ExionLC™ AD System

Hardware User Guide

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Contents

Introduction 1

This guide describes the basic operation and troubleshooting for the ExionLC™ AD system . Read this guide thoroughly before using the product and operate the product in accordance with the instructions in this manual.

This guide provides safety instructions and precautions to make sure that the user operates the system safely. Follow all Warning and Caution instructions provided in the guide.

Keep this guide for future reference. Make sure that it is accessible to the operator of the system.

Electrical Precautions

AC Mains Supply

WARNING! Electrical Shock Hazard. Use only qualified personnel for the installation of all electrical supplies and fixtures, and make sure that all installations adhere to local regulations and safety standards.

WARNING! Electrical Shock Hazard. Make sure that the system can be disconnected from the AC mains supply outlet in an emergency. Do not block the AC mains supply outlet.

WARNING! Electrical Shock Hazard. Do not remove the covers. Removing the covers might cause injury or malfunctioning of the system. The covers need not be removed for routine maintenance, inspection, or adjustment. Contact the SCIEX FSE for repairs that require the main cover to be removed.

Connect the system to a compatible AC mains supply as instructed in this guide. For information on system electrical specifications, refer to the *Site Planning Guide*.

Guidelines:

- Do not connect the wiring in a manner other than that prescribed by the manufacturer.
- Do not rest heavy objects on the power cable.
- Do not bend or pull on the power cable. To unplug the system, pull on the plug and not the cable.
- Do not route the power cable near heat-generating equipment.
- Do not modify the power cable in any way.

Protective Earth Conductor

The mains supply must include a correctly installed protective earth conductor. The protective earth conductor must be installed or checked by a qualified electrician before the system is connected.

WARNING! Electrical Shock Hazard. Do not intentionally interrupt the protective earth conductor. Any interruption of the protective earth conductor will create a potential electric shock hazard.

Environmental Precautions

Use qualified personnel for the installation of electrical mains, heating, ventilation, and plumbing supplies and fixtures. Make sure that all of installations comply with local bylaws and biohazard regulations. For more information about the required environmental conditions for the system, refer to the *Site Planning Guide*.

WARNING! Fire Hazard. Do not operate the system in the presence of an open flame, or in the same room as equipment that could potentially emit sparks.

WARNING! Fire Hazard. Do not use flammable sprays (such as hair sprays or insecticide sprays) near the system. They could ignite and cause a fire.

WARNING! Biohazard. For biohazardous material use, always comply with local regulations for hazard assessment, control, and handling. This system or any part is not intended to act as a biological containment system.

CAUTION: Potential System Damage. Avoid exposure to corrosive gas and excessive dust.

CAUTION: Potential System Damage. Take precautions to prevent the system from falling in the event of an earthquake.

Electromagnetic Environment

CAUTION: Potential Wrong Result. Do not use this device in close proximity to sources of strong electromagnetic (EMC) radiation (for example, unshielded intentional RF sources), as EMC radiation might interfere with the proper operation and cause a wrong result.

Make sure that a compatible electromagnetic environment for the equipment can be maintained so that the device will perform as intended.

Decommissioning and Disposal (Waste, Electrical, and Electronic Equipment)

Decontaminate the system before decommissioning following local regulations. Follow the SCIEX Red Tag process and complete an instrument Decontamination Form for instrument returns.

When removing the system from service, separate and recycle different materials according to national and local environmental regulations. Refer to *Storage and Handling on page 131* .

Do not dispose of system components or subassemblies, including computer parts, as unsorted municipal waste. Follow local municipal waste ordinances for proper disposal provisions to reduce the environmental impact of WEEE (waste, electrical, and electronic equipment). To safely dispose of this equipment, contact a local Customer Service office for complimentary equipment pick-up and recycling.

Note: SCIEX will not accept any system returns without a completed Decontamination Form.

Ventilation Precautions

The venting of fumes and disposal of waste must comply with all federal, state, provincial, and local health and safety regulations. Use the system indoors in a laboratory that complies with the environmental conditions recommended in the *Site Planning Guide* for the system.

WARNING! Fire and Toxic Chemical Hazard. Make sure that the laboratory in which the system operates is well ventilated. Solvents used in high performance liquid chromatography are flammable and toxic.

Chemical Precautions

WARNING! Toxic Chemical Hazard. Make sure that a water supply, such as a wash basin, is available. If solvent gets onto the eyes or skin, flush it away immediately.

WARNING! Biohazard, Toxic Chemical Hazard. Connect the drain tubing properly, to prevent leaks.

CAUTION: Potential System Damage. Do not submerge the end of the drain tubing in the waste liquid in the waste container.

- Determine which chemicals have been used in the system prior to service and regular maintenance. Refer to Safety Data Sheets for the health and safety precautions that must be followed with chemicals.
- Work in a well-ventilated area.
- Always wear assigned personal protective equipment, including powder-free neoprene or nitrile gloves, safety glasses, and a laboratory coat.
- Follow required electrical safe work practices.
- Avoid ignition sources when working with flammable materials, such as isopropanol, methanol, and other flammable solvents.
- Take care in the use and disposal of any chemicals. Potential risk of personal injury if proper procedures for handling and disposing of chemicals are not followed.
- Avoid skin contact with chemicals during cleaning, and wash hands after use.
- Comply with all local regulations for the storage, handling, and disposal of biohazardous, toxic, or radioactive materials.
- (Recommended) Use secondary containment trays beneath solvent bottles and the waste collection container to capture potential chemical spills.

Static Electricity Precautions

Liquid chromatography (LC) uses flammable organic solvents as the mobile phase. LC systems are also often used where large amount of flammable substances are present. Thus, there is a risk of accidents involving fire or explosion.

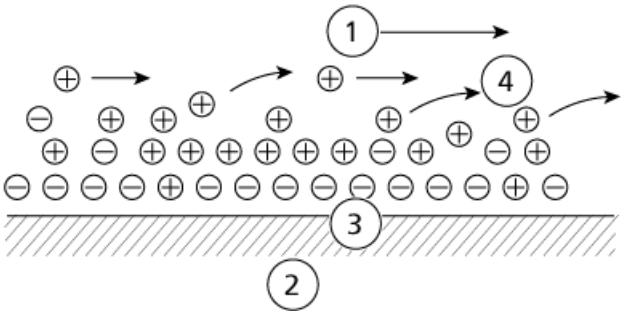
The major cause of these accidents is static electricity. Devising preventative measures for static electricity can be difficult, because the symptoms before an accident vary and can be hard to detect, because such accidents occur as a result of several simultaneous incidents. Recommended methods for preventing static electricity accidents are provided in the following sections.

Typical Cause of Static Electricity Accidents

Static electricity accidents are generally caused by this sequence of events:

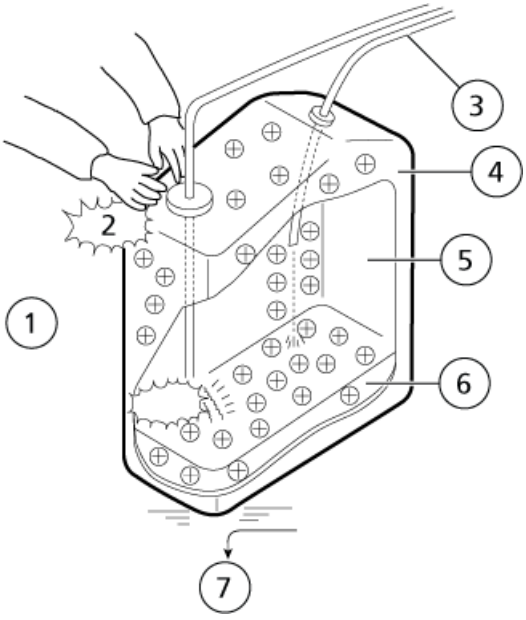
Table 1-1 Static Electricity Accidents—Sequence of Events

<table>
<tr><th>Event</th><th>Result</th></tr>
<tr><td>Generation of static activity.
↓</td><td>When liquid is passed through thin tubing at high flow rates, as in liquid chromatography, the electrostatic charges of the flowing matter generate static electricity.

Figure 1-1 Generation of Static Electricity by a Liquid Flowing Over a Solid
 

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>1</td><td>Flowing liquid</td></tr>
<tr><td>2</td><td>Solid</td></tr>
<tr><td>3</td><td>Charges move with the flow of liquid</td></tr>
<tr><td>4</td><td>Immobile charges, fixed to the surface of the solid</td></tr>
</table></td></tr>
<tr><td>Accumulation of static electricity.
↓</td><td>If electrostatically charged liquid is allowed to accumulate in an electrically insulated container, the charge will gradually increase, and can eventually reach several thousand volts.</td></tr>
</table>

Table 1-1 Static Electricity Accidents—Sequence of Events (continued)

Event	Result
Release of energy through electrical discharge. ↓	If this happens and an electrical conductor is brought within a certain distance of the container, an electrical discharge will occur, releasing thermal energy that will ignite any flammable gas of sufficient density in the vicinity.
Ignition of flammable substances.	**Figure 1-2 Potential Accident Situation** 

Item	Description
1	Dry air
2	Spark
3	Liquid flowing through thin tubing at a high rate. Air bubbles in liquid facilitate generation of static electricity.
4	Insulated container of polyethylene or a similar material
5	Flammable gas present in the container
6	Flammable organic solvent with a large electrostatic charge
7	Floor covered with rubber or a similar material cannot conduct electricity away

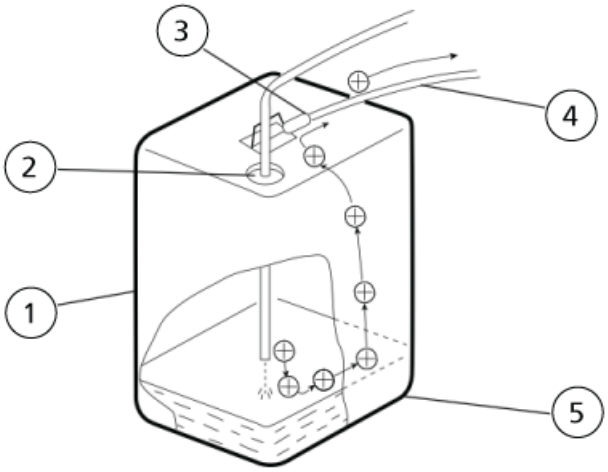
Preventing Static Electricity Accidents

The best way to prevent static electricity accidents is to prevent the occurrence and accumulation of electrostatic charges.

CAUTION: Potential System Damage. Take multiple preventative measures simultaneously. Keep the room at a proper humidity level. Ambient humidity exceeding 65% will prevent static.

Note: For low conductivity (less than 10^{-10} S/m) liquids, take preventive measures 1 to 4. For these liquids, preventive measure 5 has no effect.

Figure 1-3 Preventative Measures for Static



Item	Description
1	18 L metal can (preferably plated).
2	Reduce the opening with a cap.
3	Connect a clip to metal parts.
4	Connect to a protective earth terminal or other grounding point of the module. **CAUTION: Potential System Damage. Do not connect the grounding wire to the gas tubing, the water service tubing, or the telephone line.**
5	Static electricity generated by the liquid will be conducted through the container to the earth.

Preventive Measure One

Use a metal container for the waste liquid, and connect the container to protective earth to make sure that the electrical charges of the container and liquid pass to the earth.

Required Materials
• Grounding wire with clip • 18 L metal container • 4 L metal container

Guidelines

- **CAUTION: Potential System Damage. Do not connect the grounding wire to the gas tubing, the water service tubing, or the telephone line.**

  Connect the metal waste container to protective earth properly. If the grounding wire is not properly connected to protective earth, static electricity can build up in the container.

  Note: Some metal containers have surfaces that are laminated or oxidized, and therefore do not conduct electricity. After connecting the metal container to protective earth, use a tester to verify that electricity is conducted to the earth.

- If the liquid to be drained into the waste container is virtually nonconductive (10^{-10} S/m or less), add properly conductive liquid to the tank. This conductive liquid can be added beforehand.

Preventive Measure Two

Cover the spaces between the tubing and the sides of the inlet and outlet openings of the waste container with caps or other protective covering. This prevents any sparks generated outside the container from getting inside.

Required Materials
• Caps for 18 L or 4 L container (with three 3 mm diameter openings)

Preventive Measure Three

Keep electrostatically charged objects, including the human body, away from the waste liquid container.

CAUTION: Potential System Damage. If no other anti-static precautions have been taken, touch a metal object that is connected to protective earth before coming near the waste liquid container, in order to drain static charges.

Guidelines

- Wear anti-static clothing and shoes.
- Use anti-static wrist straps to connect the human body to protective earth. For safety, the wrist strap should be connected to the earth using an intervening resistor of about 1 MΩ.
- Spread anti-static matting on the floor, to make the floor conductive.

Preventive Measure Four

Use tubing with an inner diameter of at least 2 mm for drain lines with high flow rates.

Guidelines

- Periodically inspect the tubing connections for leaks. Air bubbles in liquid can multiply the electrostatic charge by a factor of 20, 30, or more.

Preventive Measure Five

If it is not possible to use a conductive waste liquid container, then follow these guidelines:

- Make sure that the end of the inflow tubing is always submerged inside the container. Also, put metal object that is connected to protective earth, such as a ground wire connected to the module, into the liquid.
- Use as small a container as possible to minimize damage in the event of fire.

Note: Anti-static equipment (anti-static clothing, shoes, and matting) and charge measurement equipment (potentiometer) are sold by specialty manufacturers.

Equipment Use and Modification

WARNING! Personal Injury Hazard. Contact the SCIEX representative if product installation, adjustment, or relocation is required.

WARNING! Electrical Shock Hazard. Do not remove the covers. Removing the covers might cause injury or malfunctioning of the system. The covers need not be removed for routine maintenance, inspection, or adjustment. Contact the SCIEX FSE for repairs that require the main cover to be removed.

Use the system indoors in a laboratory that complies with the environmental conditions recommended in the *Site Planning Guide*.

If the system is used in an environment or in a manner not prescribed by the manufacturer, then the protection provided by the equipment might be impaired.

Unauthorized modification or operation of the system might cause personal injury and equipment damage, and might void the warranty. Erroneous data might be generated if the system is operated either above or below the recommended environmental conditions or operated with unauthorized modifications. Contact an FSE for information on servicing the system.

WARNING! Personal Injury Hazard. Use SCIEX-recommended parts only. Use of parts not recommended by SCIEX or use of parts for any use other than their intended purpose may place the user at risk of harm or negatively impact system performance. The protection provided by the equipment might be impaired if the equipment is used in a manner not specified by SCIEX.

Maintenance, Inspections, and Adjustment

WARNING! Personal Injury Hazard. Contact the SCIEX representative if product installation, adjustment, or relocation is required.

WARNING! Electrical Shock Hazard. Always turn off the power and then unplug the instrument prior to performing inspection and maintenance. Otherwise, fire, electric shock, or a malfunction might occur.

To maintain the performance of the system and to obtain accurate measurement data, perform daily inspection and periodic calibration.

- For daily maintenance and inspection, refer to *Service and Maintenance on page 108*.
- For planned maintenance, contact a SCIEX representative.
- For replacement parts, refer to *Consumables, Options, and Spares on page 176*.
- Replacement cycles described for periodic replacement parts are estimates. Replacement might be required earlier than the described replacement cycles depending on usage environment and frequency.

Hazard Symbols 2

This section lists the hazard symbols and conventions used in the laboratory environment, on the system, and in the documentation.

Occupational Health and Safety Symbols

This section describes some occupational health and safety symbols found in the documentation and laboratory environment.

Table 2-1 General Hazard Symbol

Safety Symbol	Description
	Personal Injury Hazard

Table 2-2 Chemical Hazard Symbols

Safety Symbol	Definition
	Biohazard
	Explosion Hazard
	Toxic Chemical Hazard

Table 2-3 Electrical Hazard Warning Symbols

Safety Symbol	Definition
	Electrical Shock Hazard

Table 2-4 Mechanical Hazard Symbols

Safety Symbol	Definition
	Hot Surface Hazard
	Ultraviolet Radiation Hazard
	Laser Radiation Hazard

Documentation Symbols and Conventions

The following symbols and conventions are used throughout the guide.

DANGER! Danger signifies an action which leads to severe injury or death.

WARNING! Warning signifies an action that could cause personal injury if precautions are not followed.

CAUTION: Caution signifies an operation that could cause damage to the system or corruption or loss of data if precautions are not followed.

Note: Note emphasizes significant information in a procedure or description.

Tip! Tip provides useful information that helps apply the techniques and procedures in the text for a specific need and provides shortcuts, but is not essential to the completion of a procedure.

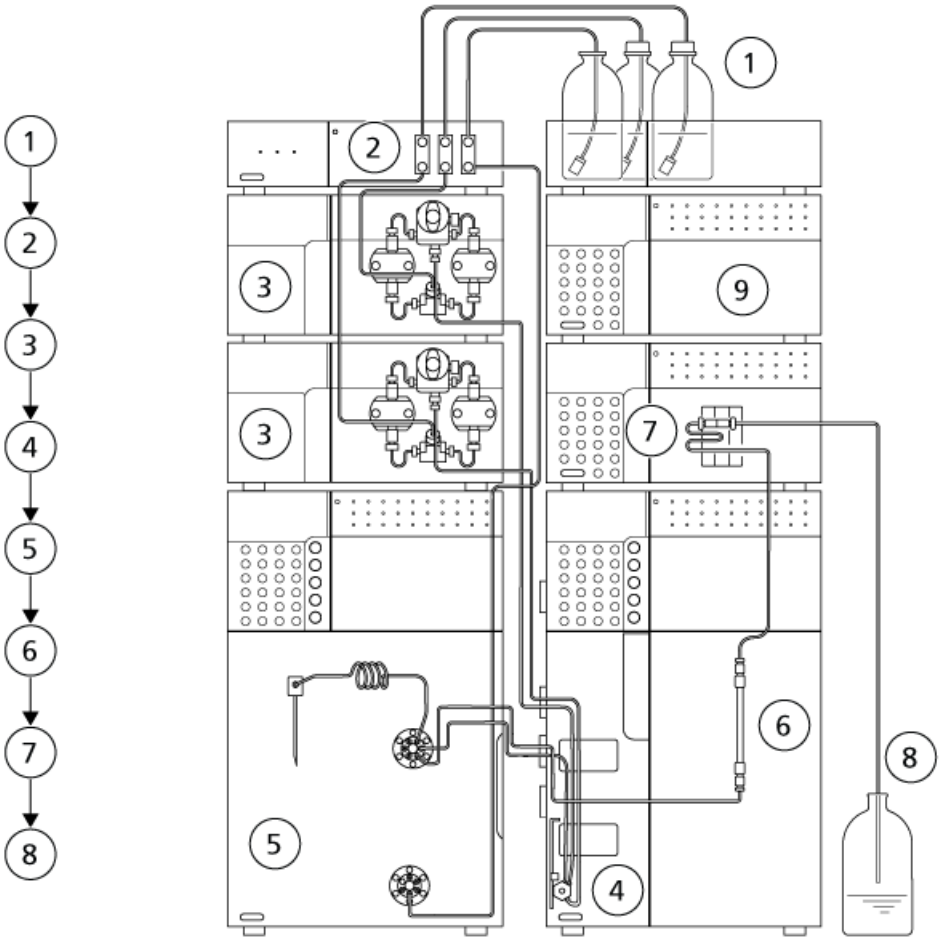
Overview 3

The ExionLC™ AD system consists of the following components:

- ExionLC™ Controller or ExionLC™ CBM-Lite (The CBM-Lite is installed in the pump module.)
- ExionLC™ AD Pump or ExionLC™ HPLC Pump
- ExionLC™ Degasser
- ExionLC™ AD Autosampler or the ExionLC™ AD Multiplate Autosampler
  For information about the Multiplate Autosampler, refer to the *ExionLC™ Multiplate Autosampler Operator Guide*
- ExionLC™ AD Column Oven
- Optional components, such as
  - ExionLC™ Rack Changer
  - ExionLC™ PDA Detector
  - ExionLC™ UV Detector

Contact a SCIEX representative for information about the components available for your system.

Figure 3-1 Example ExionLC AD System



Item	Description
1	Reservoir bottles. Mobile phase is drawn out of the reservoir bottles and then pumped through the tubing by the pump.
2	Degasser. The degasser removes dissolved air from the mobile phase, preventing air bubbles and consequent rise, drift, or other baseline irregularities caused by dissolved air.
3	Pump. The pump sends the mobile phase through the autosampler, column, and detector, in that order, and then to the waste container.
4	Mixer. The mixer enhances mixing efficiency of the mobile phases.
5	Autosampler. The autosampler automatically injects the sample into the flow lines. By adding a rack changer, it is possible to automatically change the autosampler racks.

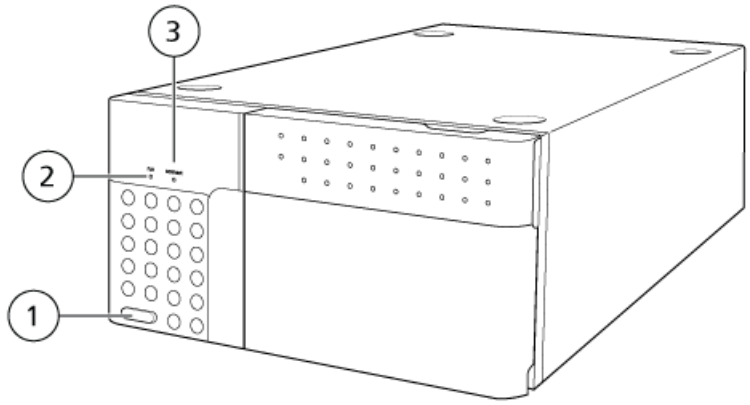
Item	Description
6	Column. The column separates the components by means of the mutual interactions of the mobile phase and the column packing (stationary phase).
7	Detector (optional). The detector detects the components eluted from the column, and then sends the signal data to the acquisition computer.
8	Waste container. Mobile phase from the detector drains into the waste container.
9	Controller. The controller can control a maximum of 8 LC components (12 LC components as an option) including a maximum of 4 pump units.

Controller

The ExionLC™ Controller/ExionLC™ CBM-Lite is a system controller that connects to and controls the components of the ExionLC™ AD series HPLC and UHPLC systems. It can be used for a number of different purposes, from centralized control to fully automated operation of liquid chromatography systems with various components.

