary.
  - Tighten the fitting screws. Make sure that the capillary does not escape the ferrules. Reinstall the retaining plate as necessary.

- Connect the power cord and turn on the pump.
- Purge all channels (→ Purging the Pump, page 34).
- Test the pump for tightness (→ Testing the Pump for Leakage (Leak Rate), page 121).

### How to uninstall the micro flow option

- If necessary, purge the pump to remove toxic solvents.
- Turn off the pump and disconnect the power cord.
- Tilt the front cover upward.
- Remove the dummy plug on the purge block tee (→ Fig. 67, dummy plug **c**).
- Undo the capillary fitting screws on the purge block inlet and the pump head outlet (→ Fig. 67, screws **d** and **e**).
- Reinstall the original capillary between the mixing chamber outlet and the purge block inlet (that was removed during the installation of the kit) and tighten both fitting screws (→ Fig. 67, screws **a** and **d**).
- Install the capillary between the pump head outlet and the mixing chamber inlet that was removed during the installation of the kit and tighten both fitting screws (→ Fig. 67, screws **e** and **f**).
- Reinstall the dummy plug on the purge block tee (→ Fig. 67, dummy plug **c**).
- Reinstall the PTFE tubing between the proportioning valve and the pump inlet valve as necessary.
- Connect the power cord and turn on the pump.
- Purge all channels (→ Purging the Pump, page 34).
- Test the pump for tightness (→ Testing the Pump for Leakage (Leak Rate), page 121).

## 8.2.2 Installing and Uninstalling on a P680A HPG-2 or P680A HPG-4 pump

### How to install the MicroFlow option:

- If necessary, purge the pump to remove toxic solvents.
- Turn off the pump and disconnect the power cord.
- Tilt the front cover upward.
- Undo the capillary fitting screws on the mixing chamber outlet and on the purge block inlet (→ Fig. 67, screws **a** and **d**) and remove the capillary.
- Undo the capillary fitting screws on the mixing chamber inlet and on the purge block tee (→ Fig. 67, screws **f** and **b**) and remove the capillary.

**i** **Please note:** Keep the two capillaries in case you wish to remove the Micro Flow option later.

- Install the capillary from the MicroFlow kit between the purge block tee and the purge block inlet and tighten both fitting screws (→ Fig. 67, screws **b** and **d**) in turn.



- Connect the power cord and turn on the pump.
- Purge all channels (→ Purging the Pump, page 34).
- Test the pump for tightness (→ Testing the Pump for Leakage (Leak Rate), page 121).

**How to uninstall the MicroFlow option:**

- If necessary, purge the pump to remove toxic solvents.
- Turn off the pump and disconnect the power cord.
- Tilt the front cover upward.
- Undo the capillary fitting screw between the purge block tee and purge block inlet (→ Fig. 67, screws **b** and **d**) in turn and remove the capillary.
- Reinstall the original capillary between the mixing chamber inlet and the purge block tee (that was removed during the installation of the kit) and tighten the fitting screws (→ Fig. 67, screws **f** and **b**).
- Reinstall the original capillary between the mixing chamber outlet and the purge block inlet (that was removed during the installation of the kit) and tighten the fitting screws (→ Fig. 67, screws **a** and **d**).
- Connect the power cord and turn on the pump.
- Purge all channels (→ Purging the Pump, page 34).
- Test the pump for tightness (→ Testing the Pump for Leakage (Leak Rate), page 121).



## 9 Technical Information

	P680A ISO	P680A LPG-4 and P680A DGP-6	P680A HPG	P680P HPG-2
Flow rate range:	1-10,000 µl/min	1-10,000 µl/min	1-10,000 µl/min (Grad. mode) 1-20,000 µl/min (Double Flow mode)	0.2-50 ml/min (Grad. mode) 0.2-100 ml/min (Double Flow mode)
Flow rate accuracy and reproducibility:	±0.1% at 1ml/min	±0.1% at 1 ml/min	±0.1% at 1 ml/min	±1.0% at 2 ml/min
Displacement vol. (working head):	79.2 µl per stroke	79.2 µl per stroke	79.2 µl per stroke	477.8 µl per stroke
Piston diameter:	3.175 mm	3.175 mm	3.175 mm	7.8 mm
Flow profiles:	Linear and step, 50 ramps per run			
Gradient formation:	N/A	Quaternary	Binary (with opt. solvent selector: from 4 solvents)	Binary
Gradient profiles:	N/A	Linear, step, 50 ramps per run	Linear, step, 50 ramps per run	Linear, step, 50 ramps per run
Pressure range:	0.1-50 Mpa (7250 psi)	0.1-50 Mpa (7250 psi)	0.1-50 Mpa (7250 psi)	1-10 MPa (1450 psi) (short-term: 15 MPa (2100 psi))
Pressure ripple:	typically < 1%	typically < 1%	typically < 1%	typically < 1.5%
Proportioning accuracy:	N/A	±0.5% at 2 ml/min	±0.2% at 2 ml/min	±0.2% at 5 ml/min
Proportioning reproducibility:	N/A	±0.5% at 2 ml/min	±0.2% at 2 ml/min	±0.2% at 5 ml/min
Number of solvents:	1	P680A LPG-4: 4 P680A DGP-6: 3 (per pump)	2, optional 4 (gradient formation 2 from 4)	2
Gradient delay volume (standard pump):	N/A	<400 µl	<150µl	<150 µl
Solvent degassing:	External (optional)	P680A LPG-4: Built-in 4-channel vacuum degasser P680A DGP-6: External (optional)	External (optional)	External (optional)

	P680A ISO	P680A LPG-4 and P680A DGP-6	P680A HPG	P680P HPG-2
Remote control:	All functions controllable via LAN or USB Permanent status transfer Program-controlled or stand-alone operation			
I/O interfaces:	3 digital inputs for Start, Stop, and Hold 4 programmable relays Depending on the pump type: Port for connecting a motorized switching-valve or an SOR-100 Solvent Rack with integrated degasser Analog output for system pressure			
PC connection:	USB or TCP/IP (RJ-45)			
Additional communication ports:	RS-232 port for connection of a Dionex ASI-100 autosampler or a Dionex STH585 Column Thermostat			
Additional USB ports:	Integrated USB hub with three type A USB ports for connection of other Summit HPLC modules			
Safety features:	Minimum/maximum pressure shut-down (selectable) Time monitoring of pump functions Leak sensors			
User input/display:	Keypad (solvent-resistant) 8-line LCD (21 characters per line) 11 LEDs User input is possible while a program is active.			
Wetted parts:	Stainless steel (1.4571), sapphire, ruby, ceramics, UHMW polyethylene, PCTFE, PTFE, PEEK, zirconium oxide (ZrO <sub>2</sub> ), aluminium oxide (Al <sub>2</sub> O <sub>3</sub> ).			
Power requirements:	max. 80 W (100-120V, 60 Hz; 200-240V, 50 Hz)			
Environmental conditions:	Range of use: Indoor use Temperature: 10°C to 35°C (50°F to 95°F) Air humidity: 40 to 85% relative humidity, non-condensing Overvoltage category: II Pollution degree: 2			
Dimensions (h x w x d):	19 x 40 x 38 cm (7.5 x 15.8 x 15.0 in.)			
Weight:	12.3 kg (27.1 lb)	P680A LPG-4: 15.8 kg (34.8 lb) P680A DGP-6: 17.6 kg (38.8 lb)	16.8 kg (37.0 lb)	16.8 kg (37.0 lb)