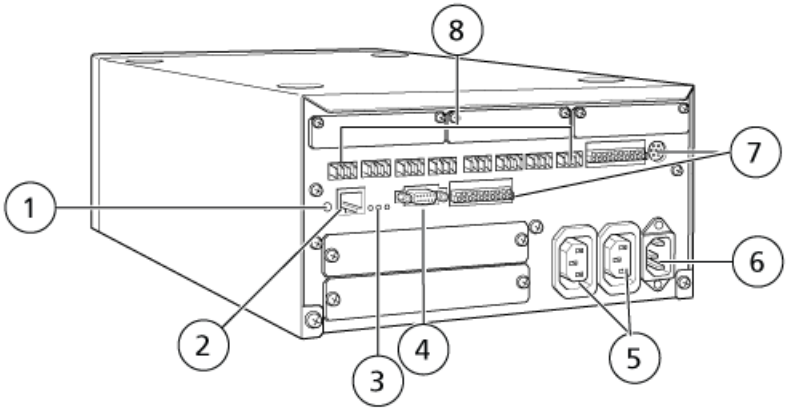
The system controller is a dual-plunger parallel-flow LC pump. It offers improved accuracy and sensitivity in high-performance liquid chromatography.

Figure 3-2 Front View



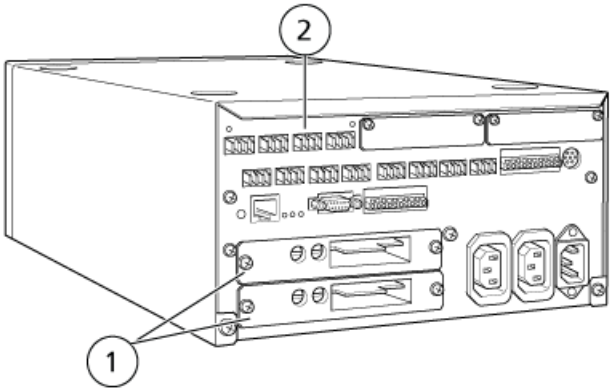
Item	Description
1	Power switch. Used to turn power on and off. Press the switch in to turn on the power. Press it again to turn off power.
2	Run LED. Turns on when analysis starts and turns off when analysis stops.
3	Connection LED. Turns on when the system controller is controlled from the computer. Flashes during system startup.

Figure 3-3 Back View



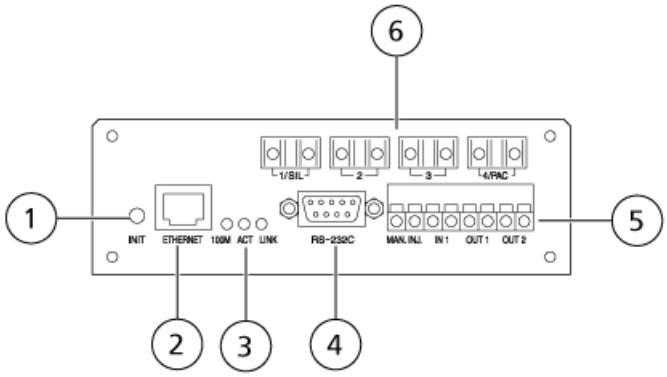
Item	Description
1	Initialization button. Press to initialize the system controller or clear errors.
2	Ethernet connector (**ETHERNET**). Connector for connecting to the network.
3	Network LEDs. Show the status of the connection to the network. • **100M**: Turns on when operating at 100 Mbps. • **ACT**: Turns on when exchanging data. • **LINK**: Turns on when linked to the network.
4	RS-232C connector. Connector for exchanging data with a computer.
5	AC output connectors. These connectors are for AC power output and are operationally linked to the power switch. They can be used to supply power to ExionLC™ HPLCs. Do not use them for any other application.
6	Power cord connector. Connector for connecting the power cable.
7	Remote connectors 1 to 8. Connectors for connecting to ExionLC™ system components.

Figure 3-4 Controller with Options



Item	Description
1	A/D board. Board for analog-digital conversion for connecting a detector that uses the analog output.
2	Optical-connector expansion board. Board for optical-connector expansion.

Figure 3-5 CBM-Lite Connections



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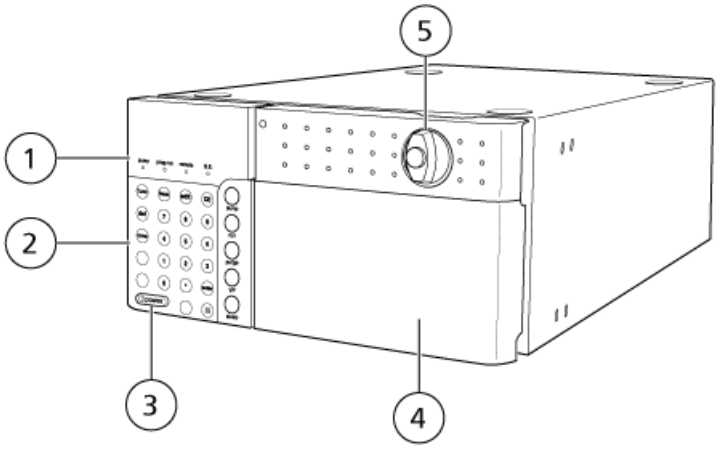
6	Remote connectors 1 to 4. Connectors for connecting to ExionLC™ system components.

Pump

The ExionLC™ AD pump is capable of delivering up to 130 MPa, to provide ultra fast analysis and ultra high-resolution separation as an extension of high precision and reliability in HPLC analysis.

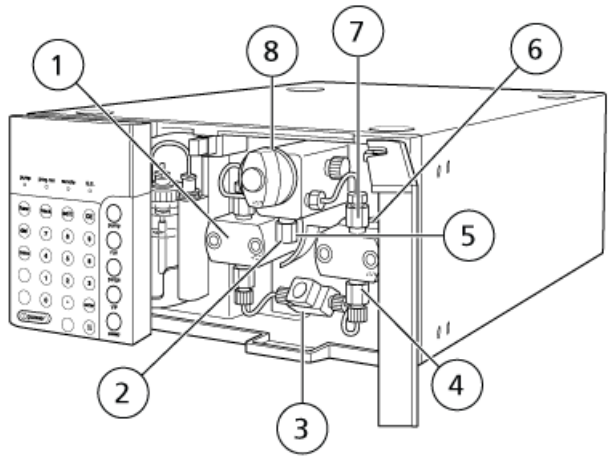
Note: Unless otherwise specified, the information in this guide also applies to the optional HPLC pump. The HPLC pump supports pressures up to 40 MPa.

Figure 3-6 Front View



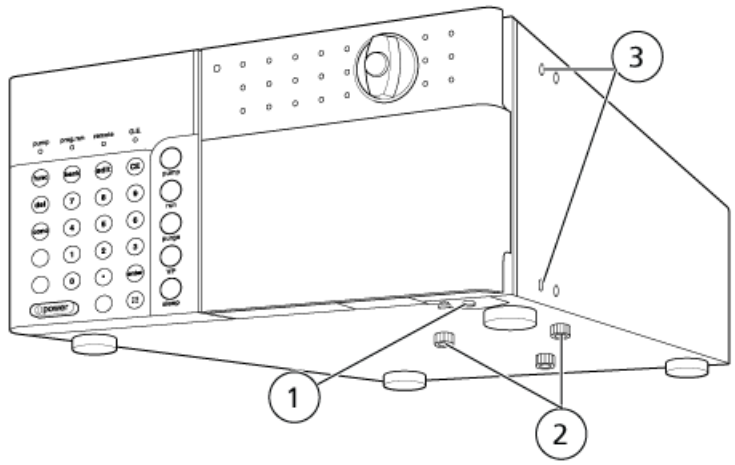
Item	Description
1	Status panel. Comprises the status panel screen and LEDs. Shows operational settings.
2	Keypad. Used to operate and configure settings. Press to show the operation keys.
3	Power switch. Used to turn power on and off. Press the switch in to turn power on. Press again to turn power off.
4	Front cover. Covers the pump heads and flow lines.
5	Drain valve knob. To open the drain valve, turn the knob counter-clockwise. To close the valve, turn the knob back as far as it will go.

Figure 3-7 Front Cover Open



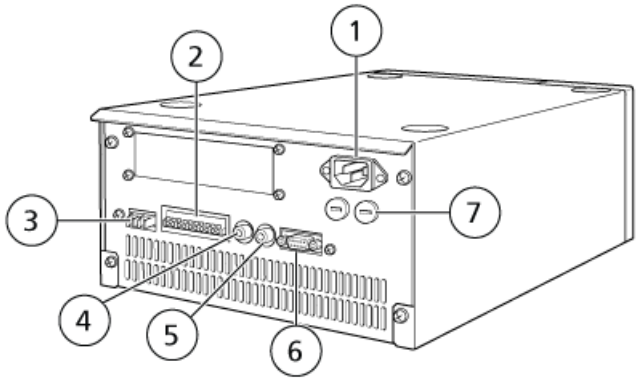
Item	Description
1	Pump head. Enclosed reciprocating plunger that delivers the solvent.
2	Pump outlet. Connects to the autosampler or manual injector inlet plumbing.
3	Pump inlet. Connects the filtered solvent line to this inlet.
4	Inlet check valve
5	Line filter. Protects the LC system from clogging due to particles from worn seals.
6	Head holder. Supports the plunger rinse flow line and the pump head.
7	Outlet check valve
8	Drain valve. Used to purge the mobile phase and bleed air from the flow line. The valve has a built-in pressure transducer.

Figure 3-8 Right Side and Base Panel



Item	Description
1	Leakage drain outlet. Used to connect the provided drain tubing.
2	Shipping screws. Prevent damage during transportation. Remove before installation.
3	Mixer mounting holes. Used to install mixer and column holder.

Figure 3-9 Back View



Item	Description
1	Power cord connector. Used to connects the power cord.
2	External input/output terminals. Connects to external equipment.
3	REMOTE connector. Connects to the system controller or an identical pump unit.
4	DGU PRESS connector. Receives the pressure signal from degassing unit.

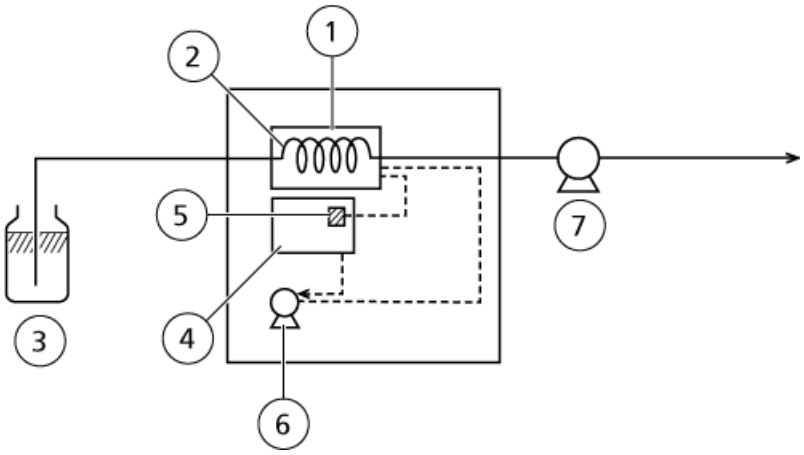
Item	Description
5	PUMP PRESS connector. Outputs voltage so that pressure can be monitored with an external device. Can be adjusted from 0-5 MPa to 0 -100 MPa in 20 steps.
6	DGU/SOL.V connector. Connects to the flow line switching valve (FCV series) or degasser.
7	Fuse holders. Hold the fuses.

Degasser

The degasser continuously removes dissolved gases from liquids using a special degassing membrane. It prevents the formation of gas bubbles caused by dissolved gases, which can cause the pump to malfunction, and can cause fluctuations in the in the detector baseline. The degasser also helps improve the stability and reproducibility of HPLC analysis.

Figure 3-10 shows the principle of how the degasser operates. The degasser includes three or five independent flow lines and provides the same degassing performance and functions for each flow line.

Figure 3-10 Degasser Flow Lines



Item	Description
1	Degassing chamber
2	Degassing membrane
3	Mobile phase
4	Control board
5	Pressure sensor

Item	Description
6	Vacuum pump
7	LC pump

Figure 3-11 Front View

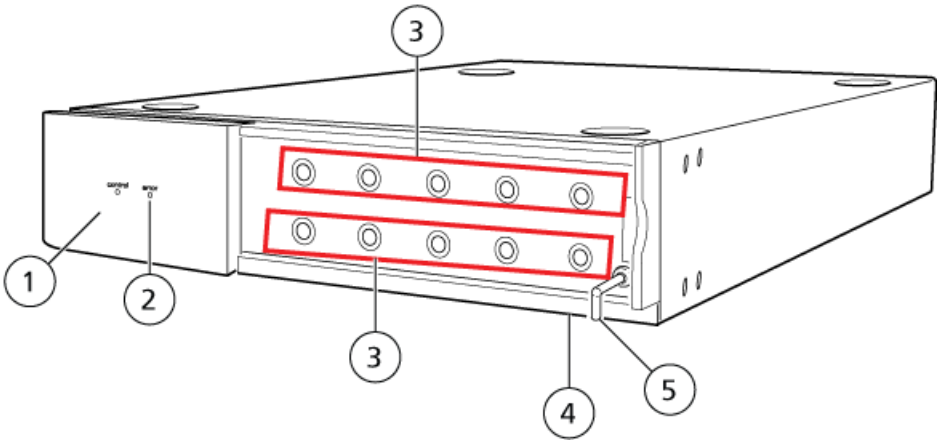
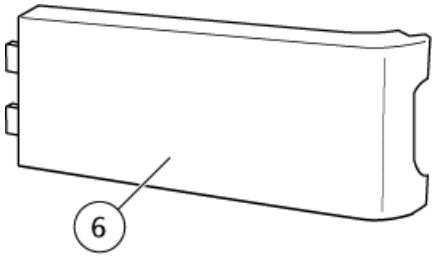


Figure 3-12 Front Panel

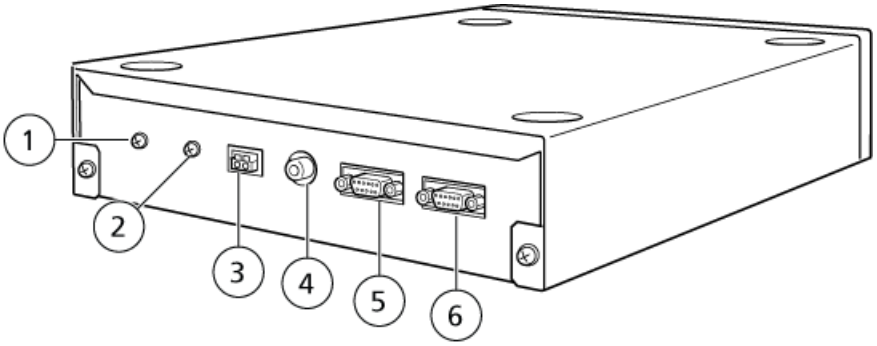


Item	Status Indicator	Function
1	Control light	The green LED illuminates when there is sufficient vacuum for degassing and degassing can be performed properly.
2	Error light	The red LED flashes when the target vacuum level is not maintained. After 6 minutes of flashing red, the LED illuminates without flashing and the vacuum pump stops.
3	Solvent IN/OUT ports	Inlet and outlet ports for the solvent. The upper and lower ports are paired into independent flow lines, so configure tubing connections by combining upper and lower ports. The ports are not specifically designated as either inlet or outlet.

Item	Status Indicator	Function
4	Leakage drain outlet	Any solvent leakage is discharged through this port and then discarded through the waste port for the LC pump, located under the degasser.
5	Exhaust port	Air from the internal flow lines is discharged from this port.
6	Front panel	Protects the tubing connectors.

Note: The degassing membrane is made of highly gas-permeable material and might allow permeation of mobile phase or moisture. If the power is turned off while moisture is present in the vacuum line, then condensation might occur due to the fluctuation of room temperature. When the power is turned on again in this condition, the pressure in the vacuum line might be temporarily unstable, and the Error lamp might illuminate. Refer to *Degasser Issues on page 164*.

Figure 3-13 Back View



Item	Label	Description
1	Ground terminal for degasser	Used to ground the degasser.
2	Ground terminal for ALARM	To reduce the external noise for ALARM signal line.
3	ALARM terminal	Sends external output signal when alarms occur.
4	DGU PRESS OUT connector	Used to output the vacuum pressure level.
5	AUX power supply connector	Supplies power to other components.
6	PUMP power supply connector	The power cable D SUB 9-pin connector is inserted.

Degassing Performance

The degasser uses the pressure reduction degassing method using membrane, which provides many advantages over the helium degassing method. However, because the gas is removed by permeating the solvent through a membrane, its degassing capacity (degassing performance) can be limited, depending on the flow rate.

When low pressure gradients are generated with the low pressure gradient valve connected, bubble formation can occur above a certain flow rate (the flow rate depends on the solvent being used).

Note:
The following flow rate ranges can be used to avoid bubble formation during generating gradients when a low pressure gradient valve is connected to the degasser. When one flow line of the degasser is connected to each solvent:

- HPLC-grade water/methanol: 1.5 mL/min

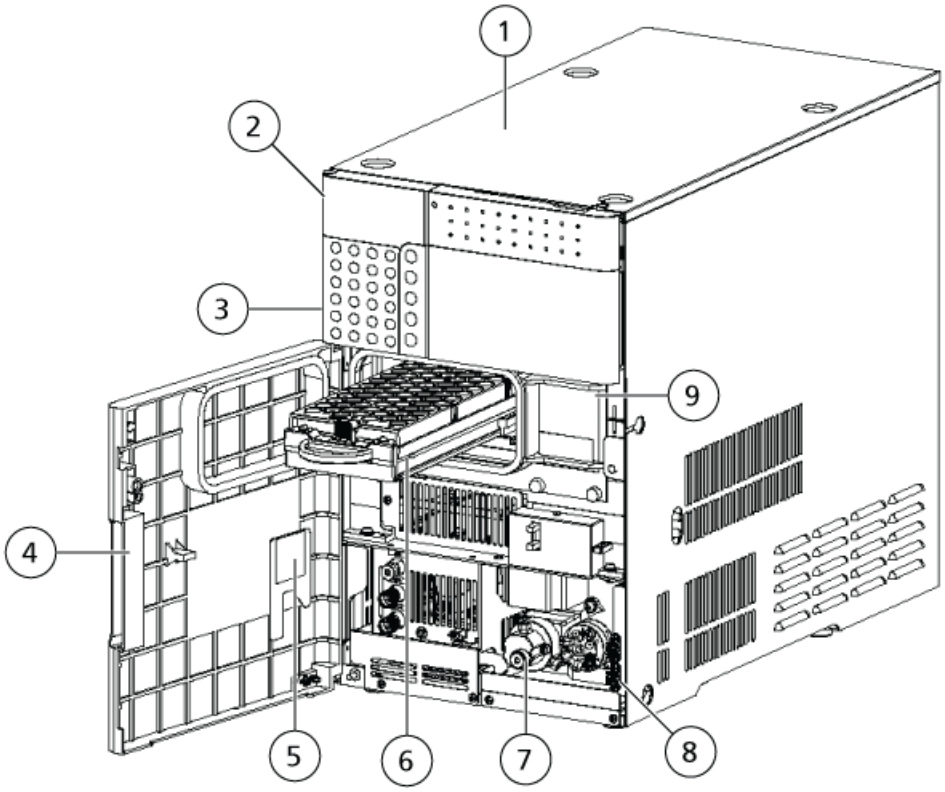
When using the degasser at a flow rate higher than 1.5 mL/min, degas the mobile phase using an ultrasonic vacuum degassing system beforehand.

Autosampler

This autosampler is designed for use with an ExionLC™ AD system. The maximum allowable pressure is increased to 130 MPa and the injection capacity ranges from a volume of 0.1 µL up to a maximum of 50 µL (or 20 µL with the loop injection method).

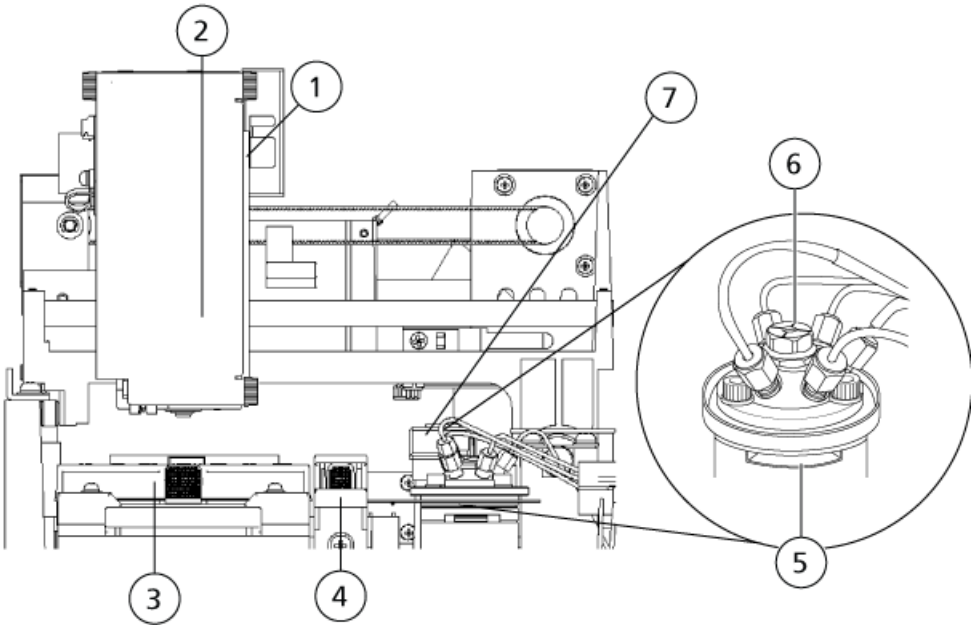
The autosampler is equipped with a sample cooler that can control the sample temperature in the range between 4 °C and 40 °C. With this feature, a sample that decomposes at the room temperature can be cooled and analyzed continually.

Figure 3-14 Front Cover Open



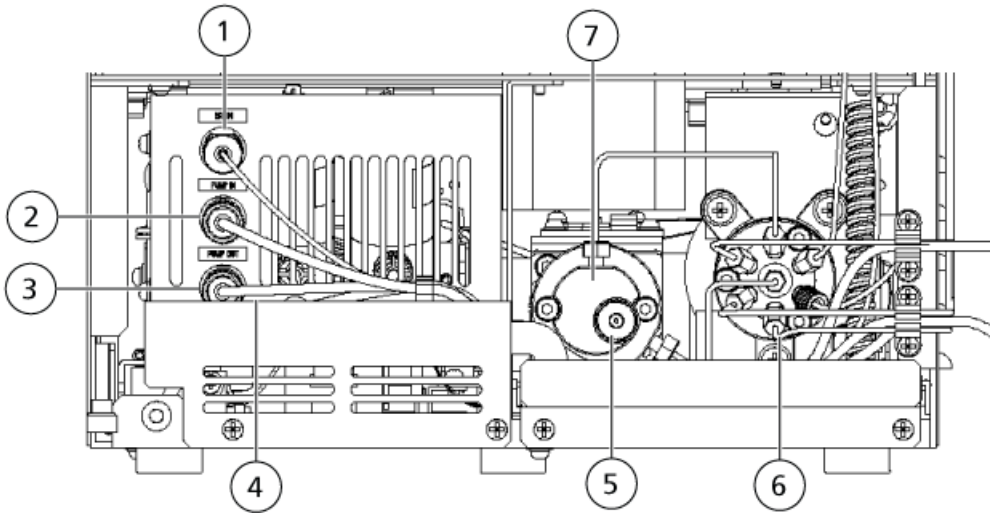
Item	Description
1	Right cover. Opened by pressing on the top left corner
2	Status panel. Comprises the status screen and LEDs. Shows operational settings.
3	Keypad. To operate and configure settings. Press ⁞⁞⁞ to show the operation keys.
4	Front door
5	High-pressure valve rotor replacement jig. Used for replacing the high-pressure valve rotor.
6	Sample rack
7	Measuring pump. Measures samples.
8	Low pressure valve. Switches the rinse solvent flow line.
9	Panel F. (When the door sensor function is used, injection can be performed only if panel F is attached.)

Figure 3-15 Internal View



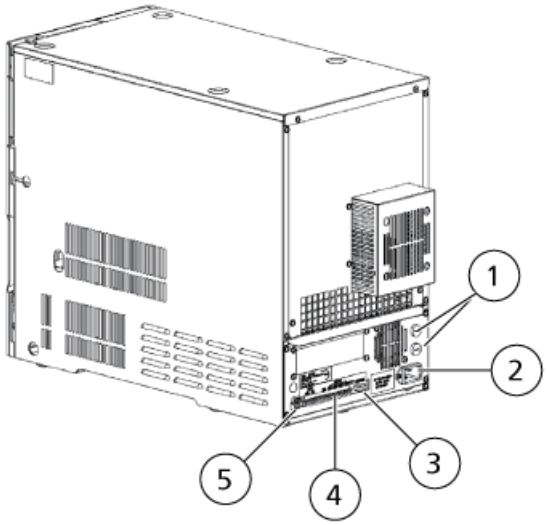
Item	Description
1	Z-mount
2	Needle. Aspirates the samples
3	Sample rack. Holds sample vials.
4	Control vial rack. Holds control vials.
5	High pressure valve
6	Injection port. The samples are injected here.
7	Rinsing port. Rinses the needle. The port on the far side is the standard rinsing port, where the needle is dipped in rinse solution and the outside of the needle is rinsed. The port on the near side is the rinsing port for the rinsing pump, where the outside of the needle is rinsed with a rinse solution different from the standard one.

Figure 3-16 Internal View - Detail



Item	Description
1	Drain valve inlet. Introduces waste liquid in to the solenoid valve after internal rinsing of the needle.
2	Rinsing pump inlet. Introduces a rinse solution for external rinsing of the needle from the reservoir bottle to the rinsing pump. No degasser is used.
3	Rinsing pump outlet. Delivers a rinse solution for external rinsing of the needle from the rinsing pump to the rinsing port.
4	Drain valve outlet. Discharges waste liquid out of the autosampler through the solenoid valve after internal rinsing of the needle.
5	Manual prime valve. Used to draw a rinse solution using the manual syringe provided with the autosampler.
6	Low pressure valve. Switches the rinse-solvent flow line.
7	Measuring pump

Figure 3-17 Back View

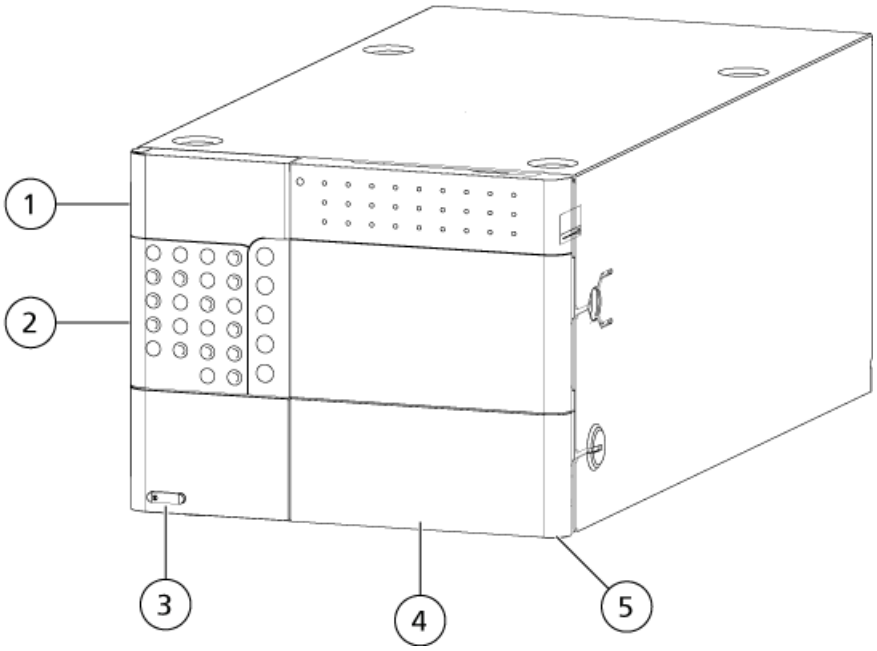


Item	Description
1	Fuse holder
2	Power cord connector
3	Changer connector
4	External input/output terminals
5	REMOTE connector. Connects to the controller.

Column Oven

The ExionLC™ AD column ovens were developed to maintain the temperature of the LC system column and flow lines at a constant temperature, to provide heightened analysis reproducibility and separation performance. The oven is equipped with a thermostatically controlled heating block with room for two columns and associated optional switching valves.

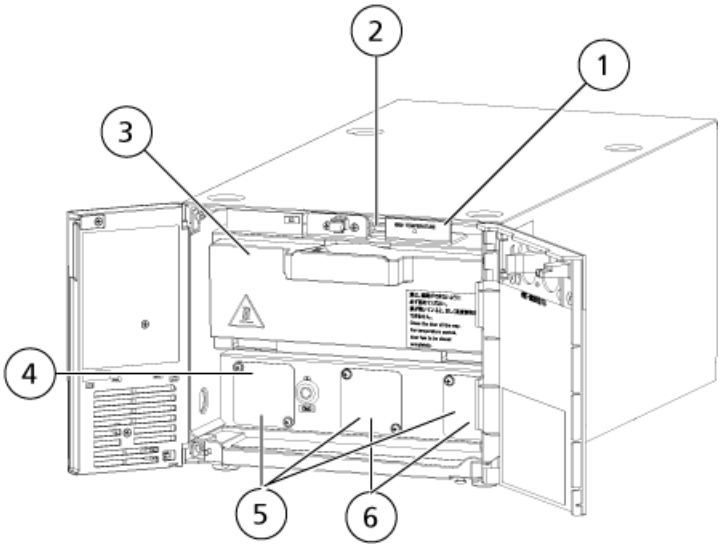
Figure 3-18 Front View



Item	Description
1	Status panel. Comprises the status panel screen and the LEDs. Shows operational settings.
2	Keypad. Used to operate and configure settings. Press to show the operation keys.
3	Power switch. Used to turn power on and off. Press the switch in to turn power on. Press again to turn power off.
4	Right door
5	Drain outlet. Drainage hole for liquid leaked inside the over.

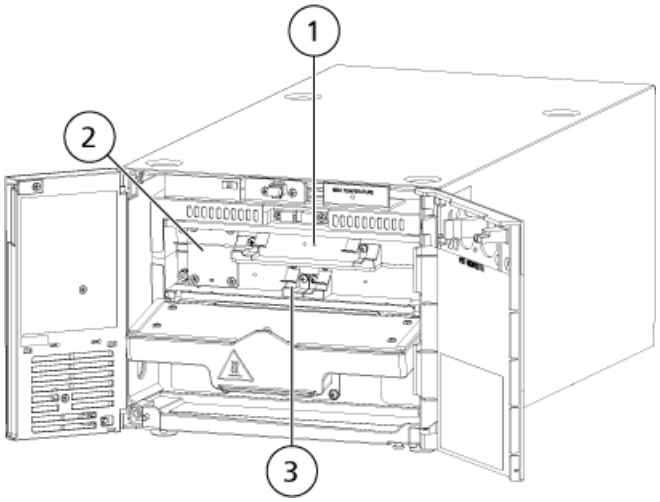
Note: When the doors are opened, temperature regulation stops and the **oven** LED flashes. Temperature regulation resumes as soon as the doors are closed.

Figure 3-19 Internal View



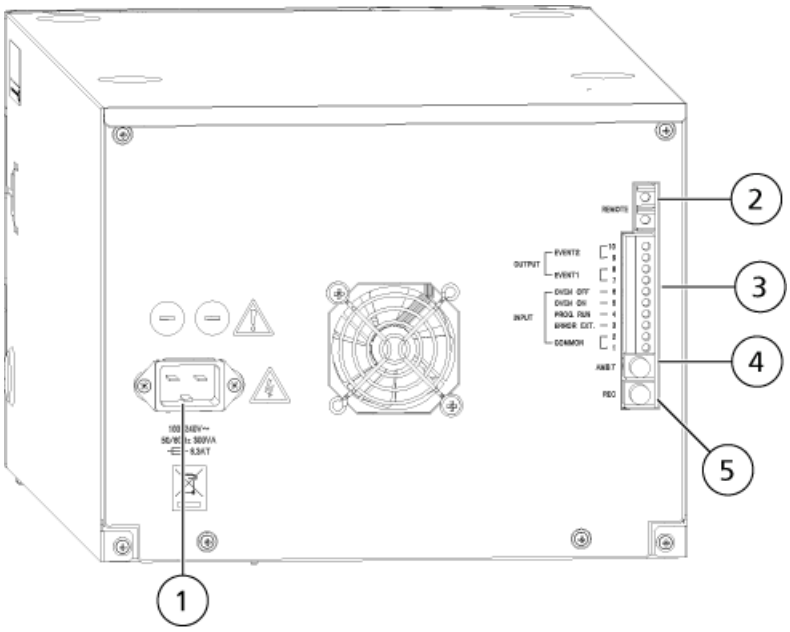
Item	Description
1	High temperature lamp. Flashes at short intervals when the heat block temperature is higher than 85 °C and flashes at long intervals when it is higher than 60 °C.
2	Door sensor. Used to ensure that the door is securely closed.
3	Internal door. This is the heat block door.
4	Mixer MR position. Mixer MR 20/180 L can be installed here.
5	Post-column cooler positions. Post-column coolers can be installed here.
6	Automatic column switching valve positions. Automatic column switching valves can be installed here.

Figure 3-20 Internal View - Internal Door Open



Item	Description
1	Heat block. Used to control the temperature up to150 ºC.
2	Preheat block. Used to preheat the mobile phase.
3	Column block and clip. Used to secure the column.

Figure 3-21 Back View



Item	Description
1	Power cord connector. Used to connect the power cord.
2	**REMOTE** connector. Connects to the controller.
3	External input/output terminals. Connects to external equipment.
4	Ambient temperature sensor connector. Connects to the ambient temperature sensor.
5	**REC** connector. Connector for the ambient temperature (oven temperature) sensor output (100 °C/mV). **Note:** This connector is for making adjustments and normally does not need to be used.

Sample Injection

The following table provides a legend for the figures in this section.

Table 3-1 Legend for the Figures

Item	Description
1	Vial
2	Rinsing port
3	Drain
4	Needle
5	Sample loop
6	Injection port
7	High pressure valve
8	Column
9	Mixer
10	LC pump
11	Degasser
12	Mobile phase A
13	Mobile phase B
14	Drain valve

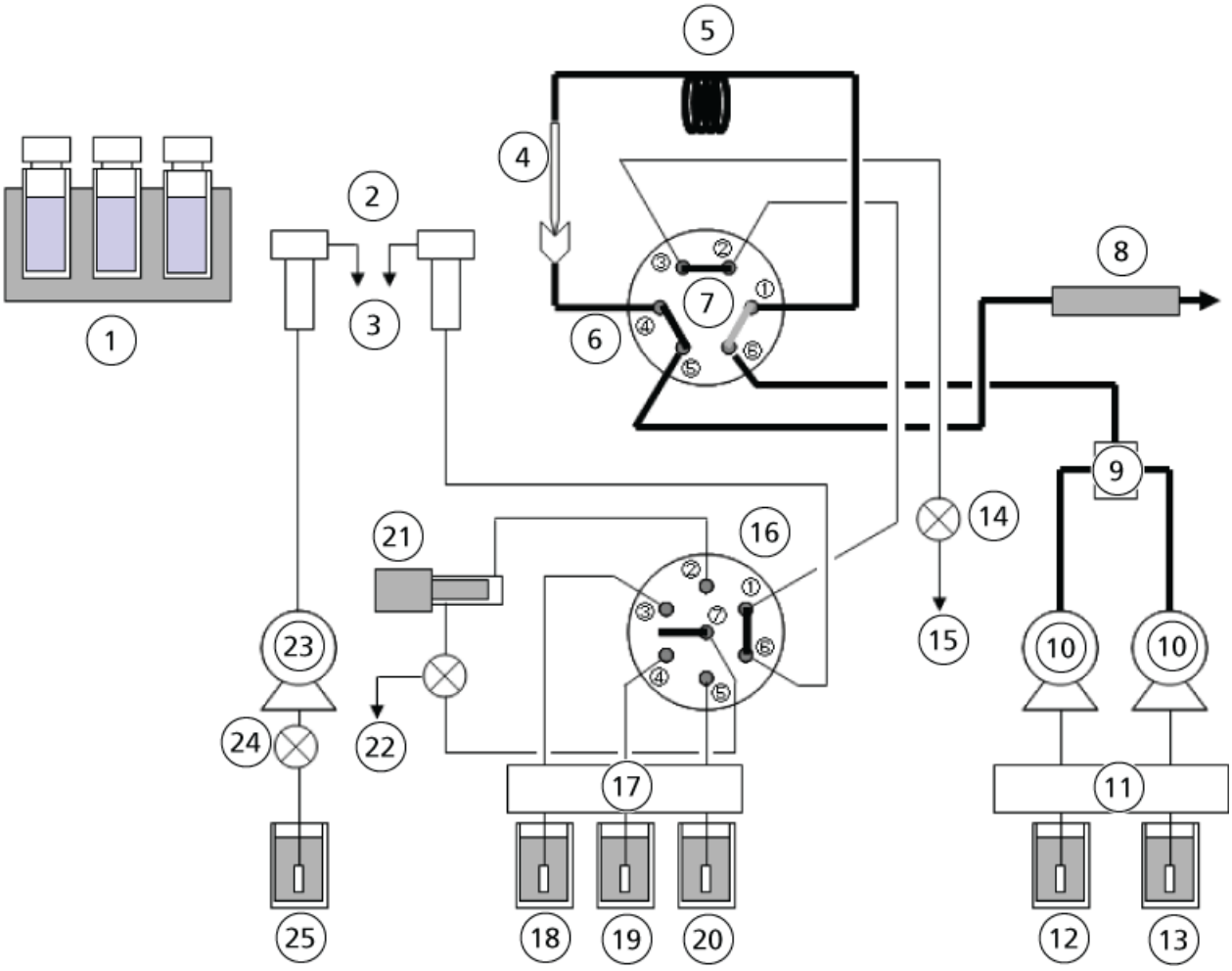
Table 3-1 Legend for the Figures (continued)

Item	Description
15	Drain
16	Low pressure valve
17	Degasser
18	Rinse solution R2
19	Rinse solution R1
20	Rinse solution R0
21	Measuring pump
22	Manual prime valve
23	Rinsing pump
24	Solenoid valve
25	Rinse solution R3
▬▬▬	High pressure mobile phase
·····	Discharge, aspiration, or pressure release

Standby (Ready)

The mobile phase is pumped from the reservoir through the high-pressure valve > sample loop > needle > injection port, and then back through the high-pressure valve, before reaching the analysis column.

Figure 3-22 Standby

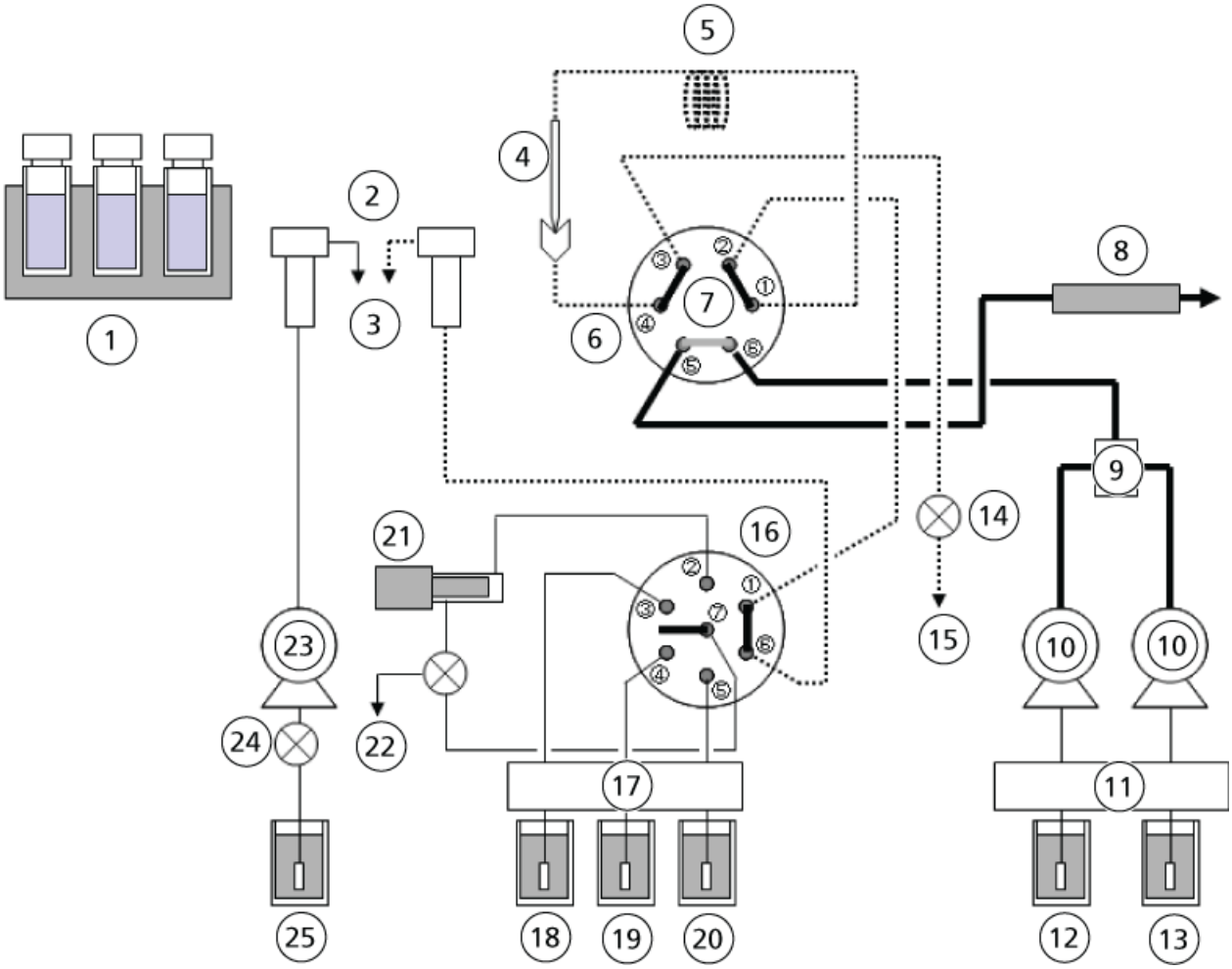


- Drain valve: closed
- High pressure valve: inject
- Low pressure valve: 1 to 6

Pressure Release

The high-pressure valve rotates to the load position (60 degrees in the clockwise direction), and the high-pressure sample-loop mobile phase remaining in the sample loop flows through the needle > sample loop > high-pressure valve > low-pressure valve > rinsing port > and needle > injection port > high-pressure valve > drain valve, relieving the pressure in the sample loop.

Figure 3-23 Release of Pressure in Flow Line

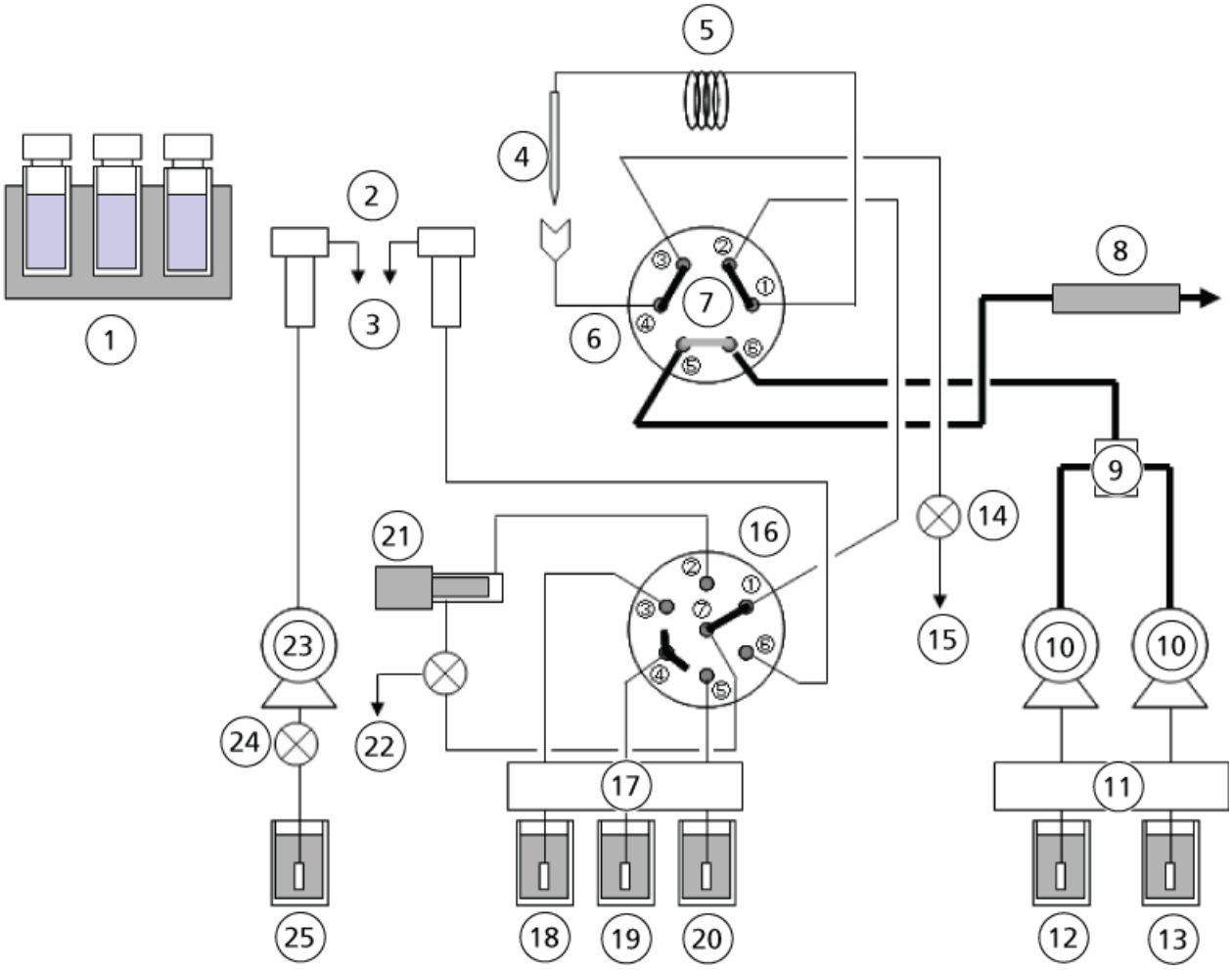


- Pressure release
- Drain valve: Open
- High pressure valve: Load
- Low-pressure valve: 1 to 6

Needle Movement

The low pressure valve rotates to the measuring position (210 degrees in the counter-clockwise direction) and the needle moves up.