Technical information: April 2004.

All technical specifications are subject to change without notice.

## 10 Accessories and Spare Parts

Accessories and spare parts for the P680 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.

### 10.1 Standard Accessories (included in the shipment)

The following accessories are shipped with the pump (subject to change without notice). Accessory parts listed below without their part numbers are usually available in one of the P680 spare part kits (→ section 10.3, page 140).

Description	Part No.*	Quantity in the accessories pack
<b>Accessory pack for isocratic P680A ISO pumps:</b>	<b>5030.9000</b>	
Power cord (200-240 V), 2m <i>or</i> Power cord (90-130 V), 2m (depending on the destination country)	1310.7031 <i>or</i> 1310.7032	1
Tool set for analytical pump including: Open-end wrench (1/4 x 5/16), open-end wrench (11 x 13), pin wrench (3,0), and flat-blade screwdriver (for 1/8" piston)	5007.9301	1
Fuse, 1A, TT (5 x 20 mm)		2
Fuse, 2A, TT (5 x 20 mm)		2
Solvent filter	2200.0011	10
Silicone tube (OD x ID: 2.80 x 1.30 mm), 3m		1
Plastic syringe, 12 ml		1
Labels "A-D", 3mm, white		1
Plastic bag (100 x 70 x 0.5 mm)		3
Capillary connection (1/16", 0.25 mm), 1m	5020.9110	1
Solvent line for isocratic pump		1
Remote input - pressure output cable	8005.9001A	1
Knurled fitting, 1/8", PEEK		1
Clamp ring, PEEK (for 3 x 1.5 mm (OD x ID) tubing)		1
Support flange, PEEK (for 3 x 1.5 mm (OD x ID) tubing)		1
Digital I/O connector (type: D-Sub, 25-pin, male)		1
Housing for digital I/O connector		1
USB cable, type A to type B, 5m	8911.0002	1
RJ45 cable for Ethernet hub, 3m	8906.2038	1
Extractor for bushing with draining device	4010.3015	1
Chromeleon 6 Service Pack CD <i>or</i> CM Driver Update CD	4580.0316 <i>or</i> 5950.0092	1
Operating instructions, English	4820.3050	1
Assortment box for accessories	2309.1100	1

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

Description	Part No.*	Quantity in the accessories pack
<b>Accessory pack for P680A LPG-4 low-pressure gradient pumps:</b>	<b>5030.9001</b>	
Power cord (200-240 V), 2m <i>or</i> Power cord (90-130 V), 2m (depending on the destination country)	1310.7031 <i>or</i> 1310.7032	1
Tool set for analytical pump including: Open-end wrench (1/4 x 5/16), open-end wrench (11 x 13), pin wrench (3,0), and flat-blade screwdriver (for 1/8" piston)	5007.9301	1
Fuse, 1A, TT (5 x 20 mm)		2
Fuse, 2A, TT (5 x 20 mm)		2
Solvent filter	2200.0011	10
Silicone tube (OD x ID: 2.80 x 1.30 mm), 3m		1
Plastic syringe, 12 ml		1
Labels "A-D", 3mm, white		1
Plastic bag (100 x 70 x 0.5 mm)		3
Capillary connection (1/16", 0.25 mm), 1m	5020.9110	1
P680 solvent tube set, including: 2 white "A", "B", "C", "D" wire labels each 1 wiring spiral 4 solvent lines for low-pressure gradient pumps	5030.2545	1
Remote input - pressure output cable	8005.9001A	1
Knurled fitting, 1/8", PEEK		1
Clamp ring, PEEK (for 3 x 1.5 mm (OD x ID) tubing)		1
Support flange, PEEK (for 3 x 1.5 mm (OD x ID) tubing)		1
Digital I/O connector (type: D-Sub, 25-pin, male)		1
Housing for digital I/O connector		1
USB cable, type A to type B, 5m	8911.0002	1
RJ45 cable for Ethernet hub, 3m	8906.2038	1
Extractor for bushing with draining device	4010.3015	1
Chromeleon 6 Service Pack CD <i>or</i> CM Driver Update CD	4580.0316 <i>or</i> 5950.0092	1
Operating instructions, English	4820.3050	1
Assortment box for accessories	2309.1100	1

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

Description	Part No.*	Quantity in the accessories pack
<b>Accessory pack for P680A DGP-6 dual low-pressure gradient pumps :</b>	<b>5030.9030</b>	
Power cord (200-240 V), 2m <i>or</i> Power cord (90-130 V), 2m (depending on the destination country)	1310.7031 <i>or</i> 1310.7032	1
Tool set for analytical pump including: Open-end wrench (1/4 x 5/16), open-end wrench (11 x 13), pin wrench (3,0), and flat-blade screwdriver (for 1/8" piston)	5007.9301	1
Fuse, 1A, TT (5 x 20 mm)		2
Fuse, 2A, TT (5 x 20 mm)		2
Solvent filter	2200.0011	10
Silicone tube (OD x ID: 2.80 x 1.30 mm), 3m		1
Plastic syringe, 12 ml		1
Plastic bag (100 x 70 x 0.5 mm)		3
Capillary connection (1/16", 0.25 mm), 1m	5020.9110	1
Remote input - pressure output cable	8005.9001A	1
Digital I/O connector (type: D-Sub, 25-pin, male)		1
Housing for digital I/O connector		1
USB cable, type A to type B, 5m	8911.0002	1
RJ45 cable for Ethernet hub, 3m	8906.2038	1
Extractor for bushing with draining device	4010.3015	1
Chromeleon 6 Service Pack CD <i>or</i> CM Driver Update CD	4580.0316 <i>or</i> 5950.0092	1
Operating instructions, English	4820.3050	1
Assortment box for accessories	2309.1100	1