Figure 3-24 Needle Movement



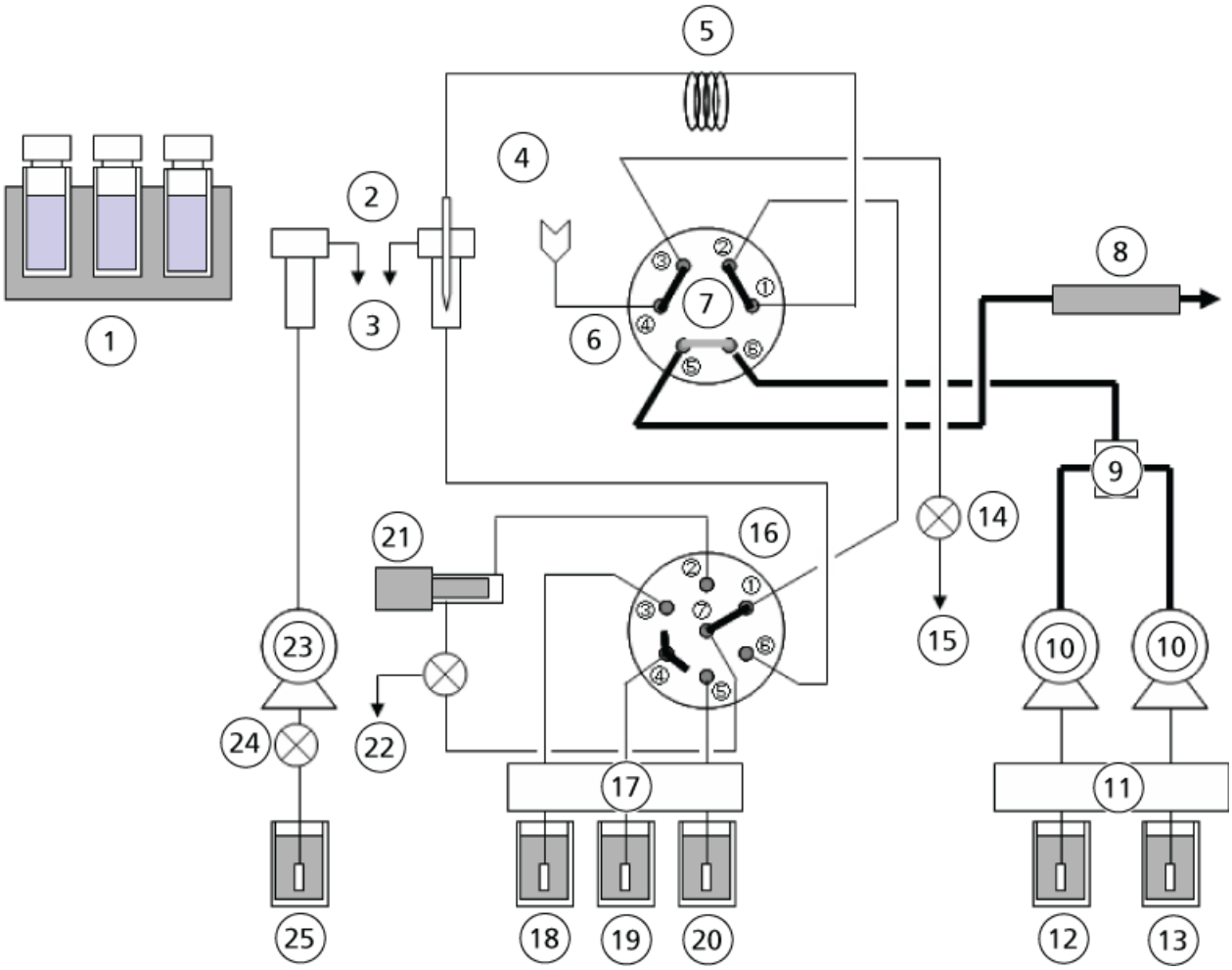
External Needle Rinse Before Sample Aspiration

The low-pressure valve rotates to measuring position (30 degrees in the clockwise direction), and the needle is inserted in the rinsing port, where its outer surfaces are rinsed with the rinse solution inside the port.

It is also possible to set the autosampler to skip external rinsing. Rinsing can be performed with two kinds of rinse solution when a rinsing pump is used.

The high pressure valve (4) is in Load state.

Figure 3-25 External Needle Rinse

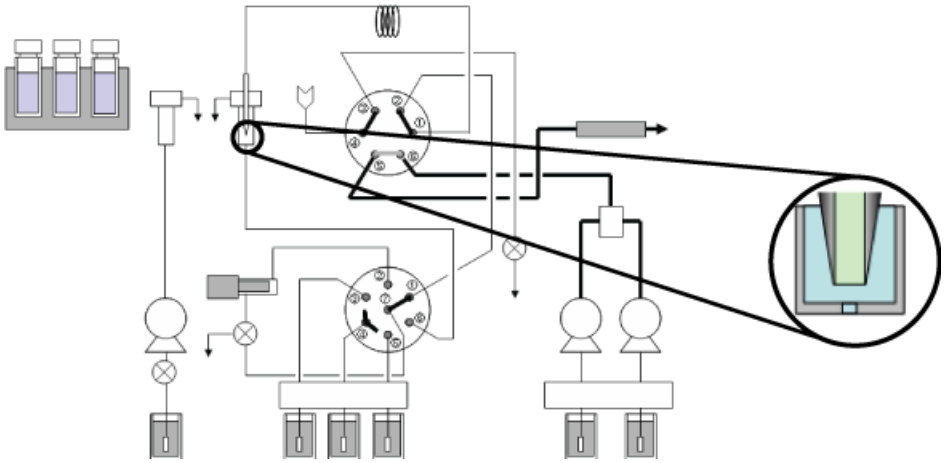


- Drain valve: closed
- High pressure valve: load
- Low pressure valve: 1 to 7

External Rinsing of the Needle

This is the function that rinses the external surface of the needle by dipping the needle in the rinsing port or pumping the rinse solution using a rinsing pump before and after sample aspiration to eliminate contamination from the external surface of the needle.

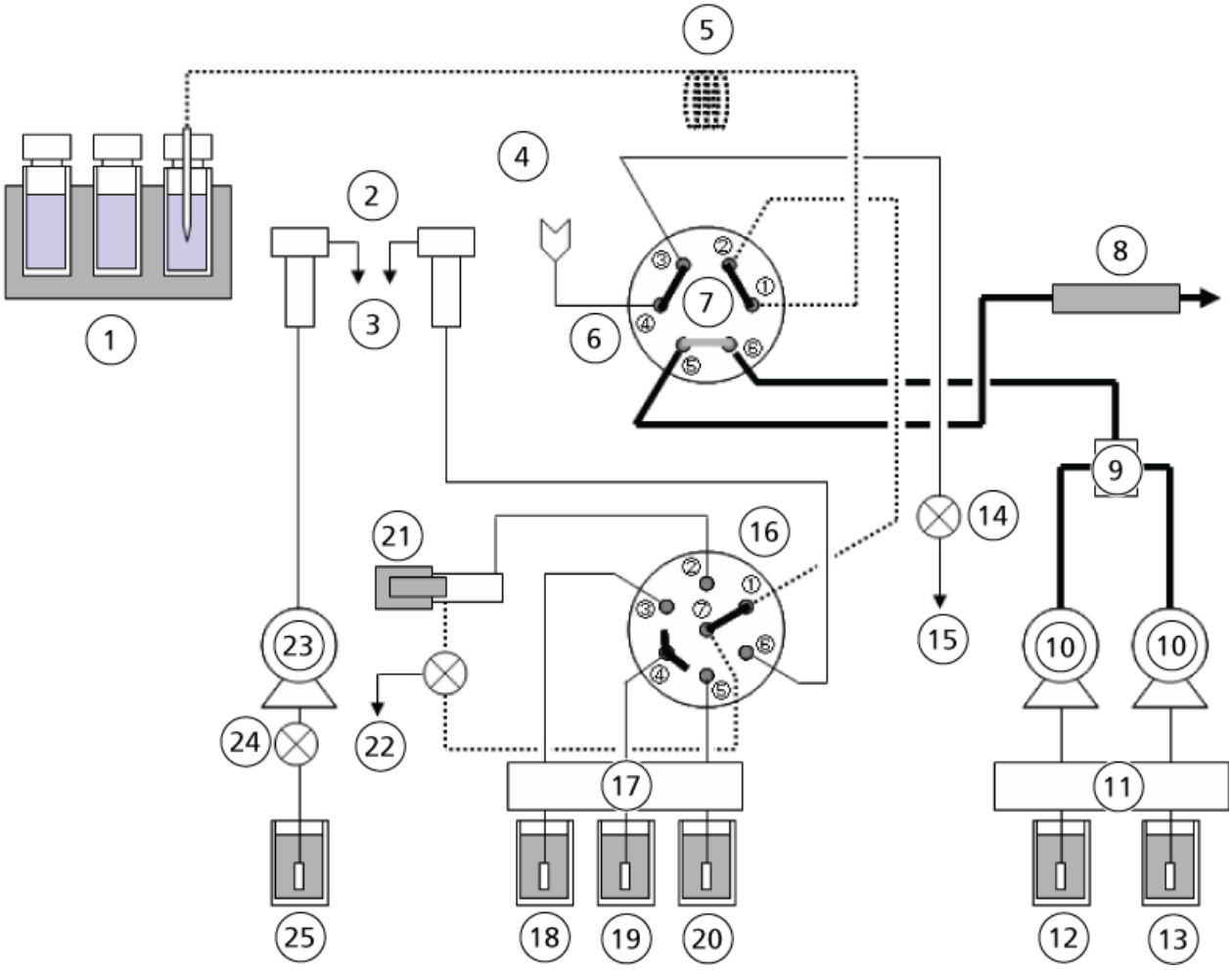
Figure 3-26 Rinsing the External Surface of the needle



Sample Aspiration

The needle is inserted into the sample vial. Then the measuring pump draws the sample into the needle and sample loop.

Figure 3-27 Sample Aspiration



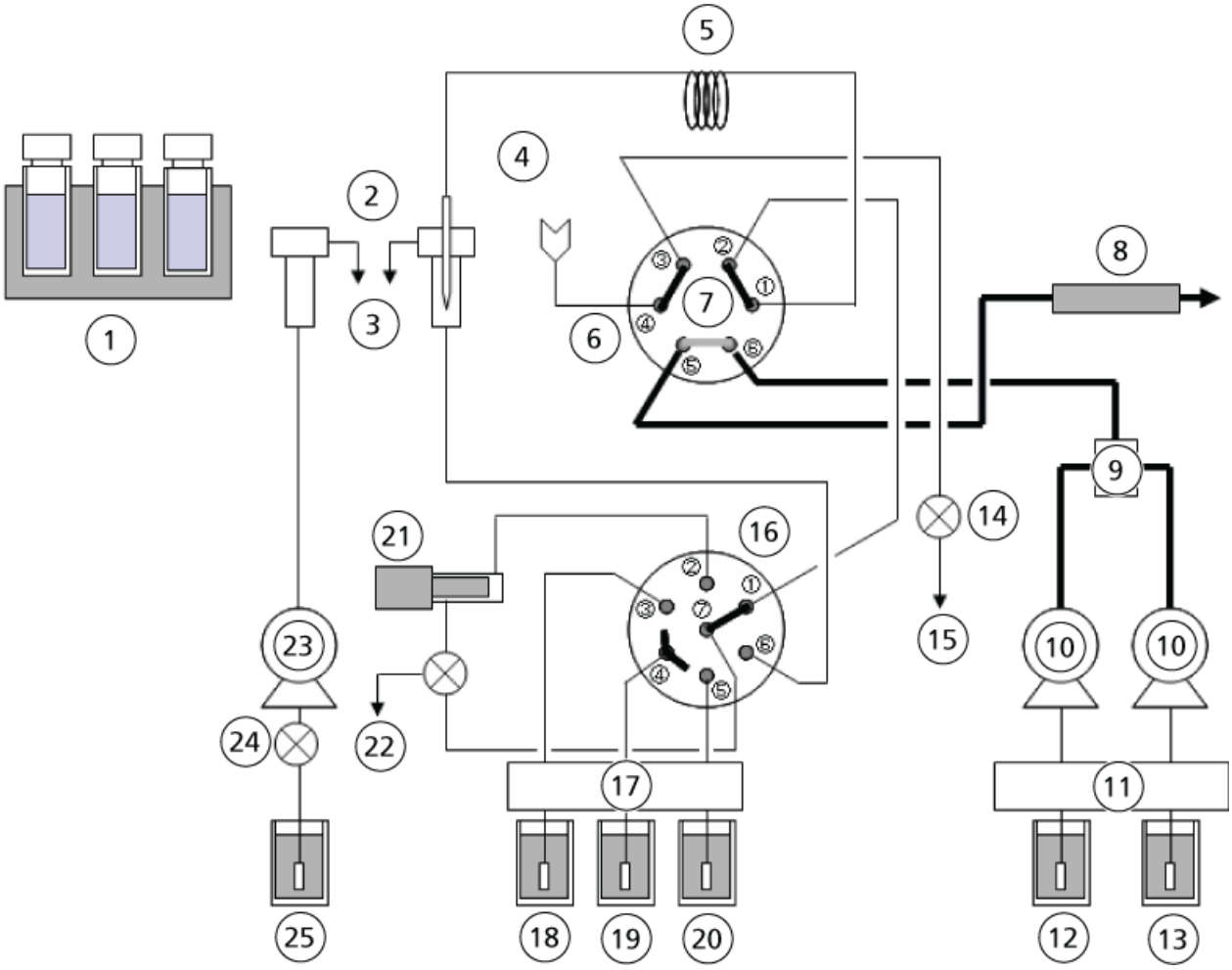
- Aspiration
- Drain valve: Closed
- High pressure valve: Load
- Low pressure valve: 1 to 7

External Needle Rinse after Sample Aspiration

The needle is inserted in the rinsing port, where its outer surfaces are rinsed with the rinse solution inside the port.

It is also possible to set the autosampler to skip the rinse step. In addition, a needle-rinsing pump allows rinsing to be performed with two types of rinse solutions.

Figure 3-28 Needle Rinse

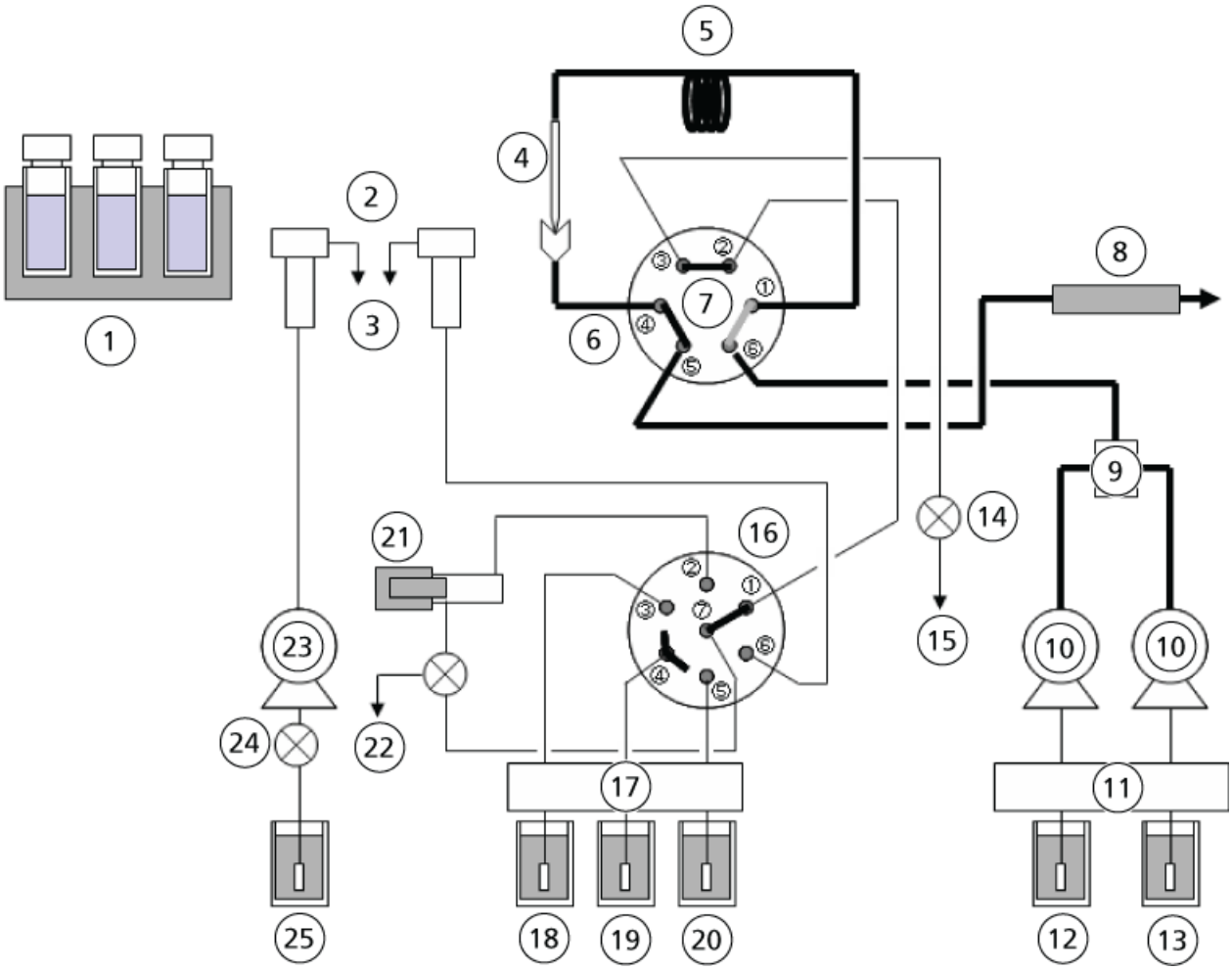


- Drain valve: closed
- High pressure valve: load
- Low pressure valve: 1 to 7

Start of Analysis

The needle is inserted in the injection port, and the high-pressure valve rotates 60 degrees counter-clockwise to the injection position. The sample is injected into the flow lines and, along with the mobile phase, passes through the high-pressure valve and into the column, where analysis begins.

Figure 3-29 Sample Injection

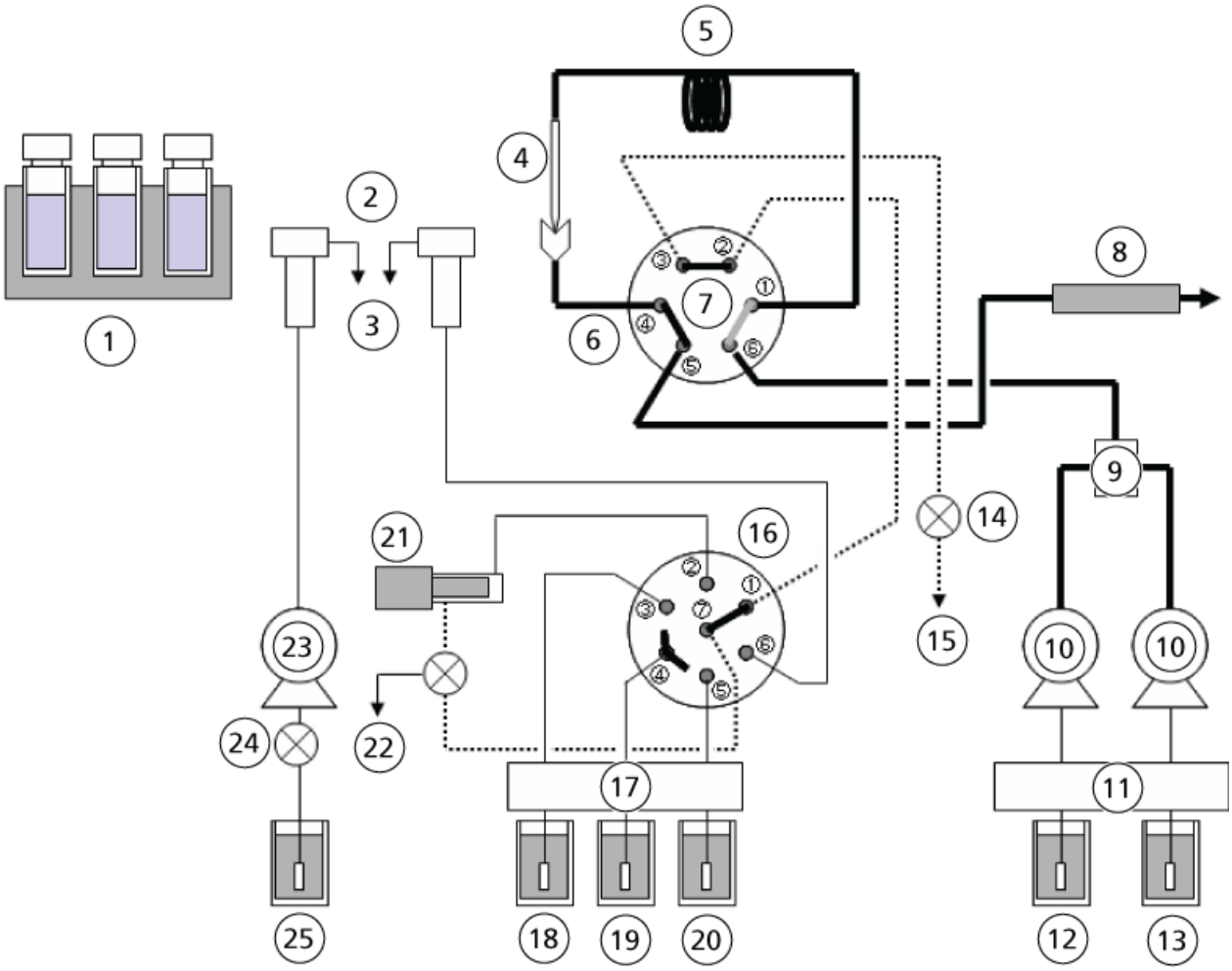


- Drain valve: Closed
- High pressure valve: Inject
- Low pressure valve: 1 to 7

Measuring Pump Home Position Setting

The measuring pump dispenses the sample and sets the home position.

Figure 3-30 Measuring Pump

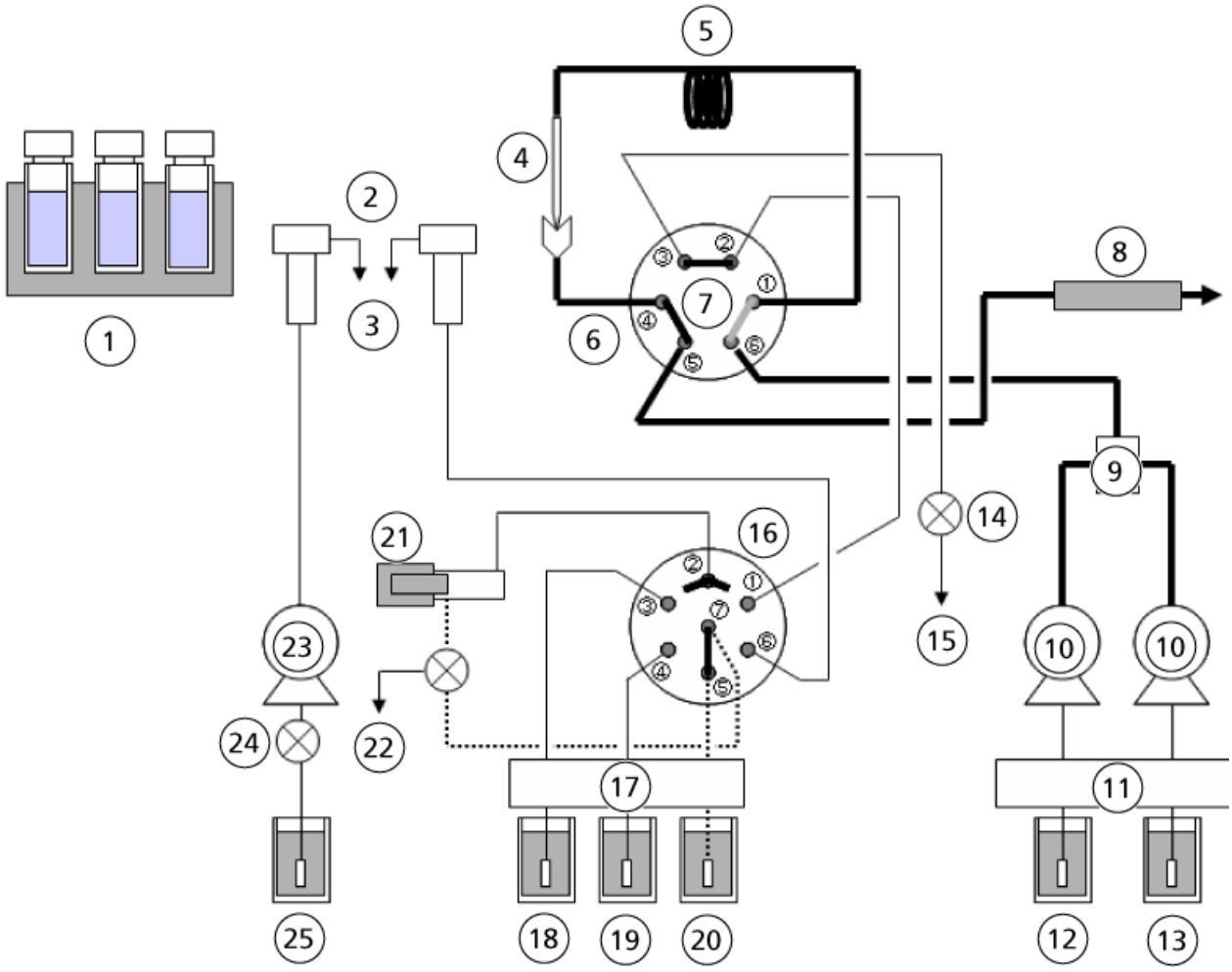


- Discharge
- Drain valve: open
- High pressure valve: inject
- Low pressure valve: 1 to 7

Rinse Solution Aspiration (R0)

The low-pressure valve rotates to the position (120 degrees in the clockwise direction) where ports 5 and 7 are connected, and aspirates rinse solution (R0).

Figure 3-31 Rinse Solution Aspiration

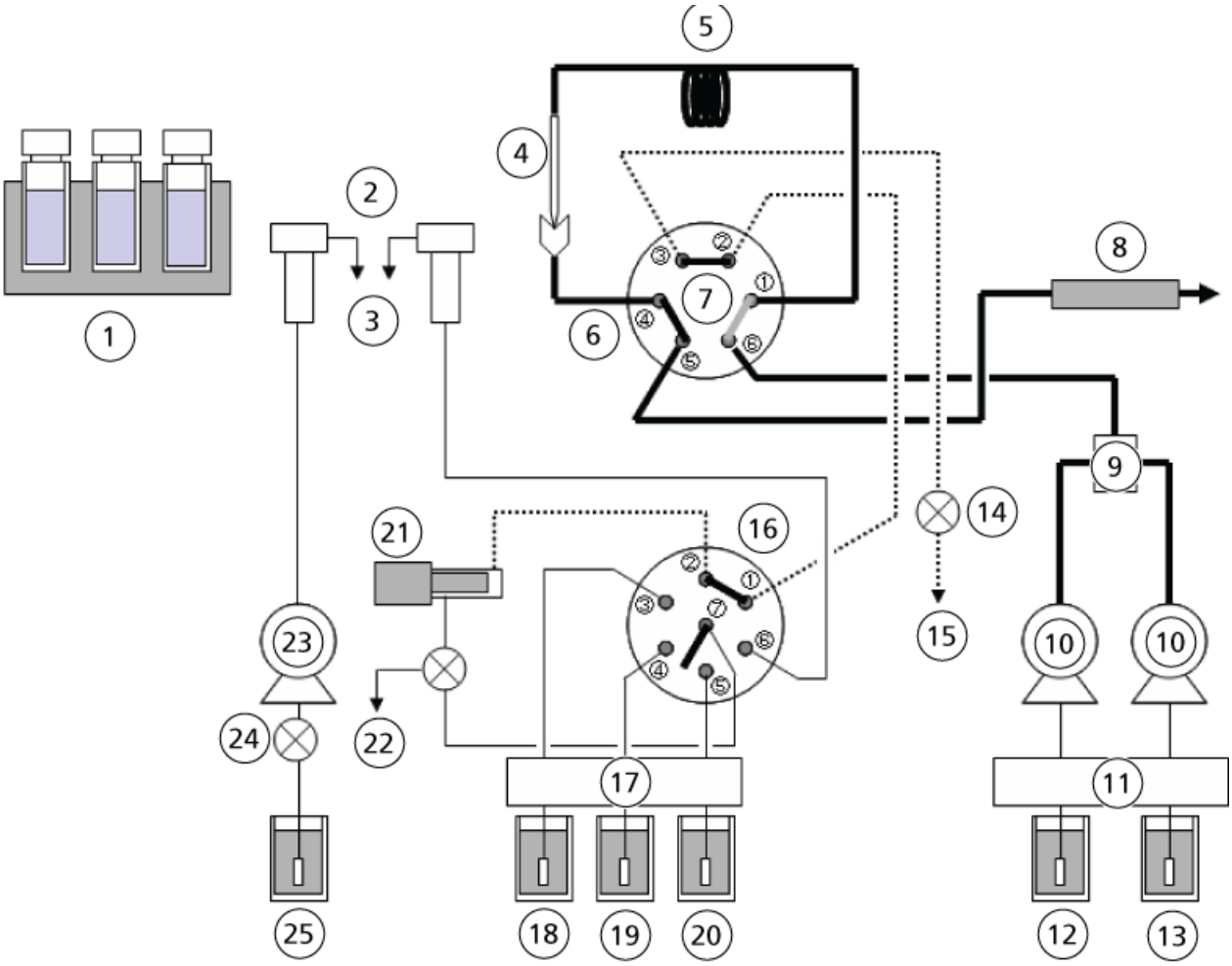


- Discharge
- Drain valve: closed
- High pressure valve: inject
- Low pressure valve: 5 to 7

Dispense Rinse Solution (R0) to the Measuring Flow Line

The low pressure valve rotates 30 degrees in the clockwise direction and the measuring pump dispenses rinse solution (R0) to the drain valve to purge the measuring flow line.

Figure 3-32 Dispense to Measuring Flow Line

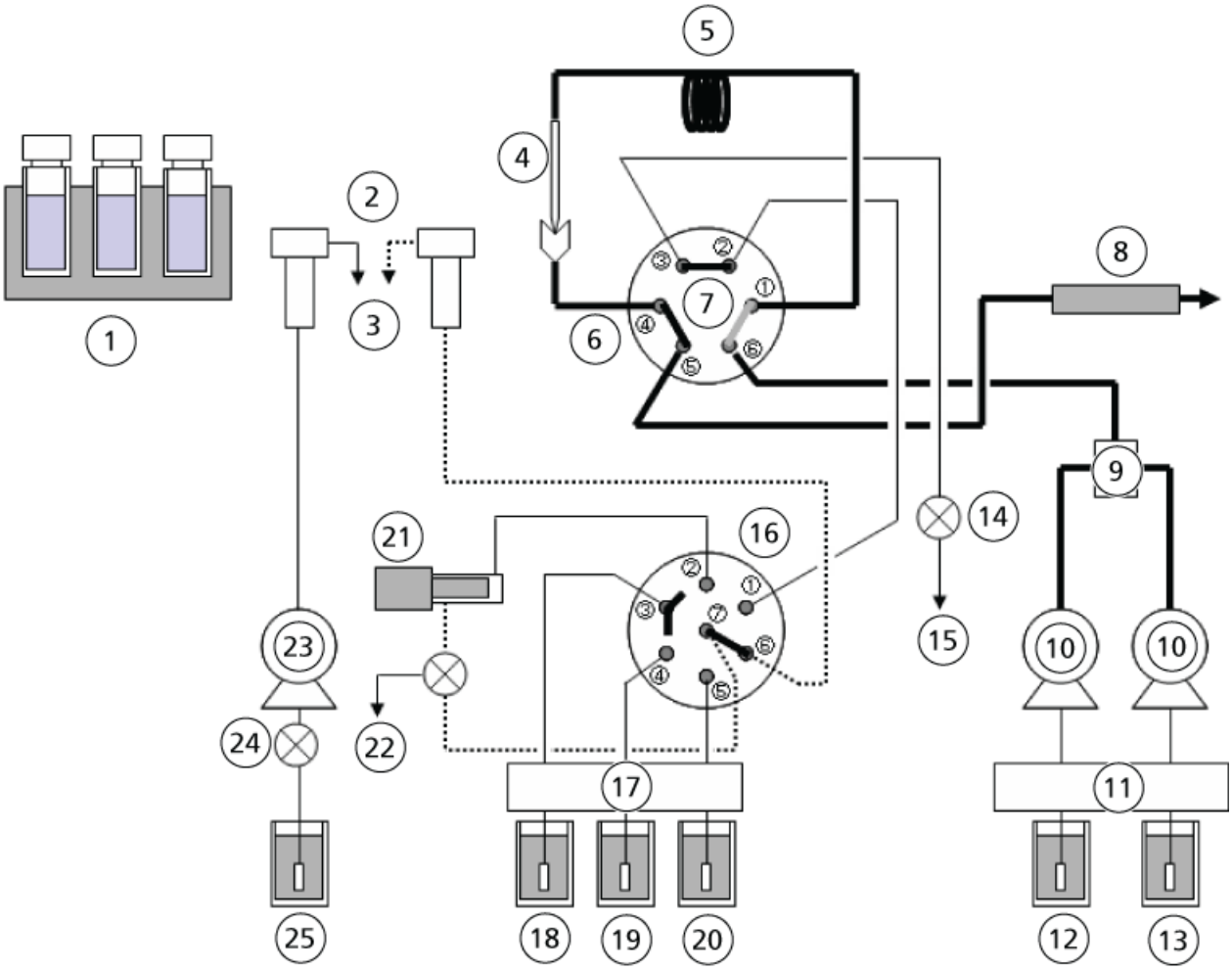


- Discharge
- Drain valve: open
- High pressure valve: inject
- Low pressure valve: 1 to 2

Dispense Rinse Solution (R0) to the Rinsing Port

The low pressure valve rotates 30 degrees in the counter-clockwise direction and aspirates rinse solution (R0). Then the low pressure valve rotates 60 degrees in the counter-clockwise direction, and the measuring pump dispenses rinse solution (R0) to the rinsing port.

Figure 3-33 Dispense to Rinsing Port

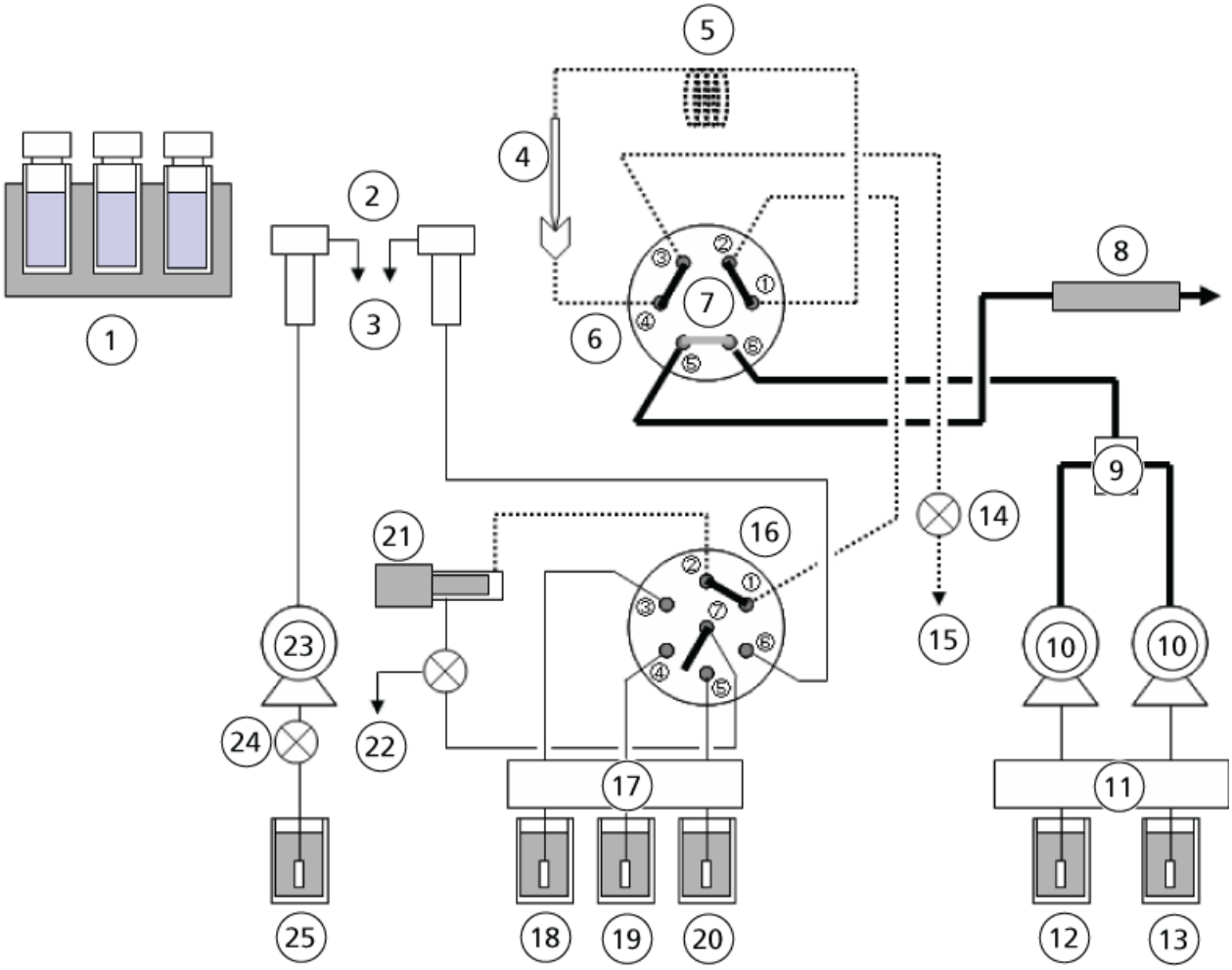


- Discharge
- Drain valve: closed
- High pressure valve: inject
- Low pressure valve: 6 to 7

(Reference) Internal Rinsing of Needle with Rinse Solution (R0, R1, R2)

When RINSE TYPE is set to 2 and internal rinsing of the needle is performed after sample injection, the specified rinse solution is aspirated by the measuring pump, and ports 1 and 2 of the low pressure valve are connected and rinse solution is dispensed to the high pressure valve > sample loop > needle > injection port > high pressure valve > drain valve.

Figure 3-34 Internal Rinse

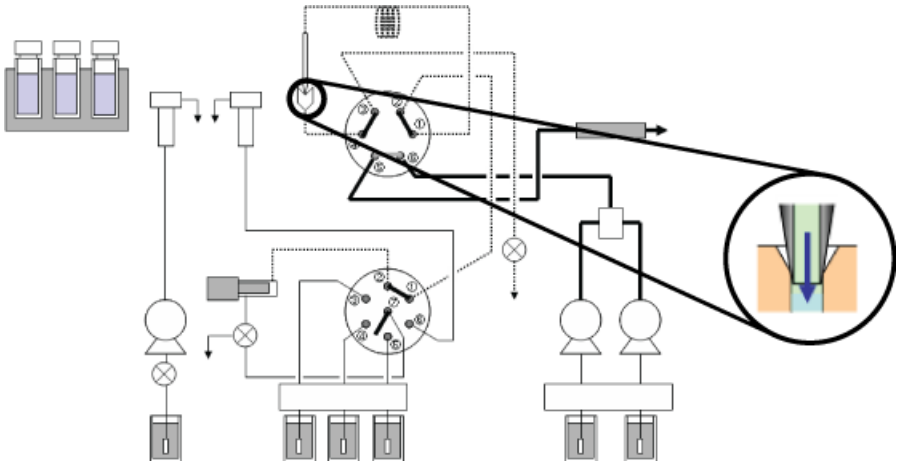


- Discharge
- Drain valve: open
- High pressure valve: load
- Low pressure valve: 1 to 2

Internal Rinsing of the Needle

This is the function that rinses the HPLC flow line using a maximum of three kinds of rinse solution (R0, R1, R2) during or after analysis to eliminate contamination from the flow line in the autosampler including the needle, the injection port, the sample loop, and the high-pressure valve. To perform internal rinsing of the needle, set the RINSE TYPE in the Parameter Setting group to 2 (internal/external rinsing of the needle).

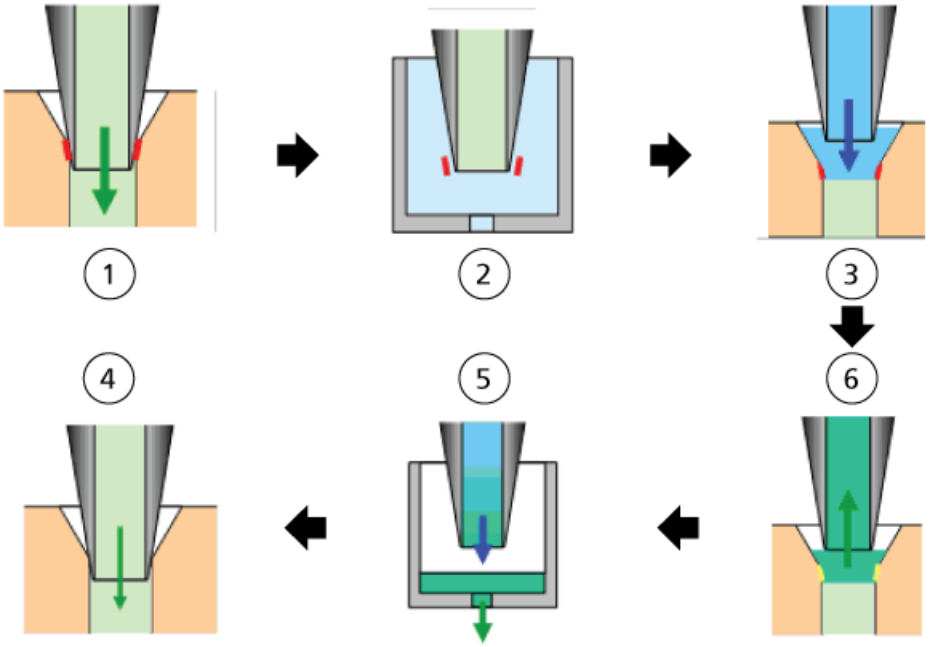
Figure 3-35 Rinsing the Internal Surface of the Needle



Rinsing of the Injection Port

Use this function to rinse the injection port immediately after internal rinsing of the needle. This function is available only when internal rinsing of the needle is used. To perform rinsing of the injection port, set **2** (internal/external rinsing of the needle) at RINSE TYPE and then select the solvent to be used at INJ.P RINSE. The major rinsing sequence is shown in *Figure 3-36*.