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

Description	Part No.*	Quantity in the accessories pack
<b>Accessory pack for P680A HPG-2 high-pressure gradient pumps:</b>	<b>5030.9002</b>	
Power cord (200-240 V), 2m <i>or</i> Power cord (90-130 V), 2m (depending on the destination country)	1310.7031 <i>or</i> 1310.7032	1
Tool set for analytical pump including: Open-end wrench (1/4 x 5/16), open-end wrench (11 x 13), pin wrench (3,0), and flat-blade screwdriver (for 1/8" piston)	5007.9301	1
Fuse, 1A, TT (5 x 20 mm)		2
Fuse, 2A, TT (5 x 20 mm)		2
Solvent filter	2200.0011	10
Silicone tube (OD x ID: 2.80 x 1.30 mm), 3m		1
Plastic syringe, 12 ml		1
Labels "A-D", 3mm, white		1
Plastic bag (100 x 70 x 0.5 mm)		3
Capillary connection (1/16", 0.25 mm), 1m	5020.9110	1
Solvent line for high-pressure pump		2
Remote input - pressure output cable	8005.9001A	1
Knurled fitting, 1/8", PEEK		1
Clamp ring , PEEK (for 3 x 1.5 mm (OD x ID) tubing)		1
Support flange, PEEK (for 3 x 1.5 mm (OD x ID) tubing)		1
Digital I/O connector (type: D-Sub, 25-pin, male)		1
Housing for digital I/O connector		1
USB cable, type A to type B, 5m	8911.0002	1
RJ45 cable for Ethernet hub, 3m	8906.2038	1
Extractor for bushing with draining device	4010.3015	1
Chromeleon 6 Service Pack CD <i>or</i> CM Driver Update CD	4580.0316 <i>or</i> 5950.0092	1
Operating instructions, English	4820.3050	1
Assortment box for accessories	2309.1100	1

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



Description	Part No.*	Quantity in the accessories pack
<b>Accessory pack for P680A HPG-4 high-pressure gradient pumps:</b>	<b>5030.9003</b>	
Power cord (200-240 V), 2m <i>or</i> Power cord (90-130 V), 2m (depending on the destination country)	1310.7031 <i>or</i> 1310.7032	1
Tool set for analytical pump including: Open-end wrench (1/4 x 5/16), open-end wrench (11 x 13), pin wrench (3,0), and flat-blade screwdriver (for 1/8" piston)	5007.9301	1
Fuse, 1A, TT (5 x 20 mm)		2
Fuse, 2A, TT (5 x 20 mm)		2
Solvent filter	2200.0011	10
Silicone tube (OD x ID: 2.80 x 1.30 mm), 3m		1
Plastic syringe, 12 ml		1
Labels "A-D", 3mm, white		1
Plastic bag (100 x 70 x 0.5 mm)		3
Capillary connection (1/16", 0.25 mm), 1m	5020.9110	1
Solvent line for high-pressure pump		4
Remote input - pressure output cable	8005.9001A	1
Knurled fitting, 1/8", PEEK		1
Clamp ring , PEEK (for 3 x 1.5 mm (OD x ID) tubing)		1
Support flange, PEEK (for 3 x 1.5 mm (OD x ID) tubing)		1
Digital I/O connector (type: D-Sub, 25-pin, male)		1
Housing for digital I/O connector		1
USB cable, type A to type B, 5m	8911.0002	1
RJ45 cable for Ethernet hub, 3m	8906.2038	1
Extractor for bushing with draining device	4010.3015	1
Chromeleon 6 Service Pack CD <i>or</i> CM Driver Update CD	4580.0316 <i>or</i> 5950.0092	1
Operating instructions, English	4820.3050	1
Assortment box for accessories	2309.1100	1

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

Description	Part No.*	Quantity in the accessories pack
<b>Accessory pack for P680P HPG-2 semi-preparative high-pressure gradient pumps:</b>	<b>5030.9020</b>	
Power cord (200-240 V), 2m <i>or</i> Power cord (90-130 V), 2m (depending on the destination country)	1310.7031 <i>or</i> 1310.7032	1
Tool set for semi-preparative pump including: Open- end wrench (1/4 x 5/16), open-end wrench (11 x 13), pin wrench (3,0), flat-blade screwdriver (for 8 mm piston), and installation tool for cap seal (for purge valve screw)	5007.9302	1
Fuse, 1A, TT (5 x 20 mm)		2
Fuse, 2A, TT (5 x 20 mm)		2
Silicone tube (OD x ID: 2.80 x 1.30 mm), 3m		1
Plastic syringe, 12 ml		1
Labels "A-D", 3mm, white		1
Plastic bag (100 x 70 x 0.5 mm)		3
Capillary connection (1/16", 0.7 mm), 1m		1
Solvent line for preparative pump (OD X ID: 3 x 2 mm)	6007.9300	2
Filter frits	2268.3310	2
Remote input - pressure output cable	8005.9001A	1
Knurled fitting, 1/8", PEEK		1
Clamp ring , PEEK (for 3 x 2 mm (OD x ID) tubing)		1
Support flange, PEEK (for 3 x 1.5 mm (OD x ID) tubing)		1
Digital I/O connector (type: D-Sub, 25-pin, male)		1
Housing for digital I/O connector		1
USB cable, type A to type B, 5m	8911.0002	1
RJ45 cable for Ethernet hub, 3m	8906.2038	1
Extractor for bushing with draining device	4010.3015	1
Chromeleon 6 Service Pack CD <i>or</i> CM Driver Update CD	4580.0316 <i>or</i> 5950.0092	1
Operating instructions, English	4820.3050	1
Assortment box for accessories	2309.1100	1