Figure 3-36 Rinsing Sequence

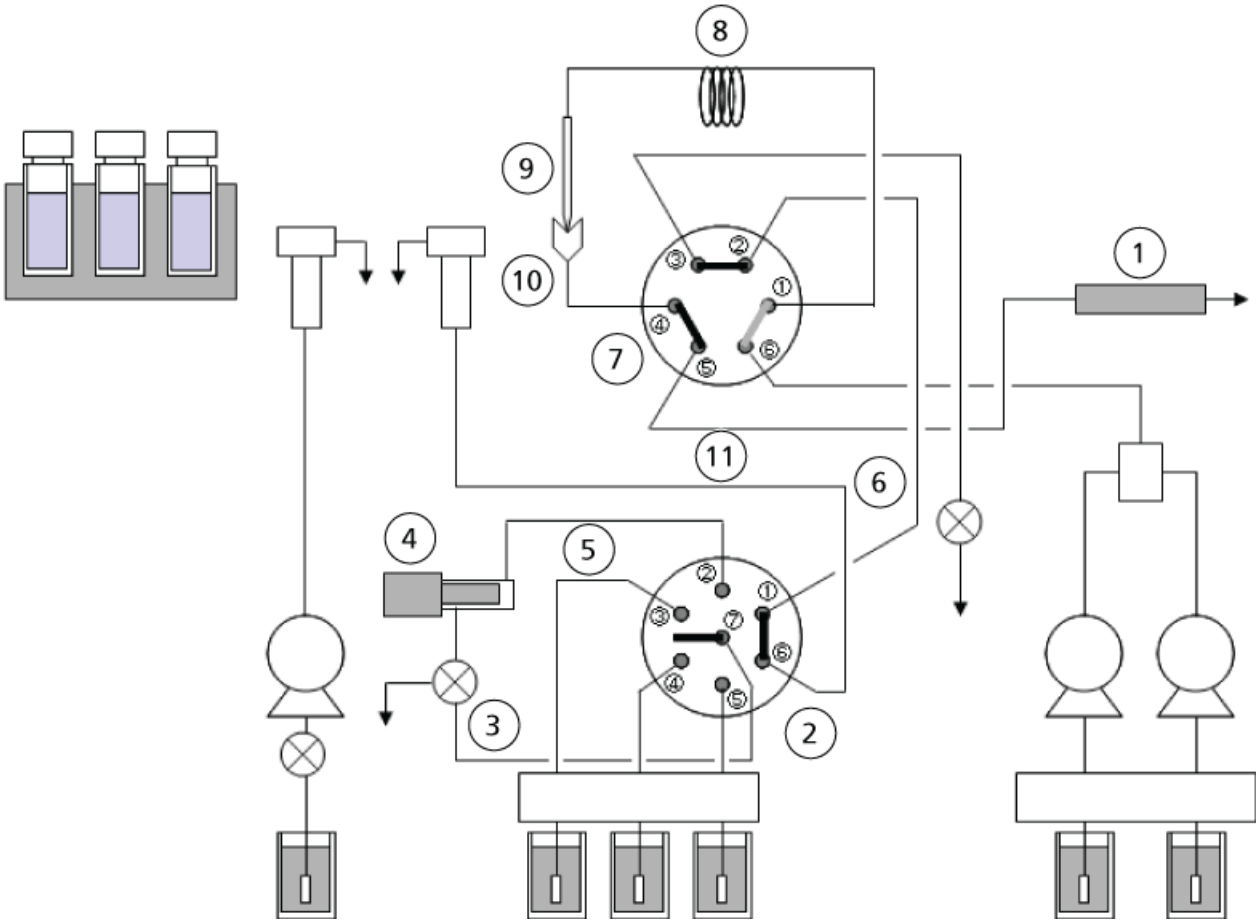


Item	Description
1	Injection port after sample injection.
2	Rinsing the external surface of the needle.
3	Raising the needle and dropping the rinse solution.
4	Aspirating the rinse solution in which remaining components are dissolved.
5	Discharging the contaminated rinse solution to the drain port.
6	Injection port after rinsing.

(Reference) Holding Capacity in the Flow Line

Note: When the RINSE TYPE parameter is set to **2** (internal/external rinsing of the needle) and multiple rinse solutions are used for rinsing the flow line, the rinse solution R0 must be used as mobile phase (initial concentration for gradient analysis).

Figure 3-37 Holding Capacity



Item	Description	I.D. × Length (mm)	Capacity (µL)	Capacity from Mixer Outlet to Column Inlet (µL)	Capacity for Internal Rinsing of Needle (µL)
1	Mixer – HPV No. 6	Φ0.3 × 300	21.2	21.2	
2	Between LPV ports	–	2.6		5.2
3	LPV No. 7 –Measuring pump inlet	Φ0.5 × 135	26.5		26.5

Item	Description	I.D. × Length (mm)	Capacity (µL)	Capacity from Mixer Outlet to Column Inlet (µL)	Capacity for Internal Rinsing of Needle (µL)
4	Inside the measuring pump	–	34.5		34.5
5	Measuring pump outlet – LVP No. 2	Φ0.5 × 170	33.4		33.4
6	LPV No. 1 – HPV No. 2	Φ0.5 × 430	84.4		84.4
7	Between HPV ports	–	0.7	1.4	1.4
8	Sample loop	Φ0.3 × 1200	84.8	84.8	84.8
9	Needle	–	11.7	11.7	11.7
10	Injection port	–	1.0	1.0	11.0
11	HPV No. 5 – Column inlet	Φ0.1 × 800	6.3	6.3	
			Total	126.4[0]	282.9[1]

Needle Rinse Conditions

This section describes analysis sequences with respective needle rinsing methods.

Table 3-2 Legend for the Figures

Item	Description
1	Start of analysis
2	Measuring flow line purge > rinsing port purge (RINSE TYPE = 1)
3	Inject
4	End of analysis
5	High pressure valve switching

1 Equivalent to the capacity in the flow line to be rinsed when performing internal rinsing of the needle.

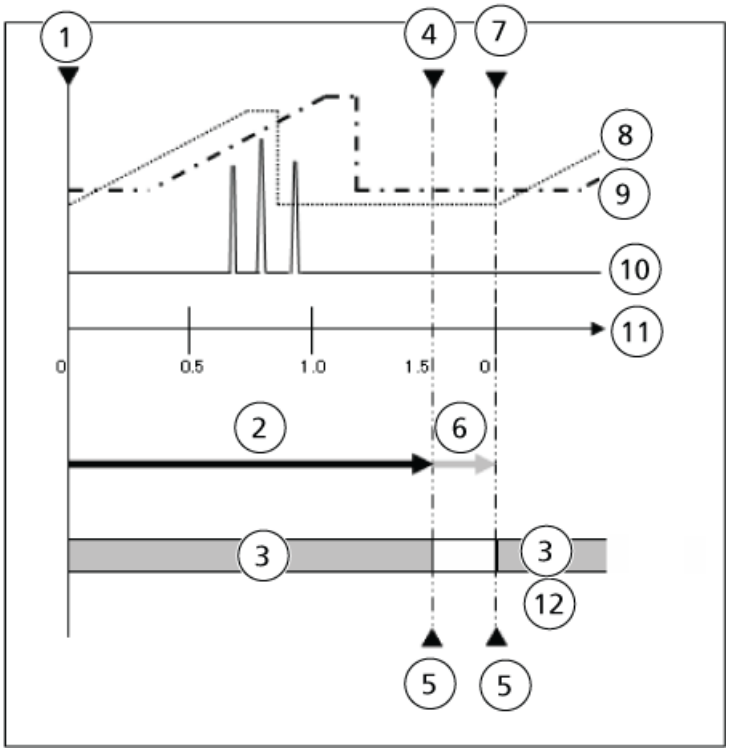
0 Equivalent to the delay volume for high-pressure gradient analysis (excluding the mixer capacity).

Table 3-2 Legend for the Figures (continued)

Item	Description
6	Pretreatment
7	Load
8	Time program
9	Gradient
10	Chromatogram
11	Analysis time
12	High pressure valve position
13	Internal rinsing of the needle > measuring flow line purge > rinsing port purge
14	Purging in the needle by pumping (sample loop equilibration)

RINSE TYPE = 0, 1, 3: When "no rinsing", "external rinsing of the needle" or "no rinsing (fast)" is selected for the needle rinsing method, the measuring flow line and the rinsing port are purged immediately after the start of analysis, and then the pretreatment process for the next analysis starts. External rinsing of the needle can be performed before and after sample aspiration during the pretreatment process.

Figure 3-38 Rinse Type 0, 1, 3

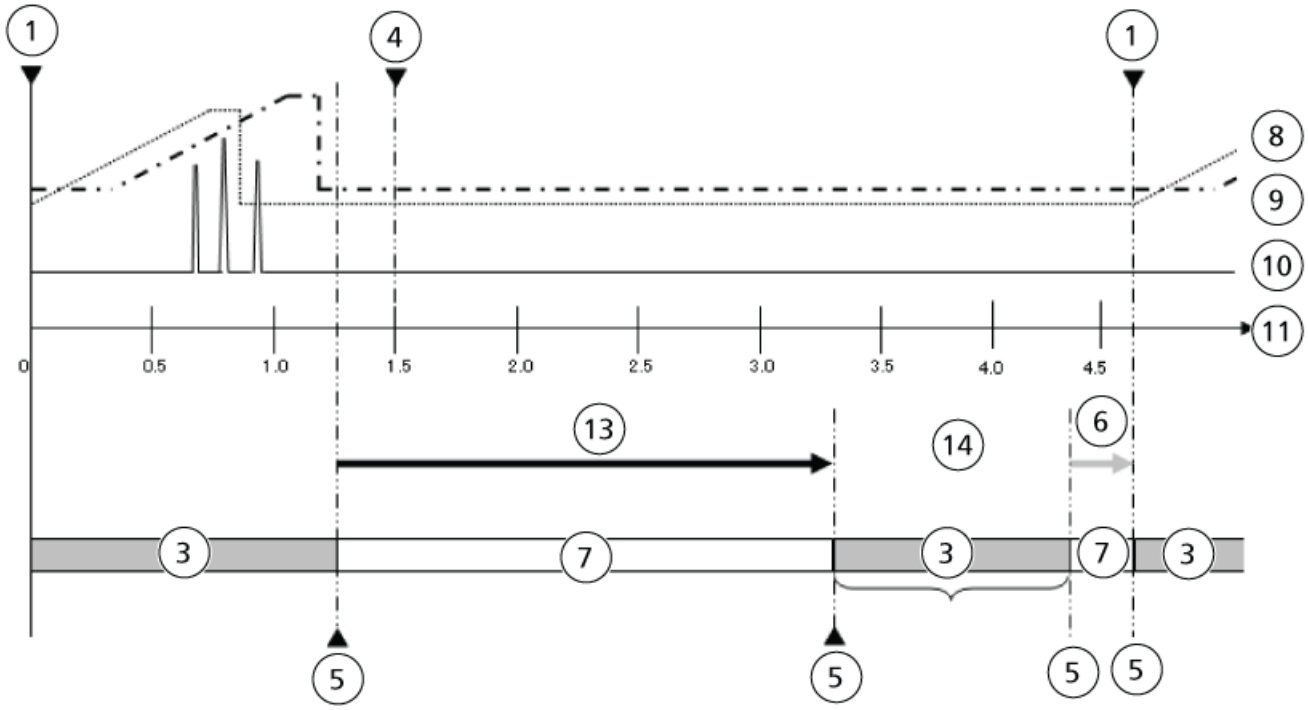


RINSE TYPE = 2: When internal/external rinsing of the needle is selected for the needling rinsing method, the following events occur:

1. The high-pressure valve is switched to the load position during or after analysis.
2. Internal rinsing of the needle is performed.
3. The measuring flow line and the rinsing port is purged.
4. The high-pressure valve is switched to the injection position.
5. The solvent in the sample loop and the needle is purged with the mobile phase and then the pretreatment process for the next analysis starts.

External rinsing of the needle can be performed before and after sample aspiration during the pretreatment process.

Figure 3-39 Rinse Type 2



Configuration 4

To create the hardware profile for the system, refer to the *ExionLC™ System Software User Guide*.

Some configuration tasks can be performed with the VP and Auxiliary functions. Refer to *VP Functions on page 210* and *Auxiliary Functions on page 216* .

Operating Instructions 5

WARNING! Hot Surface Hazard. Do not open the column oven door if the high temperature lamp is blinking. The internal temperature of the column oven is (60 °C or greater).

CAUTION: Potential System Damage. Do not use the manual injector at pressures higher than 35 MPa.

CAUTION: Potential System Damage. Do not use the cooling operation for extensive periods, and remove condensation regularly.

CAUTION: Be sure to maintain the pressure at a level lower than the withstand pressure of the valve.

CAUTION: Potential System Damage. Do not use a high level of organic solvent (greater than 50%) when the column oven is operated at temperatures exceeding 85 °C.

Sample Workflow

Step	To do this...	Find the information in....
1	Turn on the HPLC system	*Turn on the System on page 73*
2	Create and select an LC method	*ExionLC™ System Software User Guide*
3	Prepare the mobile phase and rinse solution for the autosampler	*Prepare the Mobile Phase and Rinse Solution on page 62*
4	Prepare the column	*Install the Column on page 70*
5	Prepare the sample	*Prepare the Sample on page 97*
6	Start acquisition	*System User Guide* for the mass spectrometer.
7	Complete acquisition and turn off the HPLC system	*Post-Analysis Procedures on page 105*

Prepare the Mobile Phase and Rinse Solution

WARNING! Biohazard, Toxic Chemical Hazard. Do not use a cracked or scratched bottle. The bottle might leak.

WARNING! Toxic Chemical Hazard. Install the waste container lower than the instrument (for example, on the floor). If the container is higher than the instrument, then the liquid will not drain and it will leak from the connections.

CAUTION: Potential System Contamination. Do not use resin parts for the high-pressure tubing while pumping at high pressures. Pumping at high pressure might cause resin tubing to be ruptured or disconnected, which could result in mobile phase leaks. Note the maximum withstand pressure of each part when resin parts are used for the high-pressure tubing.

CAUTION: Potential System Damage. Do not use highly volatile acids, such as acetic acids in high concentration (10 % to 50 %) or 1 % TFA (trifluoroacetic acid) solution, as a mobile phase or rinse solution of the autosampler continually. Doing so can cause metallic parts in the instrument to corrode. If such liquids have been used for analysis, purge the mobile phase or rinse solution from the flow line with distilled water or other liquid that is less corrosive. Also, turn the autosampler off after analysis and open the front door slightly to let the vapor release from the inside of the instrument.

CAUTION: Potential System Damage. Do not use solutions of pH 13 or more. Some types of mobile phases might damage the flow cell quartz if used for a long period of time at pH 10 or more, resulting in transformation of the transmission characteristics. After using this type of mobile phase, pump HPLC grade water or other liquid to rinse the flow cell.

CAUTION: Potential System Damage. Do not use the following solvents in the degassing unit. They can damage the system.

- **HFIP (Hexafluoroisopropanol)**
- **HF (Hydrogen fluoride)**
- **Freon 113**
- **Fluorinert FC-40, Fluorinert FC-72, or Fluorinert FC-75**
- **Perfluoro benzene**
- **Perfluoro octane**
- **Perfluoro decalin**
- **Perfluoro 1-methyldecalin**
- **Perfluoro dimethyldecalin**
- **Perfluoro methyl-cyclohexane**
- **Perfluoro dimethyl-cyclohexane**
- **AK-225**
- **Nitric acid of 30 % or more of concentration**
- **Sulfuric acid of 40 % or more of concentration**
- **Hydrogen peroxide**

CAUTION: Potential System Damage. If PEEK resin parts are used for tubing connections, do not use the following mobile phases. They weaken PEEK resin, which might lead to cracked tubing and mobile phase leaks.

- **Concentrated sulfuric acid**
- **Concentrated nitric acid**
- **Dichloroacetic acid**
- **Tetrahydrofuran (THF)**
- **Dichloromethane**
- **Chloroform**
- **Dimethyl sulfoxide(DMSO)**
- **Fluorine organic solvents such as hexafluoroisopropanol (HFIP)**

Follow these guidelines when choosing mobile phase solutions:

- Use only HPLC grade or comparable mobile phase, and filter it with a filter of 0.45 µm mesh or finer before use to remove particulates and foreign matter.
- If stainless steel materials are used, then avoid mobile phases containing halogen ions, such as KCl, NaCl and NH_4Cl, or mobile phases that generate halogen ions in certain reactions. If mobile phases containing halogen must be used, then clean all of the flow lines thoroughly with HPLC-grade water immediately after analysis. Halogen ions can corrode the stainless steel material (SUS316L).
- Avoid ammonia aqueous solution at a concentration exceeding 0.1 %. It might damage the plunger of the pump and shorten the service life of the plunger and the plunger seal.
- Always degas the mobile phase, as air bubbles might form during solvent mixing or during temperature or pressure changes. Air bubbles might cause pump malfunctions and detector signal noise.
- Understand the properties, including boiling points, firing points, and viscosities, of the mobile phase.
- When a PDA or UV detector is used for high-sensitivity analysis, be sure to use HPLC-grade mobile phases that have a low absorptivity of UV rays.

Precautions When Using a Buffer Solution

Tubing for Use with a Buffer Solution

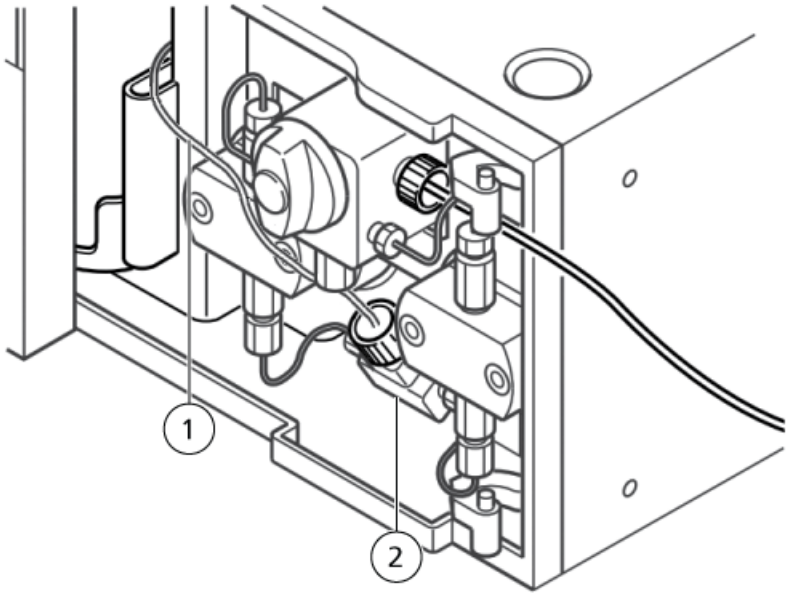
When the low-pressure gradient analysis is performed using organic solvent with buffer solution in high concentration, salt might be precipitated at the interface between organic and buffer solutions, especially under high organic ratio. This might cause a pumping malfunction.

For the following buffer solutions, we recommend the use of the OUTLET TUBE LPGE, 465MM, supplied with low-pressure gradient unit, instead of the standard tube, which is mounted between the outlet of the solenoid valves and the inlet of the pump:

- Potassium phosphate buffer at over 10 mmol/L
- Sodium phosphate buffer at over 50 mmol/L
  Potassium salt has a greater tendency to precipitate than sodium salt. However, precipitation also depends on the property or the concentration of the organic solvent.

Internal volume from mixing point of solvents to inlet check valves of a pump increases with the longer tube. This might stimulate deposited salt to re-dissolve and reduce the risk of pumping problems. However, the gradient delay volume rises by approximately 160 mL, because the accessory tube is 465 mm while the length of the standard tube is 230 mm.

Figure 5-1 Inlet Tubing



Item	Description
1	Inlet tubing
2	Inlet block

Rinse the Gradient Valve after Using a Buffer Solution

If a mobile phase that could potentially cause precipitation is used, such as a phosphate buffer solution, it might precipitate a salt if the mobile phase dries out or is mixed with an organic solvent. Depending on the precipitated salt crystal, it could shorten the life of the gradient valve or delivery unit consumables.

If such a mobile phase is being used for analysis, then on a regular basis (about once a week), purge all ports (A, B, C, and D) with HPLC-grade water and then set the concentration for each port (A, B, C, and D) to 25% and rinse the flow lines by flushing them for at least 30 minutes at a flow rate of 1.0 mL/min, either with the column disconnected or the drain valve open.

If the system will not be used for an extended period, rinse all the ports with water using the same procedure.

Select a Rinse Solution

CAUTION: Potential Wrong Result. Be sure to turn on the degasser when using the LC system. Air bubbles in the rinse solution pipe during sample injection decrease accuracy.

Select the rinse solution appropriate to the mobile phase.

Reversed Phases, Ion Exchanges, and Aqueous Normal Phases

Use a 1:1 methanol:HPLC-grade water solution, except under these conditions:

- If the solution precipitates salt when coming into contact with the sample, then use a solution that is similar in composition to the mobile phase and that does not contain salt.
- If the component to be analyzed tends to cause the sample to remain on the outside of the needle (for example, if it is an acidic, basic, or ionic material), then use the following rinse solutions:
  - Organic solvents, including methanolor acetonitrile, with an acid such as formic acid or acetic acid added.
  - 0.1% trifluoroacetic acid (TFA) aqueous solution or organic solvent solution, or a mixture of the two.

Non-aqueous Normal Phases and GPC

Use the same rinse solution as used for the mobile phase.

When the target compound is an acid, base, or ionic substance, and rinse mode is required, use a 0.1% TFA aqueous solution, an organic solvent solution, or a mixture of both.

Guidelines for Using High Concentrations of Volatile Acids

If the rinse solution contains high concentrations of volatile acids (formic acid or acetic acid at a concentration exceeding 1% or trifluoroacetic acid [TFA] at a concentration exceeding 0.1%), then volatile components generated during lengthy serial analyses might cause the metal parts inside the module to rust, resulting in malfunctions. Follow these guidelines when using high concentrations of volatile acids:

- Avoid using acid solutions with concentrations exceeding the following concentrations by diluting before use:
  - Formic acid and acetic acid solution at a concentration exceeding 1%
  - Trifluoroacetic acid (TFA) solution at a concentration exceeding 0.1%
- After the analysis finishes, replace the rinse solution with a liquid that does not contain acid, such as HPLC-grade water or methanol, and then remove the sample racks to ventilate the inside of the module.
- After the analysis finishes, keep the Z mount waiting in a position away from the rinsing port.
  Rinse solution always accumulates at the rinsing port and its volatilized acid is at a high concentration, especially around the rinse port. When the needle is inserted in the injection port, the Z mount is in the closest position to the rinsing port, which might cause the motor of the Z mount to rust.

Guidelines for Using a Buffer Solution

When a buffer solution is used as the mobile phase, tubes might become clogged, depending on the buffer solution used. Follow these guidelines:

- During autosampler injection, the rinse solution and the mobile phase are mixed in the tubing between the high-pressure valve and the low-pressure valve. Verify that no salt is precipitated when the rinse solution and the mobile phase are mixed.

- To prevent precipitation of salt, when using a buffer solution with a concentration exceeding 50 mmol/L, keep the concentration of organic solvent in the rinse solution to 50% or less.
  After injection of the sample, flow lines indicated by solid lines in *Figure 5-2* are filled with rinse solution. Flow lines indicated by dotted lines are filled with mobile phase. Before sampling, the high-pressure valve rotates and a portion of mobile phase compressed by high pressure is pushed through high-pressure valve ports 4 and 5 , as well as 1 and 6, as shown in *Figure 5-3*. Depending on the pumping pressure, rinse solution and the mobile phase might be mixed in the are inside the circle in *Figure 5-3*, and depending on the pumping pressure, which might result in salt deposits.

Figure 5-2 Rinse Step A

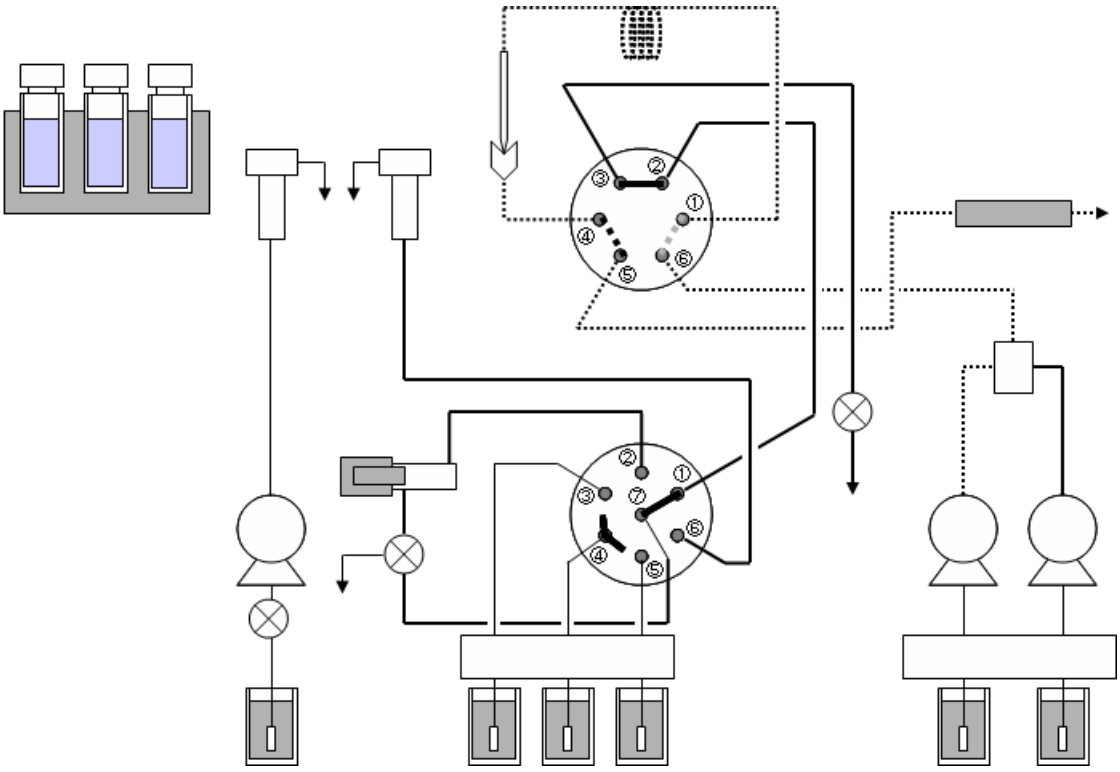
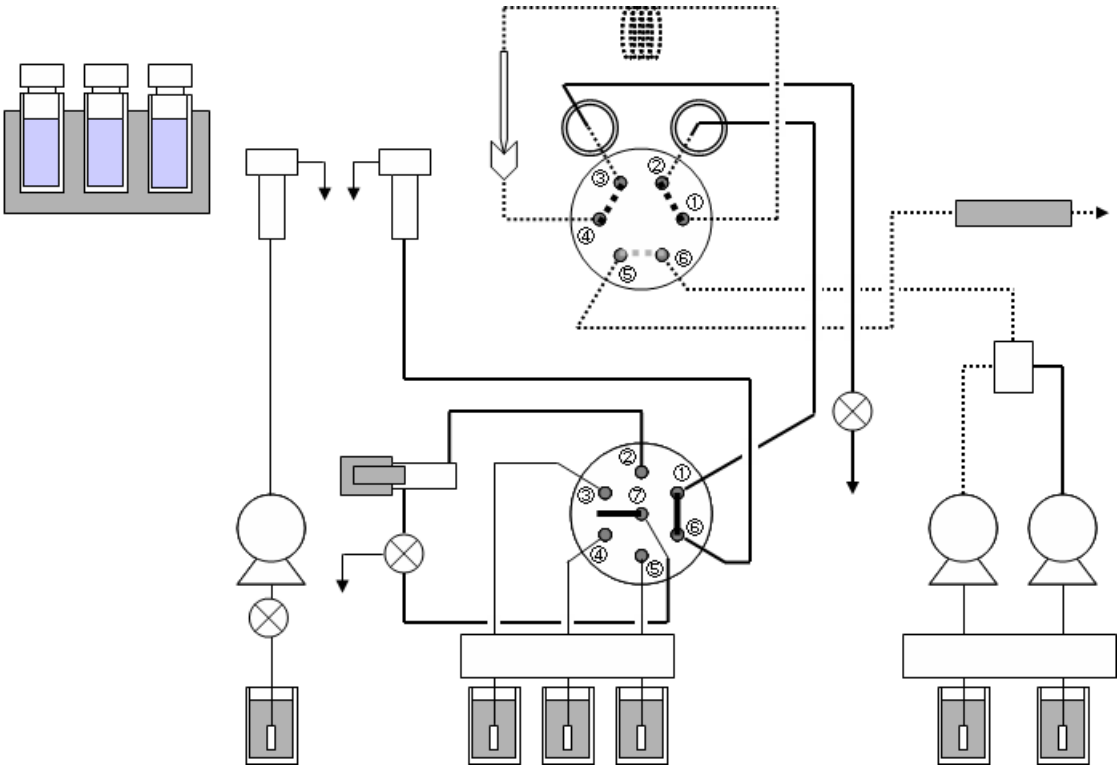


Figure 5-3 Rinse Step B



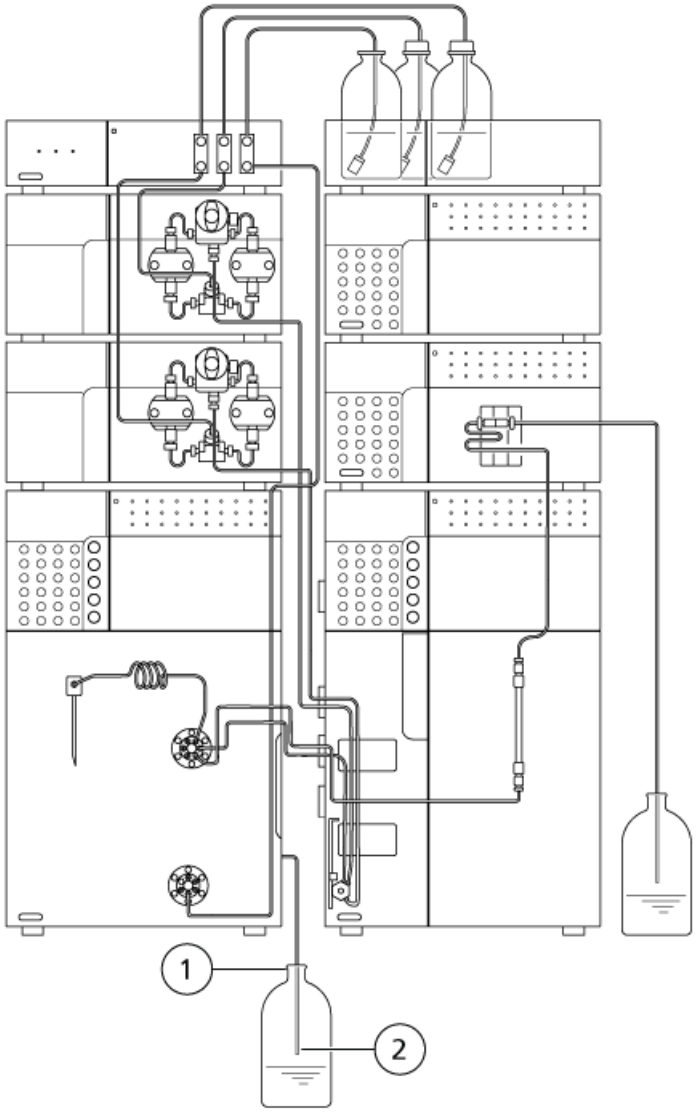
Prepare the Reservoir, Rinse, and Waste Container

WARNING! Toxic Chemical Hazard. Do not use cracked or damaged containers.

WARNING! Toxic Chemical Hazard. Install the waste container lower than the instrument (for example, on the floor). If the container is higher than the instrument, then the liquid will not drain and it will leak from the connections.

- Make sure that the drain tubing is attached in the way shown in *Figure 5-4*. The upper outlet is for the rinse solution, the center outlet is for condensation, and the lower outlet is for liquid leaked inside the equipment. Attach a drain tubing adapter (accessory) to the mouth of the waste container, and then make sure that the tip of the drain tubing connected to the rinse solution outlet is not immersed in the waste. If the tip of the drain tubing is immersed in the waste, then the waste solution might flow inside the module and might damage the module.

Figure 5-4 Waste Container



Item	Description
1	Attach the drain tubing adapter
2	Make sure that the tip of the drain tubing is not immersed in the waste.

Install the Column

Columns of up to 4.6 mm i.d. can be used.

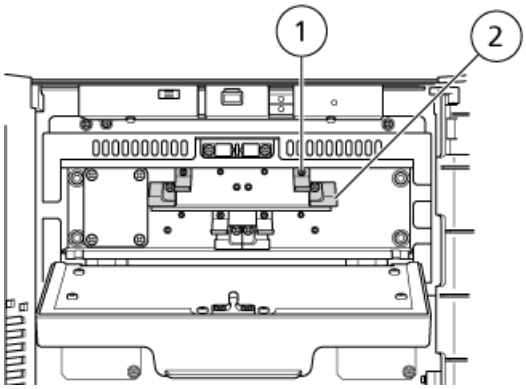
WARNING! Hot Surface Hazard. Do not open the column oven door if the high temperature lamp is blinking. The internal temperature of the column oven is (60 °C or greater).

WARNING! Crushing Hazard. Be careful not to pinch fingers when opening the doors.

1. Open the right, left, and internal doors.
2. Adjust the column block position.

   - If the column length is 120 mm to 150 mm, then attach the two column blocks and two clips for both ends of the heat block using the screws.

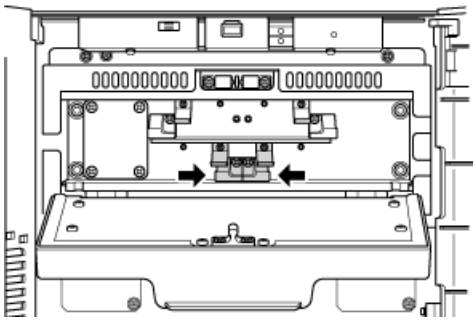
Figure 5-5 Column Block Position, 120 mm to 150 mm Column



Item	Description
1	Clip
2	Column block

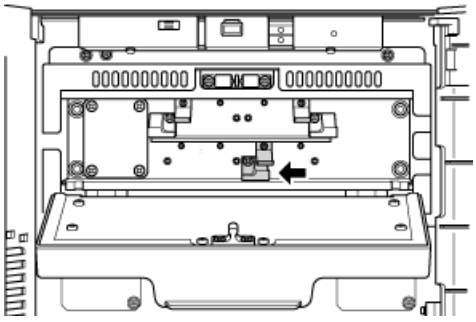
- If the column length is 60 mm to 120 mm, then attach two column blocks and two clips to the center of the heat block using the screws.

Figure 5-6 Column Block Position, 60 mm to 120 mm Column



- If the column length is 30 mm to 60 mm, then attach one column block and one clip to the right in the center of the heat block using the screws.

Figure 5-7 Column Block Position, 30 mm to 60 mm Column

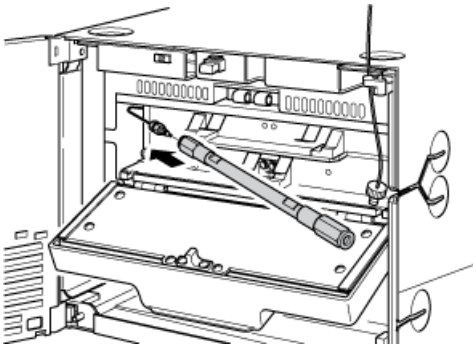


3. Confirm the direction of flow for the column, and then connect the outlet tubing from the pre-heater to the column inlet. Use the UHPLC fitting attached to the oven.

   Before performing analysis, make sure that there are no leaks.

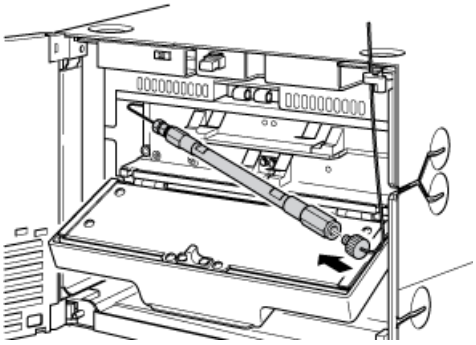
Note: Before beginning analysis, make sure that there are no leaks. If there is a leak, then tighten the column and tubing connections.

Figure 5-8 Connecting the Column Inlet Tubing



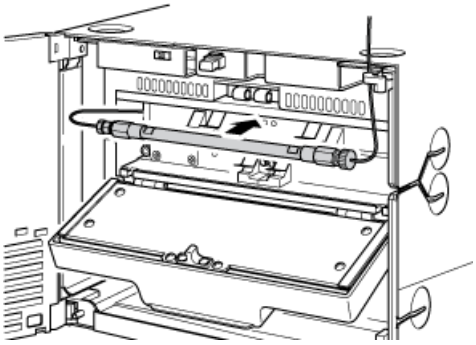
4. Connect the tubing from connected to the detector to the column outlet.

Figure 5-9 Connecting the Column Outlet Tubing



5. Secure the column with the column block and clip in the heat block of the column oven.

Figure 5-10 Securing the Column to the Column Oven



Turn on the System

Turn on the Pump

Prerequisites
• Make sure that the power cable is plugged in to the AC mains supply. If it is not, make sure that the pump is turned off, and then plug it in.

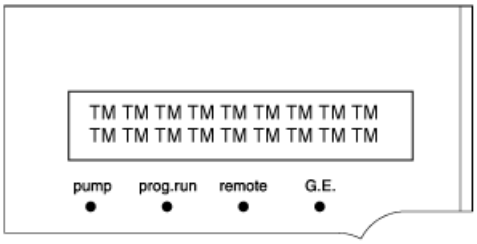
- Press the power switch to turn on the pump.

Figure 5-11 Power Button

The following events occur:

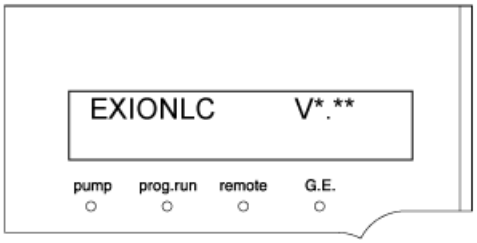
a. All of the dots in the status panel screen and all of the LEDs illuminate.

Figure 5-12 Status Screen: Initial



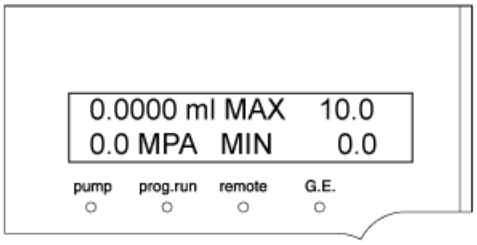
b. The memory is automatically tested, and after the memory check passes, the version number of the control program is shown briefly. The following figure shows the version as V * . **.

Figure 5-13 Status Screen: Control Program Version



c. The status indicator turns green and the LC pump is operable.

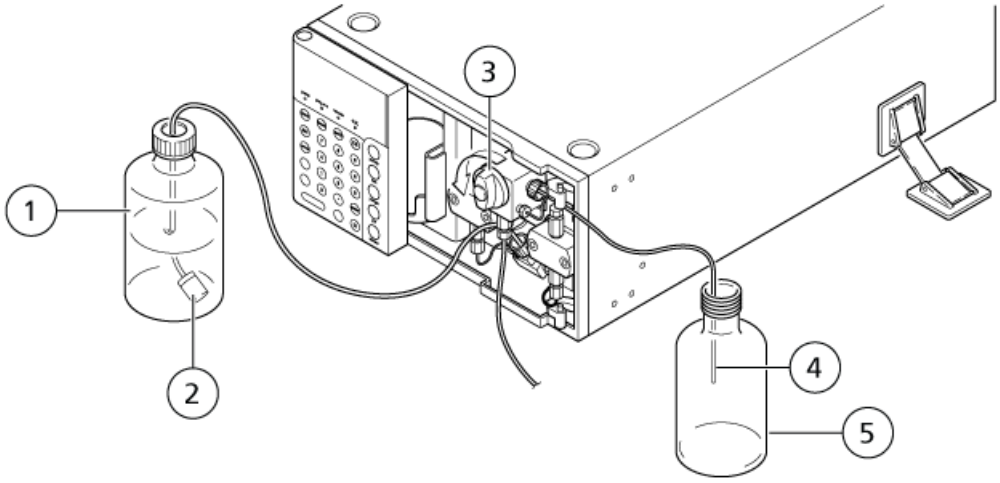
Figure 5-14 Status Screen: System in Operation



Purge the Pump

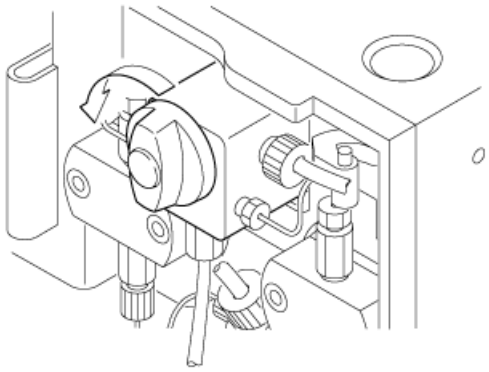
1. Pour mobile phase in the reservoir, and then put the suction filter inside the reservoir. The end of the drain tubing should be in the waste container, which is placed on the floor.

Figure 5-15 Verifying Pump Pressure



2. To open the drain valve, turn the drain valve knob 180 degrees counter-clockwise.

Figure 5-16 Opening the Drain Valve

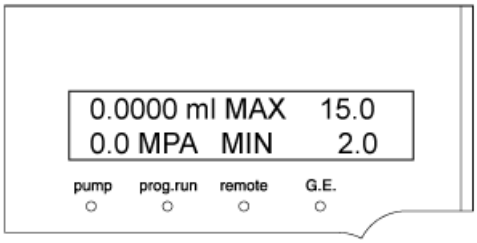


Note: If the drain valve knob is turned more than 180 degrees, then any mobile phase that drains out might contain air bubbles. This is normal.

3. Press **CE** to return to the initial screen.
4. Make sure that the pressure value shown on the screen is in the range of –0.3 to 0.3 MPa.

Note: If the pressure is not correct, then zero the value of the pressure sensor with **ZERO ADJ** function.

Figure 5-17 Status Screen: Pressure



5. Make sure that the pressure upper and lower limits are appropriate values.
6. Press **purge**.

Note: Normally, pumping begins at the set flow rate as soon as **purge** is pressed. But in the following situations, pumping is initially carried out at low speed (for a few seconds) to detect the pump home position, before rising to the set flow rate:

- **purge** is pressed for the first time after the power is turned on.
- **purge** is pressed for the first time after a pressure upper limit of 22 MPa or more has been activated.

Pumping begins at a registered flow rate.

7. Observe the mobile phase that flows from the end of the drain tubing for about 10 seconds. The mobile phase should flow continuously and be free of air bubbles.
8. Press **purge**.

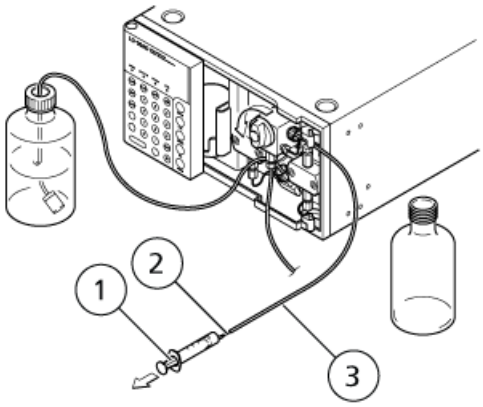
Note: If the flow of mobile phase starts and stops repeatedly in synchronization with pumping, then there are probably air bubbles in the pump heads. Press **purge**.

WARNING! Toxic Chemical Hazard. When injecting the solvent with a syringe, hold the needle and tubing attached to the syringe tightly. Otherwise, the solvent might splash.

WARNING! Puncture Hazard. Take care when handling the syringe. The tip of the syringe is extremely sharp.

Note: If no mobile phase emerges, attach the syringe needle to the disposable syringe (provided), insert the tip of the needle into the end of the drain tubing, and then draw the mobile phase through the tubing.

Figure 5-18 Purging Manually



Item	Description
1	Disposable syringe (25 mL)
2	Syringe needle
3	Syringe tubing

Tip! If this procedure is not effective, then follow these steps:

a. Unplug the PTFE tubing connected to the malfunctioning side of the inlet check valve.

b. Plug this PTFE tubing with the provided "Stop joint D" to stop the mobile phase from leaking.

c. Open the drain valve.

d. Connect the provided "Syringe tubing D" and then inject solvent such as isopropanol into the inlet check valve.

The pump stops and the pump LED goes out.

9. Press **purge**.

   The pump stops and the pump LED goes out.

Set the Pump Flow Rate

1. Turn on the pump, or press **CE** until the initial screen is shown.
2. Press **func**.

   The cursor blinks, prompting for a new value.
3. Type the new value using the keypad and then press **enter**.

   The new value is set, and the initial screen is shown.

Tip! To change other parameters, press **func**. Pressing **func** accesses the items in the following sequence: flow (press) > P.max > P.min. When an item is accessed, the cursor blinks, prompting for input.

4. Press **CE** to return to the initial screen.
5. Press **func** until PARAMETER is shown, and then press **enter**.
6. Press **func** until COMP is shown.
7. Set the compressibility value.

Set the Maximum Pressure Limit

Set a maximum limit to protect the column and other flow line components. If pressure exceeds the maximum limit, pumping stops automatically, an alarm sounds, and an error message is shown on the status panel screen.

1. On the initial screen, press **func** twice.

   The cursor moves to the P.MAX field.
2. Use the keypad to type the new pressure value and then press **enter**.