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

## 10.2 Optional Accessories

Part No.	Description	Remarks
5030.9200	SOR-100 Solvent Rack without degasser	To be connected to a P680A LPG-4 pump.
5030.9210	SOR-100A-2 Solvent Rack with 2-channel degasser (analytical)	To be connected to the Solvent Rack port on a P680A ISO or P680A HPG-2 pump.
5030.9220	SOR-100A-4 Solvent Rack with 4-channel degasser (analytical)	To be connected to the Solvent Rack port on a P680A HPG-4 pump.
5030.9230	SOR-100A-6 Solvent Rack with 6-channel degasser (analytical)	To be connected to the Solvent Rack port on a P680A DGP-6 pump.
5030.0600	Manual injection valve kit (analytical), including: Rheodyne valve with 20 µl loop Valve installation kit	
5030.0610	Manual injection valve kit (semi-preparative), including: Rheodyne valve with 2 ml loop Valve installation kit	
5707.0000	Solvent-Saver Valve (1-channel)	Requires Chromeleon.
5707.0010	Solvent-Saver Valve (2-channel)	Requires Chromeleon.
5804.0002	MSV-6 Motor Switching Valve	Automates two-column switching or post-column reagent addition.
5804.0004	MSV-2x3 Motor Switching Valve	Automates selection of multiple systems/detectors, fraction collection for micro-preparative work.
6030.0010	MicroFlow Kit for P680A LPG-4 pumps	Reduces the delay volume.
6030.0020	MicroFlow Kit for P680A HPG-2 and HPG-4 pumps	Reduces the delay volume.
6030.0030	Extended Mixing Chamber Kit, 600 µl	Reduces the ripple.
6030.0040	Extended Mixing Chamber Kit, 1250 µl	Reduces the ripple.
8911.0004	USB extension cable with signal amplifier, 5m	
2140.0001	Capillary cutting tool	

### 10.3 Spare Parts

Part No.*	Description
1384.0308	Solenoid stirrer for mixing chamber
2090.6082	Bushing with draining device (pack. unit: 5 bushings), for all P680A pumps
2090.8083	Bushing with draining device (pack. unit: 5 bushings), for P680P pumps
2182.5051	Klüber Isoflex grease (pack. unit: 1 kg)
2266.0082	Ring seal (pack. unit: 10 seals)
2266.1814	Standard mixing chamber ring seal
2267.0032	Piston unit, for all P680A pumps
2267.0802A	Piston unit, for P680P pumps
2268.0031	Filter frits (SS 10µm) for the outlet block of P680A DGP-6 pumps
2270.0012	1-liter solvent bottle with screw cap
2270.0021	2-liter solvent bottle with screw cap
4010.3015	Extractor for pump head bushing
5001.0105	Piston retaining screw for all P680A pumps
5004.8104	Ppiston retaining screw for P680P pumps
5005.3100	Outlet valve for working pump head (P680P pumps)
5005.3200	Inlet valve for P680P working pump head (P680P pumps)
5020.0380	4-port proportioning valve
5020.2100	Inlet valve incl. valve cartridge for working pump head for all P680A pumps
5020.2200	Outlet valve incl. valve cartridge vor P680A working pump head
5020.2300	Valve cartridge for working pump head for all P680A pumps (for both the inlet and outlet valve)
5020.9110	Capillary (1/16", 0.25 mm), 1m
5025.2001	Working pump head without pressure sensor (P680A ISO, P680A LPG-4, P680A DGP-6)
5025.2005	Equilibration pump head without pressure sensor (P680A HPG-2, P680A HPG-4)
5025.2205B	Equilibration pump head without pressure sensor (P680P HPG-2)
5025.2010	Rear-seal wash system for all P680A pumps including: 1 piston seal (analytical) 1 pump head bushing 1 DR retaining screw
5025.2210A	Rear-seal wash system for P680P pumps, including: 1 piston seal 1 pump head bushing 1 DR retaining screw
5025.2611	Solvent Selector (left pump block)
5025.2612	Solvent Selector (right pump block)
5030.0605	Rheodyne manual injection valve, analytical, including 20-µl sample loop
5030.0615	Rheodyne manual injection valve, semi-preparative
5030.2514	Tube between the proportioning valve and the pump head (P680A LPG-4)
5030.2540	Degasser A/B - proportioning valve connection tube (P680A LPG-4) <b>Note:</b> The part no. does not include the degasser fitting. If necessary, please order the fitting separately (part no. 715.2801.1252)
5030.2541	Degasser C/D - proportioning valve connection tube (P680A LPG-4) <b>Note:</b> The part no. does not include the degasser fitting. If necessary, please order the fitting separately (part no. 715.2801.1252)
5030.2543	Solvent Selector - pump head connection tube (P680A HPG-4)
5030.2547	Set of connection tubes (P680A DGP-6: proportioning valve - degasser)

Part No.*	Description
5030.3013	Capillary between equilibration pump head and mixing chamber (P680A LPG-4)
5030.3014	Capillary between equilibration pump head and purge block (P680A ISO)
5030.3015	Capillary between working pump head and equilibration pump head (all P680A pumps)
5030.3016	Capillary between mixing chamber and purge block (P680A ISO LPG-4, P680A HPG-2, P680A HPG-4)
5030.3017	Capillary between the right equilibration pump head and the purge block (tee) (P680A HPG-2, P680A HPG-4)
5030.3018	Capillary between the left equilibration pump head and the purge block (tee) (P680A HPG-2, P680A HPG-4)
5030.3019	Capillary between the purge block (tee) and the mixing chamber (P680A HPG-2, P680A HPG-4)
5030.3020	Capillary between the purge block and the manual sample injector for analytical manual injection valve (part no. 5030.0600)
5030.3021	Capillary between equilibration pump head and mixing chamber (P680A DGP-6, right pump)
5030.3022	Capillary between equilibration pump head and mixing chamber (P680A DGP-6, left pump)
5030.3025	Capillary between the working pump head and the equilibration pump head (P680P HPG-2)
5030.3026	Capillary between the mixing chamber and the purge block (P680P HPG-2)
5030.3027	Capillary between the equilibration pump head with pressure sensor and the purge block (P680P HPG-2)
5030.3028	Capillary between the equilibration pump head without pressure sensor and the purge block (P680P HPG-2)
5030.3029	Capillary between the purge block (tee) and the mixing chamber (P680P HPG-2)
5030.3030	Capillary between the purge block and the manual sample injector for semi-preparative manual injection valve (part no. 5030.0610)
5030.3041	Capillary between mixing chamber and outlet block (P680A DGP-6, right pump)
5030.3042	Capillary between mixing chamber and outlet block (P680A DGP-6, left pump)
5030.4110	Peristaltic pump
5030.4130	Detector of the rear-seal wash system
6000.0010	Syringe and tubing kit, including: 5 Plastic syringe (12 ml) 3m silicone tubing (OD 2.80 x ID 1.30)
6025.2010A	Support ring/piston seal spare part kit for all P680A pumps (Reversed Phase), including: 1 support ring and 2 piston seals
6025.2011A	Support ring/piston seal spare part kit for all P680A pumps (Normal Phase), including: 1 support ring and 2 piston seals
6030.2546	Set PEEK connection line (P680A ISO, P680A HPG-2, P680A HPG-4, P680A DGP-6), including: 1 PEEK connection line 4 white labels (A, B, C, and D)
6030.9002	P680 Fuses Kit EU, including: 5 0.20A fuses (idle, 50 x 20 mm) 5 4A fuses (idle, 6.3 x 32 mm) 5 2A fuses (TT, 5 x 20 mm) 10 1A fuses (TT, 5 x 20 mm)
6030.9003	P680 Fuses Kit US, including: 5 0.20A fuses (idle, 50 x 20 mm) 5 4A fuses (idle, 6.3 x 32 mm) 15 2A fuses (TT, 5 x 20 mm)

Part No.*	Description
6030.9010	Support ring/piston seal spare part kit for P680P pumps (Reversed Phase), including: 1 support ring 2 piston seals
6030.9011	Support ring/piston seal spare part kit for P680P pumps (Normal Phase), including: 1 support ring 2 piston seals
6030.9101	Cap/Retaining guide set for SOR-100 Solvent Rack with degasser, including 10 caps (to tap the holes in the bottle's screw cap) 5 tubing retaining guides
6030.9501	Liquid reservoir for seal washing (pack unit: 2 pcs.)
6030.9502	Tubing kit for rear-seal wash system (all P680 pumps), including 1 tube connector 1m silicone tubing
715.2801.1252	Degasser fittings for P680A LPG-4 pumps <b>Note:</b> The degasser fitting is not shipped with the degasser connection tubes (part nos. 5030.2540 and 5030.2541). Please order the fitting separately if necessary.

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

**i** **Please note:** The **SOP (Standard Operating Procedure) to Perform Maintenance of HPLC System** provides information about the wear and/or wetted parts you might want to keep in stock for maintenance purposes. The document (PDF file) is available from Dionex on request.

# 11 Reference Information

## 11.1 Chemical Resistance of PEEK

For information about the chemical resistance of PEEK, refer to the table below:

Medium	Concentration [%]	Temperature	Duration	Resistance	Notes
Acetaldehyde	techn. pure	23		+	
Acetone	100	23	7 days	+	
Ammonia	28	23	7 days	+	
Ammonium sulphate		23		+	
Amyl acetate	100	23		+	
Amyl alcohol	techn. pure	23		+	
Benzaldehyde		23	7 days	+	
Benzene	100	23	7 days	+	
Benzene/Benzene mixture		60	42 days	+	
Benzoic acid		23		+	
Borax		60		+	
Bromine		23		-	
Butane		23		+	
Butanol	100	23		+	
Calcium hydroxide		23		+	
Carbon dioxide	100	23		+	
Carbon tetrachloride	100	23		+	
Chloric gas		23		+	
Chlorine (liquid)		23		-	
Chlorobenzene	100	23		+	
Chloroform	100	23		+	
Chromic acid	40	23		+	
Citric acid		23		+	
Copper(II) sulphate		23		+	
Cyclohexane	100	23		+	
Cyclohexanol	100	23		+	
Cyclohexanone		23		+	
Diethyl ether	100	23	7 days	+	
Diisopropyl ether	100	23		+	
Dimethylformamide	100	23	7 days	+	
Dioctylphthalate		23		+	
Dioxan		23		+	
Ethanoic acid	96	23	7 days	+	
Ethanol	96 (Vol.)	23	7 days	+	
Ethyl acetate	100	23		+	
Ethylene glycol		23		+	
Ferric chloride		23		+	
Formaldehyde	30	23		+	
Formic acid	95	104	42 days	+	

Medium	Concentration [%]	Temperature	Duration	Resistance	Notes
Glycerin		23		+	
Heptane	100	23	7 days	+	
Hydrochloric acid	37	23		+	
Hydrofluoric acid		23		-	
Hydrogen peroxide	30	23	7 days	+	
Hydrogen sulphide		23		+	
Kerosene (Paraffin)		23		+	
Lactic acid		23		+	
Magnesium chloride		23		+	
Methanol	100	23		+	
Methyl ethyl ketone	100	23		+	
Methylisobutylcetone	100	23		+	
Nitric acid	40	23	7 days	+	
Nitric acid	65	23	7 days	+	
Nitrobenzene	100	23		+	
Paraffin oil		60		+	
Perchloroethylene	100	23		+	
Phenol	diluted	23		+	
Phenol	conc.	23		-	
Potassium dichromate		23		+	
Potassium hydroxide		23		+	
Potassium nitrate		23		+	
Potassium permanganate		23		+	
Propane		23		+	
Propyl alcohol		100		+	
Pure benzene		60		+	
Silicone oil		160		+	
Sodium chloride		23		+	
Sodium hydrogen carbonate		23		+	
Sodium hydroxide	40	23	7 days	+	
Sodium hydroxide	30	130		+	
Sodium thiosulphate		23		+	
Sulphur dioxide		23		+	
Sulphuric acid	40	130		+	
Sulphuric acid	50	23	7 days	+	
Sulphuric acid	98	23		-	dissolved
Toluol	100	23	7 days	+	
Trichloroethylene	100	23	7 days	+	
Water		23		+	
Xylene	100	23		+	
Zinc chloride		23		+	



## 11.2 Solvent Miscibility

Miscibility describes the ability of liquids to form homogeneous mixtures in all proportions (one-phase system). Solvent miscibility is important during elution and when changing from one solvent to another. Thus, when preparing solvents consider the miscibility and homogeneous mixing of the single components.

**i Please note:** Note that certain compositions of some solvent systems may result in miscibility gaps.

For information about solvent miscibility, refer to the table below (source: *Handbuch der HPLC*, GIT Verlag, 1995). The table provides a general idea of solvent miscibility. Under certain conditions, non-miscible liquids may mix or miscible liquids may separate.

Name	Acetone	Acetic Acid	Acetonitrile	Benzene	Butanol	t-Butylmethylether	Cyclohexane	Cyclopentane	Dichloroethane	Dichloromethane	Di-Ethylether	Dimethylformamide	Dimethylsulfoxide	Dioxan	Di-Propylether	Ethanol	Ethylacetate	Heptane	Hexane	Methanol	Methylethylketone	Octane	Pentane	Propylalcohol	Tetrachloromethane	Tetrahydrofurane	Toluene	1.1.1. Trichloroethane	Trichloromethane	Water	Xylene
Acetone																															
Acetic Acid																															
Acetonitrile																															
Benzene																															
Butanol																															
t-Butylmethylether																															
Cyclohexane																															
Cyclopentane																															
Dichloroethane																															
Dichloromethane																															
Di-Ethylether																															
Dimethylformamide																															
Dimethylsulfoxide																															
Dioxan																															
Di-Propylether																															
Ethanol																															
Ethylacetate																															
Heptane																															
Hexane																															
Methanol																															
Methylethylketone																															
Octane																															
Pentane																															
Propylalcohol																															
Tetrachloromethane																															
Tetrahydrofurane																															
Toluene																															
1.1.1. Trichloroethane																															
Trichloromethane																															
Water																															
Xylene																															

## 11.3 Properties of Common Solvents

The table below summarizes the properties of the most important solvents in HPLC [1, 2]:

	Acetonitrile	Dichloromethane	Hexane	Isopropanol	Methanol	Tetrahydrofurane	Water
UV Transmission							
20% (0.7 AU)	190	235	200	210	210	255	--
80% (0.1 AU)	195	245	225	230	235	370	--
98% (0.01 AU)	220	260	260	260	260	310	< 190
Refraction Index (RI) at 20°C	1.344	1.424	1.376	1.378	1.329	1.406	1.333
Boiling Point (BP) in °C at 1013 hPa	82	40	69	82	65	66	100
Vapor Pressure (VP) at 25°C	118	582	202	60	169	216	32
Viscosity (η) at 20°C (cP = mPa*s)	0.37	0.44	0.33	2.3	0.60	0.55	1.00
Density (ρ) (g/ml)	0.78	1.32	0.66	0.78	0.79	0.88	0.997
η/ρ (cP*ml/g)	0.47	0.33	0.50	2.9	0.76	0.62	1.00
Compressibility (χ) at 20°C (Mbar <sup>-1</sup> )	99	97	160	100	123	93	46
Critical Flow F <sub>c</sub> (ml/min) <sup>1)</sup>	13	9.4	14	83	21	18	28
Linear Drop in Pressure Δp/l (MPa/m) <sup>2)</sup>	0.06	0.08	0.06	0.40	0.10	0.10	0.17
Polarity (P') <sup>3)</sup>	5.8	3.1	0.1	3.9	5.1	4.0	10.2

<sup>1)</sup> F<sub>c</sub> = critical flow for 0.25 mm ID tubing

$$F_c \text{ (ml/min)} = 113 \times 0.25 \text{ mm} \times \eta \text{ (cP)} / \rho \text{ (g/ml)}$$

F<sub>c</sub> is an example of a hydrodynamic calculation.

<sup>2)</sup> Δp/l = linear drop in pressure for 1 ml/min and 0.25 mm ID tubing

$$\Delta p/l \text{ (MPa/m)} = 6.8 \times 10^{-6} \times 1 \text{ ml/min} \times 100 \text{ cm} \times \eta \text{ (cP)} / (0.25 \text{ mm})^4$$

Δp/l is an example of a hydrodynamic calculation.

<sup>3)</sup> P' is the polarity calculated by L.R. Snyder [3] from experimental measurements by L. Rohrschneider [4].

### References:

- [1] K.K. Unger, E. Weber (Hrsg.), *Handbuch der HPLC*, GIT Verlag, 1995
- [2] D.R. Lide, *Handbook of Chemistry and Physics*, 79<sup>th</sup> Edition, CRC Press, 1998-1999
- [3] L.R. Snyder, *Journal of Chromatographic Sciences*, 16, 223, 1978
- [4] L. Rohrschneider, *Analytical Chemistry*, 45, 1241, 1973

## 11.4 Safety Information about Flammable Solvents

The following table provides an overview of safety information for flammable solvents in HPLC:

	Acetonitrile	Diethylether	Ethanol	Ethylacetate	Heptane	Hexane	Isopropanol	Methanol	Tetrahydrofurane
Boiling point (°C)	82	35	78	77	98	69	82	65	66
Vapor pressure (hPa)	118	735	93	121	55	202	60	169	216
Flash point (°C)	6	-45	12	-4	-4	-22	12	11	-14
Auto-ignition temperature (°C)	520	190	490	490	230	260	540	510	320
Explosion Limits (%)	3-16	2-36	3-19	2-36	1-7	1-8	2-12	7-36	2-12

The table is based on the following definitions and references:

### Definitions

- The flash point is the lowest temperature at an atmospheric pressure of 1013 mbar at which a liquid gives off enough vapors to ignite with an external ignition source when mixing with the air above the liquid. [1]
- Substances whose flash point is below 38°C are classified as flammable. [2]
- The auto-ignition temperature is the lowest temperature at which substances can self-ignite at atmospheric pressure without an external ignition source, that is, without external ignition by sparks or flames. The thermal energy required to reach the auto-ignition temperature is created by a spontaneous chemical reaction or physical processes in or on the surface of the combustible substances. The determination of the auto-ignition temperature is imprecise and depends on the equipment and apparatus in use. Nevertheless, it indicates the maximum permissible surface temperature of equipment and apparatus when they are exposed to an air-vapor mixture of these substances. [1, 2]
- The explosion limit are the upper and lower concentration limits of a mixture of a flammable gas or vapor with air in which this mixture can explode when being heated or by means of sparks. [1]

**i** **Please note:** Volatile solvents are not necessarily flammable as well. For example, chloroform is volatile but non-flammable.

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## 12 Technical Appendix - Pinouts

Pin	Signal Name	Signal Level	Remarks
1			Marked wire/reserved
2			Reserved
3	RELAY 3 OUT	Potential free	Closing contact
4	RELAY 1 OUT	Potential free	Opening contact
5	RELAY 2 OUT	Potential free	Opening contact
6	RELAY 3 OUT	Potential free	Opening contact/Operable Out
7	RELAY 1 OUT	Potential free	Middle contact
8	RELAY 2 OUT	Potential free	Middle contact
9	GND	Ground	Reference potential
10	HOLD IN	Ground	Reference potential
11	STOP IN	Ground	Reference potential
12	START IN	Ground	Reference potential
13			Reserved
14	RELAY 4 OUT	Potential free	Closing contact
15	RELAY 4 OUT	Potential free	Middle contact
16	RELAY 4 OUT	Potential free	Opening contact
17			Reserved
18	RELAY 3 OUT	Potential free	Middle contact/Operable Out
19	RELAY 1 OUT	Potential free	Closing contact
20	RELAY 2 OUT	Potential free	Closing contact
21	Vcc_Save	+5V/500mA	
22	HOLD IN	TTL	Digital input 1
23	STOP IN	TTL	Digital input 2
24	START IN	TTL	Digital input 3
25			Reserved

Fig. 69: 25-pin D-Sub I/O port (female)

Pin	Signal Name	Signal Level	Remarks
1			Reserved
2	RXD	RS-232	Data receive path
3	TXD	RS-232	Data transmit path
4			
5	GND	Ground	Reference potential
6			Reserved
7			
8			
9			Reserved

Fig. 70: 9-pin D-Sub RS-232 port (male)

Pin	Signal Name	Signal Level	Remarks
1	VCC_LS		Switchable supply voltage of the position opto sensors and the LED driver IC.
2	/MSVext_LOAD_IN or Solvent Rack Error		Collector: position opto sensor "Load" or TTL_high with Solvent Rack errors
3			Jumper to pin 9
4	/MSVext_INJECT_IN or Solvent Rack Leak		Collector: position opto sensor "Inject" or TTL high with Solvent Rack leaks
5	MSVext_MOT+		Driver voltage: external MSV motor (activated for switching for a short time only)
6	VCC_MOT bzw. V_Degas		Intermediate circuit voltage of the pump motors or supply for the Solvent Rack
7	GND_MOT		Reference potential for VCC_MOT (The voltage is measurable only if the switching transistor for the motor voltage has been activated via the firmware.)
8	VCC	+5V	Voltage for logic devices
9			Jumper to pin 3
10	GND		Reference potential for VCC
11	GND		Reference potential for VCC
12	GND		Reference potential for VCC
13	MSVext_MOT-		Driver voltage: external MSV motor (activated for switching for a short time only)
14	VCC_MOT bzw. V_Degas		Intermediate circuit voltage of the pump motors or supply for the Solvent Rack
15	GND_MOT		Reference potential for VCC_MOT (The voltage is measurable only if the switching transistor for the motor voltage has been activated via the firmware.)

*Fig. 71: 15-pol. D-Sub external MSV or Solvent Rack port (female)*

## 13 Index

%A, B, C, D .....	92	Solvent Supply .....	23
%A, B, C, D Level .....	92	Connections (Rear Panel) .....	18
%A, B, C, D RemainTime .....	92	I/O Port.....	19
%A, B, C, D WarningLimit .....	93	LAN .....	19
%B, C, D.....	56	MSV .....	21
<b>A</b>			
Accessories .....	133	Pressure Output.....	21
Optional.....	139	RS-232 .....	22
Standard .....	133	Solvent Rack .....	21
Active Rear-Seal Washing.....	31, 61	USB.....	19
Anschlüsse (Geräterückseite).....	18	Control Elements .....	7
Automated Control.....	71	<b>D</b>	
<b>C</b>			
Cal. Press .....	62, 63	Date.....	62
Cam Revolutions.....	91	DC Output.....	22
Cam Zero L.....	63	Degasser.....	61, 91
Cam Zero R.....	63	Maintenance.....	120
Check Valve Replacement.....	108	Online Degasser (Connection).....	40
Chromeleon		Diagnostics	
Error Messages.....	102	Menu .....	58
Installation Program.....	79	Parameter .....	58
Operation.....	89	Diagnostics Menu .....	58
Required Modules .....	71	Diagnostics Parameter .....	58
Server Configuration Program.....	79	Firmware .....	59
Chromeleon Dialog Boxes		Rev. Left .....	59
Error Levels.....	87	Rev. Right .....	59
General.....	80	Serialno. ....	59
Inputs.....	86	Workload L.....	58
Left Pump.....	83	WorkLoad R.....	58
Left Solvents .....	85	Digital I/O Port .....	19
Pump .....	83	Disconnect .....	93
Relays.....	86	Display.....	7
Right Pump.....	83	Double Flow Mode.....	69
Right Solvents .....	85	Dual Low-Pressure Gradient System (Dual LPG)	
Solvents.....	85	Connecting Diagram .....	43
Cleaning (Piston) .....	114	Interior View .....	42
Configuration		<b>E</b>	
for Network Operation .....	77	Electrical Connection.....	15
Menu .....	59	Fuses .....	17
Separate Network Interface Card .....	73	Voltage Selector.....	15
Configuration Menu.....	59	Error Levels (Dialog Box).....	87
Connect .....	93	Error Messages .....	95, 102
Connected .....	93	Extended Mixing Chamber .....	117
Connecting Diagram		<b>F</b>	
Dual LPG .....	43	Firmware.....	59, 90
HPG.....	47	Firmware Download .....	81
Isocratic Pump.....	38	Flow .....	8, 9, 56, 92
LPG .....	40	Flow Acc.....	62
Connections (Electrical).....	15	Flow Calibration .....	63
Connections (Fluid) .....	23	Flow Rate.....	8
High-Pressure Gradient System .....	47	Fluid Connections.....	23
High-Pressure Section.....	29	High-Pressure Gradient System .....	47
Low-Pressure Section.....	28	High-Pressure Section.....	29
Purge/Outlet Block.....	36	Low-Pressure Section .....	28
Purging.....	34	Purge/Outlet Block.....	36

Purging the Pump .....	34
Rear-Seal Washing .....	31
Solvent Supply .....	23
Function Keys .....	7, 8
Fuse Replacement .....	17

## G

General (Dialog Box).....	80
Geräterückseite (Anschlüsse).....	18
Gradient Combinations .....	69

## H

Hardware Menu .....	62
HeadType .....	91
High-Pressure Gradient.....	69
Double Flow Mode .....	69
Gradient Combinations .....	69
Semi-Prep Pump.....	70
High-Pressure Gradient System (Interior View).....	45
High-Pressure Section (Connections) .....	29
Hold .....	61
Holding (Program).....	63
HPG (Interior View).....	45

## I

I/O Port .....	19, 149
Inject Synchronization .....	88
Inputs (Dialog Box) .....	86
Installation	
Anschlüsse (Geräterückseite).....	18
Connections (Fluid).....	23
Connections (Rear Panel).....	18
Electrical Connection .....	15
Fuse Replacement .....	17
LAN .....	72
Location .....	13
Network Interface Card (NIC) .....	73
Sample Injector .....	49
USB.....	71
Intended Use .....	2
IP Properties .....	77
Isocratic Pump	
Connecting Diagram .....	38
Interior View .....	37

## K

Front Panel Keys.....	8
-----------------------	---

## L

L. Flow Adj.....	63
LAN .....	19, 72
Language.....	61
Leak .....	91
Leak Rate .....	121
Leak Sensor.....	106
Leakage Test .....	121

LEDs .....	9
Flow .....	9
Min./Max. ....	9
On/Off.....	9
Pressure .....	9
Remote .....	9
Left Pump (Dialog Box) .....	83
Left Solvents (Dialog Box).....	85
Limits.....	8
Low-Pressure Gradient System	
Connecting Diagram .....	40
Interior View .....	39
Low-Pressure Section (Connections).....	28
LPG	
Connecting Diagram .....	40
Interior View .....	39
LPG Sync Out.....	61

## M

Main Menu.....	53
Maintenance	
Check Valve Replacement .....	108
Degasser.....	120
General Notes.....	105
Inspecting Piston Seals for Leakage .....	111
Leak Sensor.....	106
Maintenance Intervals .....	106
Mixing Chamber .....	117
Pistons/Piston Seals.....	109
Shut Down .....	122
Maintenance Intervals.....	106
Max.....	56
MaximumFlowRamp .....	91
Menu	
Configuration Menu.....	59
Diagnostics Menu .....	58
Hardware Menu .....	62
Main Menu.....	53
Options Menu.....	60
Programs Menu.....	55
State Menu .....	53
Structure.....	52
TCP/IP.....	59
MicroFlow Kits.....	127
Min.....	56
Min./Max. ....	9
Mixing Chamber .....	117
Mixing Chamber Extensions.....	123
Model.....	90
ModelNo.....	90
Module Address.....	80
MSV.....	56
MSV Port.....	150
MWV .....	21

## N

Network Interface Card (NIC).....	73
Network Operation (Recommendations) .....	78
Number Input.....	9



**O**

On/Off	9
Online Degasser	40
Op. Out	61
Operable Out	61
Operating Instructions	1
Operation	
after Power-Failure	70
Chromeleon	89
Control Elements	7
Display	7
Power-Up	51
Safety Measures	11
Solvent Selection	10, 143
Standalone	51
Operation Principle	6
Optimizing	
MicroFlow Kits	127
Mixing Chamber Extensions	123
Special Applications	123
Options	61, 62
Cal. Press	62, 63
Cam Zero L	63
Cam Zero R	63
Date	62
Degasser	61
Flow Acc	62
L. Flow Adj	63
Language	61
LPG Sync Out	61
Op. Out	61
Press. Unit	61
Pump Head	62
Pump Type	62
Purge Flow	61
Purge Time	61
R. Flow Adj	63
Rearseal Leak	61
Rear-Seal Wash	61
Start/Stop/Hold	61
Time	62
Timezone	62
Valve Delay	63
X	63
Options Menu	60
Outlet Block	36

**P**

P680_Input	89
P680_Motor Valve	90
P680_Operable Out	90
P680_Relay	89
P680_Relay2	90
Partial Flow	8, 56, 92
Peer-to-Peer Connection	72
Pinouts	149
I/O port	149
MSV Port	150

RS-232	149
Solvent Rack Port	150
Piston (Install/Remove)	115
Piston Cleaning	114
Piston Seal	109
Inspecting for Leakage	111
Install	115
Remove	114
Replace	112
Washing	31
Pistons	109
Power-Failure	70
Power-Up	51
Pre-compression	50
Press Unit	61
Pressure	9, 92
Pressure Limits	8, 9
Pressure Output	21
Pressure Sensor	117
Pressure Unit	61
Principle of Operation	6
Problems	101
Program	
Commands	56
Create	55
Default Program	58
Edit	55
Examples	65
Holding	63
Menu	55
Save	56
Starting	63
Stopping	63
Program Commands	56
%B, C, D	56
Flow	56
Max	56
Min	56
MSV	56
Relay 1, 2, 3, 4	56
Time	56
Program Examples	65
Ramp Gradient	65
Step Gradient	66
Stop Flow	68
Programs Menu	55
Pump (Dialog Box)	83
Pump Head	62
Install	115
Remove	112
Pump Shut Down	122
Pump Type	62
Pump Types	5
Pump_Pressure	90
Pumping	92
Purge Block	36
Purge Flow	61
Purge Time	61
Purging	8, 34

**R**

R. Flow Adj.....	63
Rear Panel (Connections) .....	18
I/O Port.....	19
LAN .....	19
MSV .....	21
Pressure Output.....	21
RS-232 .....	22
Solvent Rack .....	21
USB.....	19
Rearseal Leak.....	61
Rear-Seal Leak Counter.....	91
Rear-Seal Wash.....	31, 61
Rear-Seal Wash Pump .....	91
Rear-Seal Wash System.....	91
Rear-Seal Washing.....	31, 61
RearSealLeakLimit .....	91
Relay 1, 2, 3, 4.....	56
Relays (Dialog Box) .....	86
Remote Control.....	9
Rev. Left .....	59
Rev. Right .....	59
Right Pump (Dialog Box).....	83
Right Solvents (Dialog Box).....	85
RS-232 Port.....	22, 149

**S**

Safety Precautions.....	11
Sample Injector (Installation).....	49
Scope of Supply .....	2
Seal Washing .....	31
Selection (Solvent).....	10, 143
Self Test Key.....	8
Semipreparative Pump .....	70
Serial Number .....	59
SerialNo .....	91
Set Flow .....	8
Solvent Composition.....	8, 56, 92
Solvent Rack .....	13, 21
Solvent Rack Port .....	150
Solvent Selector .....	47
Solvent Supply .....	23
Solvent Type Selection .....	50
Solvents	
Chemical Resistance (PEEK).....	143
Dialog Box .....	85
Miscibility .....	145
Properties .....	146
Safety Information .....	147
Selection.....	10

Spare Parts .....	133, 140
Special Applications .....	123
MicroFlow Kits.....	127
Mixing Chamber Extensions.....	123
Specification .....	131
Start.....	8, 61
Starting (Program) .....	63
State Menu .....	53
Stop .....	8, 61
Stopping (Program) .....	63
Sync Inject .....	88
Synchronization (Inject) .....	88
System Pressure .....	62, 63
System Wellness .....	10

**T**

TCP/IP Menu .....	59
Text Input.....	9
Tightness.....	106, 111
Time .....	56, 62
Timezone .....	62
Troubleshooting.....	95
Chromeleon Error Messages .....	102
Error Messages.....	95
Most Frequently Problems .....	101

**U**

Unit Description	
Configurations.....	5
Overview .....	5
Principle of Operation.....	6
USB.....	19, 71
User Information.....	3

**V**

Valve Delay .....	63
Variant .....	90

**W**

Waste_WarningLimit.....	93
WasteLevel .....	92
WasteRemainTime.....	92
Wellness.....	10
Workload .....	91
Workload L.....	58
Workload R.....	58

**X**

X .....	63
---------	----