   The maximum pressure is 130 MPa.

Set the Minimum Pressure Limit

Set the minimum pressure limit to prevent a pressure drop, which can occur as a result of the following situations:

- When the mobile phase runs out and air is pumped through the flow lines.
- When a leak occurs in the flow lines.

If the pressure drops to less than the minimum pressure limit and remains below the limit for more than 1 minute, pumping stops automatically, an alarm sounds, and an error message is shown on the status panel screen.

1. On the initial screen, press **func** three times.

   The cursor moves to the P.MIN field.

2. Use the keypad to type the new pressure value and then press **enter**.

   When P.MIN is set to 0, pumping does not stop automatically, and the alarm does not sound if the pressure drops.

Turn on the Autosampler

Prerequisites
• Make sure that the power cable is plugged in to the AC mains supply. If it is not, make sure that the autosampler is turned off, and then plug it in.

1. Press the power switch to turn on the autosampler.

Figure 5-19 Power Button

The following events occur:

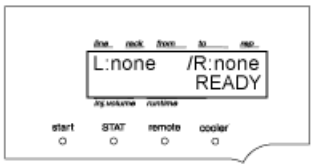
a. All of the dots in the status panel screen and all of the LEDs illuminate.

b. The system performs a memory test.

c. The version number of the control program is shown and the status indicators turns green.

d. The needle goes to the standby state and the initial screen is shown.

Figure 5-20 Initial Screen



Note:

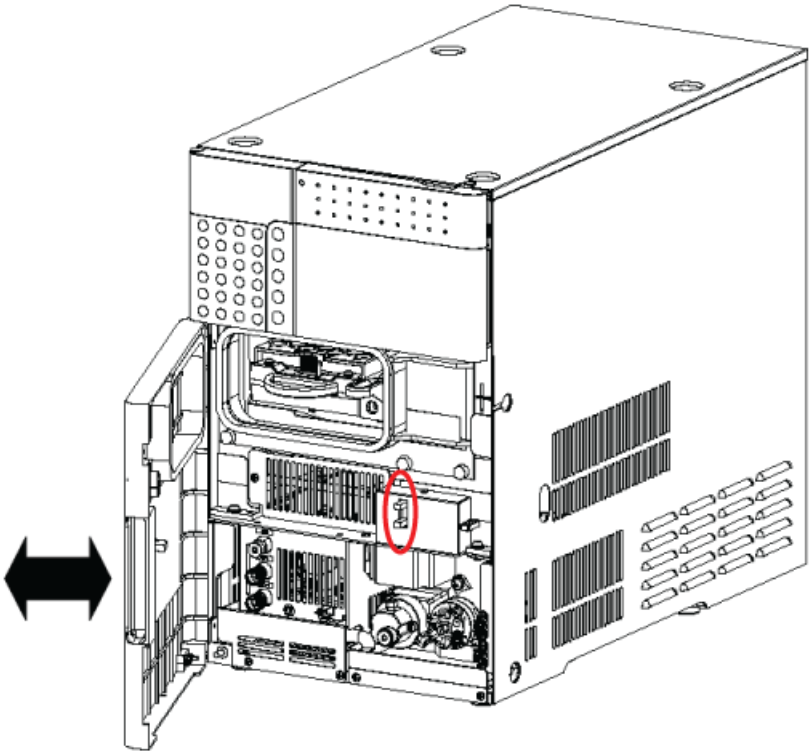
- If there is a large amount of data to be backed up, for example, if there are many lines set in the sample table, then it might take some time before initialization starts.
- If an error is detected, then an alarm sounds and an error message is shown.

2. Verify that the photo door sensor is operating by opening the door.

   The message, DOOR IS OPEN is shown on the status panel screen.

3. Close the door.

Figure 5-21 Photo Sensor



The message, READY is shown on the status panel screen.

Turn on the Column Oven

Prerequisites
• Make sure that the power cable is plugged in to the AC mains supply. If it is not, make sure that the column oven is turned off, and then plug it in.

- Press the power switch to turn on the column oven.

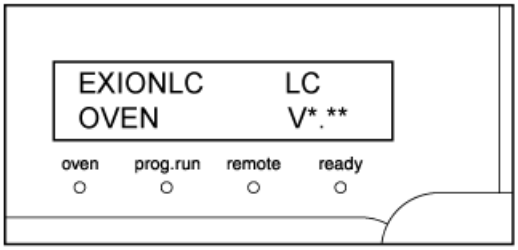
Note: Power cannot be turned on or off if the left door is open.

When the power is turned on, the following sequence of events occurs:

- All of the dots in the status panel screen and all of the LEDs illuminate.

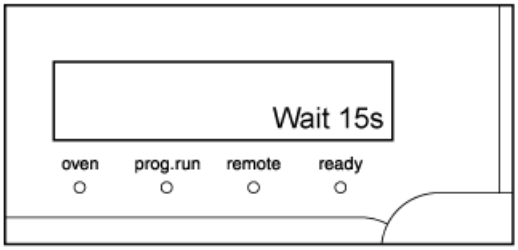
- The unit memory is automatically verified and the contents are shown on the screen. [V* **] in the example screen shows the ROM version.

Figure 5-22 Status Panel Screen: Startup



- The **WAIT** time is shown. The time counts down in decrements of 1 second from 15 seconds.
- If no error has been detected at the end of the 15-second WAIT time count, then SET, ACTUAL, and T.MAX values are shown.

Figure 5-23 Status Panel Screen: Wait Time



Note:

- The **SET** and **T.MAX** values on the initial screen are those set the last time the oven was used.
- The actual temperature is the current temperature inside the column oven.
- If an error is detected, then an alarm sounds and an error message is shown.

Setting Operating Temperature

The operating temperature is the temperature set for the column oven during operation. The initial setting for this temperature is 40 °C, but the setting can be modified.

Note: The temperature can be set to 5 °C or more above room temperature. For example, if room temperature is 27 °C, set a value of 32 °C or higher. If the temperature is too low, the message, SET TEMP. ERROR is shown.

1. From the initial screen, press **func** and then press **enter**.

   Tip! Alternatively, press **temp** to show the operating temperature setting screen.

   The operating temperature setting screen is shown.

2. Set the temperature with the numeric keypad, and then press **enter**.

   The valid temperature range is 4 °C to 150 °C.

   Tip! The temperature set here is shown as the set temperature on the initial screen. This setting remains in memory when the power is turned off.

3. Continue with *Setting Upper Temperature Limit (T.MAX) on page 82*.
4. Press **CE** twice to return to the initial screen.

Setting Upper Temperature Limit (T.MAX)

The temperature limit is the temperature above which the column oven interior must not rise. If the temperature reaches the value set for this parameter, then operation stops. The initial setting for this limit is 90 °C.

CAUTION: Potential System Damage. Do not set the upper temperature limit to a value higher than the upper temperature limit supported by the column.

1. From the initial screen, press **func** twice and then press **enter**.
2. Set the temperature with the numeric keypad and then press **enter**.

   The valid temperature range is 4 °C to 150 °C.
   The temperature set here is shown as the upper temperature limit on the initial screen. The setting remains in memory when the power is turned off.

3. Press **CE** twice to return to the initial screen.

   Note: If the upper temperature limit is exceeding during temperature regulation this message is shown: ERR OVER T.MAX. Temperature regulation is stopped.

Set the Temperature Compensation Flow Rate

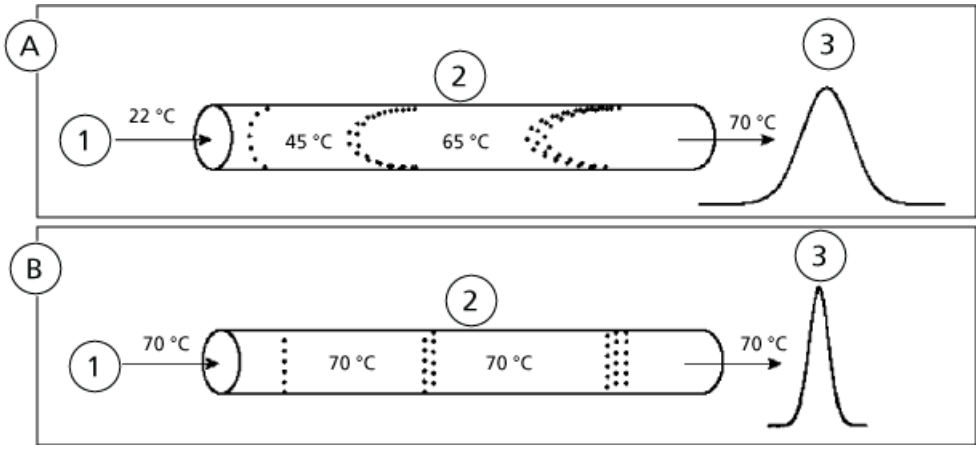
The temperature compensation flow rate is the rate of flow of mobile phase in the column. When this value is set, the operating temperature is adjusted to keep the temperature in the column constant.

If a high temperature value is set for column temperature control, a temperature gradient occurs inside the column, which could result in broad peaks or peak distortion. In such a case, preheating of the mobile phase is necessary.

To preheat the mobile phase efficiently, the preheating level is changed according to the flow rate of mobile phase. As a result, a uniform temperature distribution is obtained at any location inside the column.

The more uniform temperature distribution can be obtained by the setting of temperature compensation specified by the flow rate.

Figure 5-24 Temperature Compensation without Preheating (A) and with Preheating (B)



Item	Description
1	Mobile phase temperature
2	Column oven temperature
3	Peak

1. From the initial screen, press **func** three times and then press **enter**.
2. Set the temperature with the numeric keypad and then press **enter**.

   The valid temperature range is 0 mL/min to 10 mL/min.
   The setting remains in memory when the power is turned off.
3. Press **CE** twice to return to the initial screen.

Start Column Oven Operation

1. Press **oven**.

   The **oven** LED illuminates, and the oven starts operation. When the temperature becomes stable at 55 °C, the **ready** LED illuminates. If the room temperature is 15 °C to 30 °C, this should take less than 5 minutes.
2. Make sure that the **ready** LED illuminates after the column ovens interior temperature has stabilized.

WARNING! Hot Surface Hazard. Beware of burns when the oven operating temperature is high (60 °C or greater). If the manual injector is installed on the left door, remove the male nut from the column inlet before opening the door. Otherwise, when the left door is opened, the SUS tubing will pull on the column and could damage it.

CAUTION: Potential System Damage. Prevent tubing and other objects from getting through the metal grill inside the column oven. They could damage the fan.

Note: If the fan operates abnormally, this message is shown: ERR FAN.

Turn on the System Controller

Prerequisites
• Make sure that the power cable is plugged in to the AC mains supply. If it is not, make sure that the controller is turned off, and then plug it in.

Turn on the system controller after turning on all of the other modules.

1. Press the power switch to turn the pump on.

Figure 5-25 Power Button

2. Turn on the acquisition computer.
3. Start the Analyst® software. Refer to the *System User Guide* for the mass spectrometer or the *Getting Started Guide* for the Analyst® software.

Replace the Mobile Phase

Note:

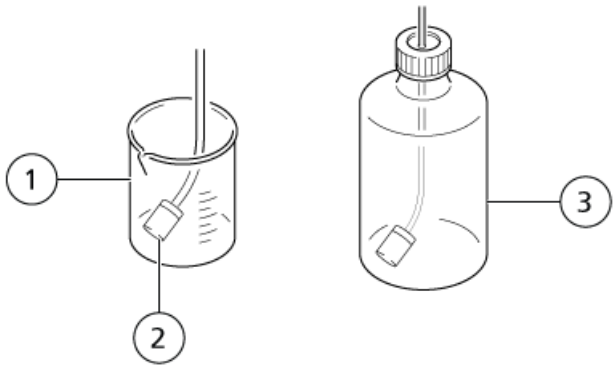
- For information on storing a used column, refer to the instruction manual provided with the column or contact the manufacturer.
- After analysis of a highly concentrated sample, thoroughly rinse the detector flow cell with mobile phase so that the sample does not remain in the flow cell. Dirt in the flow cell causes an increase in detector noise.
- If a buffer solution was used as the mobile phase, rinse the flow cell with HPLC-grade water after the analysis finishes. Dried buffer solution forms crystals, which clog the flow line, cause wear on parts, or leave residue in the flow cell.
- When replacing the mobile phase with a new mobile phase, or when mixing mobile phases, it might be necessary to replacement with another solvent first, to prevent precipitation and emulsion. For more information, refer to *Precautions when Replacing the Mobile Phase on page 89*.

Table 5-1 Examples of Solvent Combinations That Should Not be Replaced or Mixed Directly

Solvent Combination	Possible Problem	Recommended Action
Water and Mobile Phase with a Low Dielectric Constant (Hexane, Chloroform, and so on)	Emulsion and separation	Replace the solvent with isopropanol or acetone.
Buffer Solution and Organic Solvent (Methanol, Acetonitrile, Tetrahydrofuran, etc.)	Precipitation	Replace the solvent with HPLC-grade water.
Nitric Acid and Alcohol	Reaction	Replace the solvent with HPLC-grade water.

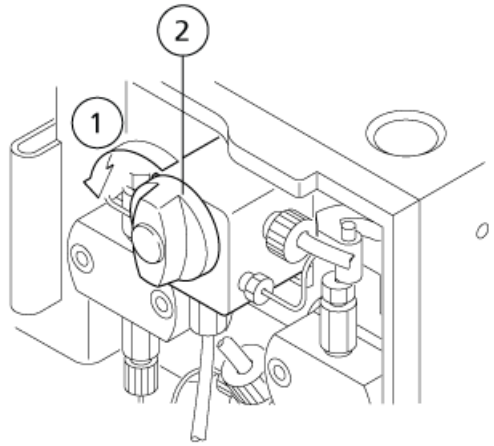
1. Pour 100 mL of the new mobile phase into a 200 mL beaker.
2. Remove the suction filter from the reservoir and then put the filter into the beaker filled with the new mobile phase in the preceding step.

Figure 5-26 Replacing the Mobile Phase



3. Shake the filter slightly to mix the mobile phases.
4. Put new mobile phase in the reservoir.
5. Remove the suction filter from the beaker and put it into the reservoir.
6. Turn the drain valve knob 180 degrees counterclockwise to open the drain valve.

Figure 5-27 Opening the Drain Valve



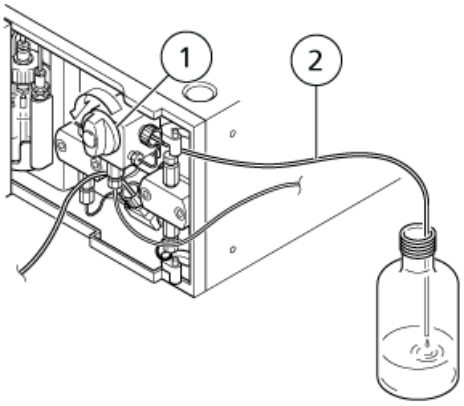
Item	Description
1	Open (counter-clockwise)
2	Drain valve knob

Note: If the drain valve knob is turned more than 180 degrees, any mobile phase that drains out might contain air bubbles. This is normal.

7. Press **purge**.

   The old mobile phase is completely expelled from the flow lines through the drain tubing.

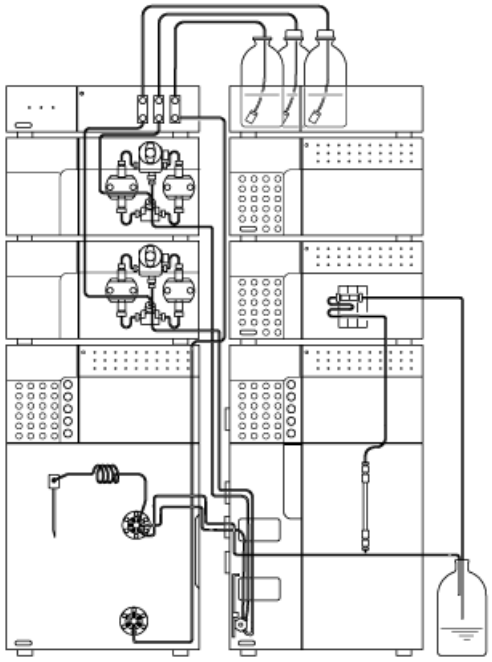
Figure 5-28 Mobile Phase Draining in to the Drain Bottle



Item	Description
1	Drain valve knob
2	Drain tubing

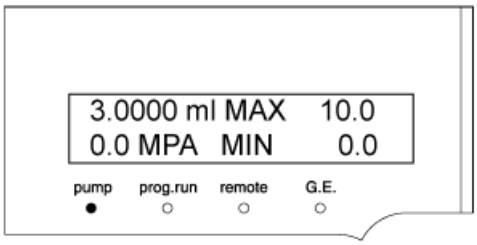
8. Disconnect the tubing.
9. Connect the autosampler outlet to the column, and then put the tubing in the reservoir.

Figure 5-29 Tubing Configuration



10. Close the drain valve. Turn the drain valve knob clockwise as far as it will go.
11. Set the flow rate to 1 mL/min to 3 mL/min.

Figure 5-30 Pump Status Panel



12. Press **pump**.

    Pumping starts, and the pump indicator illuminates.

13. Press **pump**.

    Pumping stops, and the pump indicator goes out.

14. Connect the tubing to the autosampler outlet.
15. Press **pump**.

The mobile phase in the flow line downstream of the manual injector is replaced.

Note: Set the flow rate so that the pressure is lower than the maximum column pressure.

Precautions when Replacing the Mobile Phase

Replace a Liquid with a Non-Miscible Solvent

Required Materials
• Intermediate rinse solution (such as isopropanol or HPLC-grade water) **Note:** Do not use water if the mobile phase is not miscible with water.

1. Replace the old mobile phase with the intermediate rinse solution.
2. Replace the intermediate rinse solution with the new mobile phase.

Replace a Buffer Solution Used as a Mobile Phase

CAUTION: Potential System Damage. After analysis using a buffer solution as the mobile phase, clear the flow line with distilled or purified water to prevent blockages in the flow line caused by crystals formed due to dehydration of the buffer solution.

Note: Use HPLC-grade water for purging. Organic solvents, such as isopropanol, might cause crystals.

Required Materials
• HPLC-grade water

1. Replace the mobile phase with the water.
2. Pump at least 200 mL of water through the system.
3. Replace the water with the new mobile phase.

Prepare the Automatic Rinsing Kit

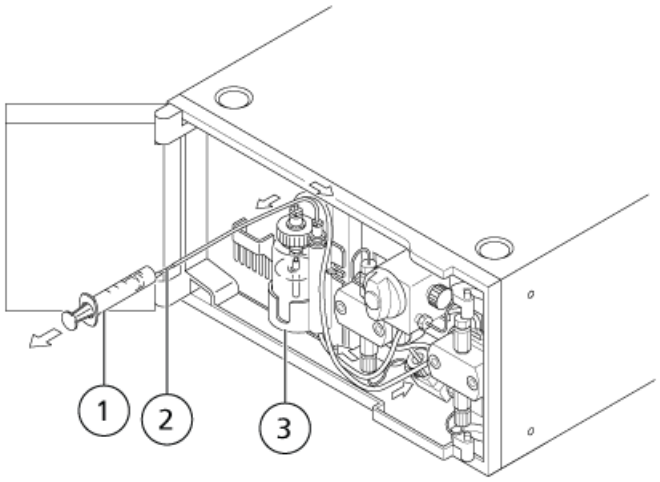
The automatic rinsing kit is a service-installable option for the HPLC pump.

CAUTION: Potential System Damage. Use distilled water as a rinse solution, to maximize the lifetime of the plunger seal.

Required Materials
• 1:9 isopropanol:HPLC-grade water • Disposable syringe with syringe needle

1. Disconnect the tubing from the automatic rinsing kit outlet on the rinse bottle.
2. Fill the rinse bottle with HPLC-grade water.
3. Draw the water into the disposable syringe, filling the rinse flow line with liquid.
4. Connect the tubing to the automatic rinsing kit outlet.

Figure 5-31 Automatic Rinsing Kit Connections



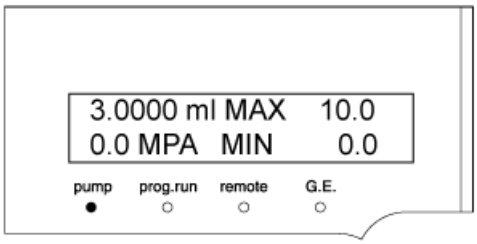
Note: Arrows show the direction of flow of the rinse solution.

Item	Description
1	Disposable syringe
2	Syringe needle
3	Rinse solution bottle

5. Set the pump flow rate to 3 mL/min.
6. Press **pump**.

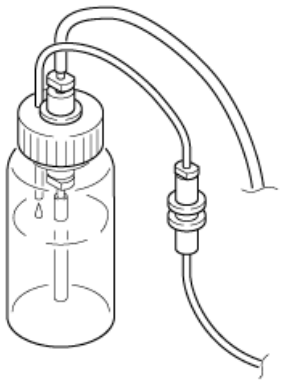
   Pumping starts and the pump LED illuminates.

Figure 5-32 Pump Status Panel



7. Make sure that liquid is emerging from the tip of the tubing connected to the automatic rinsing kit outlet.

Figure 5-33 Liquid Emerging from Tubing



8. If liquid is emerging, press **pump**.

   The pump LED goes out and the pump stops.

Manual Rinse of Seals and Plungers

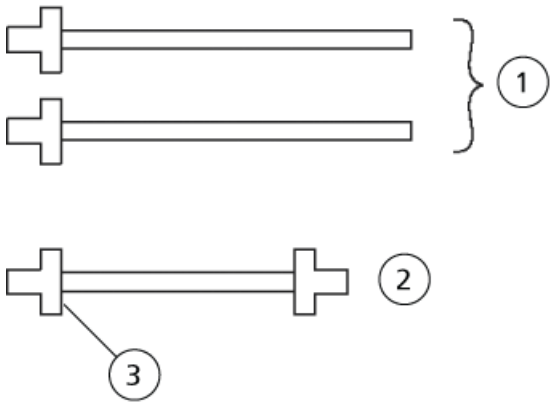
Use this procedure if the automatic rinsing kit is not installed on the HPLC pump. Following are some suggested manual rinse cycles:

- Phosphoric acid buffer solution (low concentration): Several times a day.
- Boric acid buffer solution (low concentration): Frequently during the day.
- Use an automatic rinsing kit for ammonium sulfate (high concentration).

Tip! Manual rinsing can be performed regardless of whether the pumps are running.

1. Cut the transparent tubing (both provided as accessories) to appropriate lengths.
2. Insert the tubing joint into the transparent tubing cut off in the previous step, as shown in *Figure 5-34*.

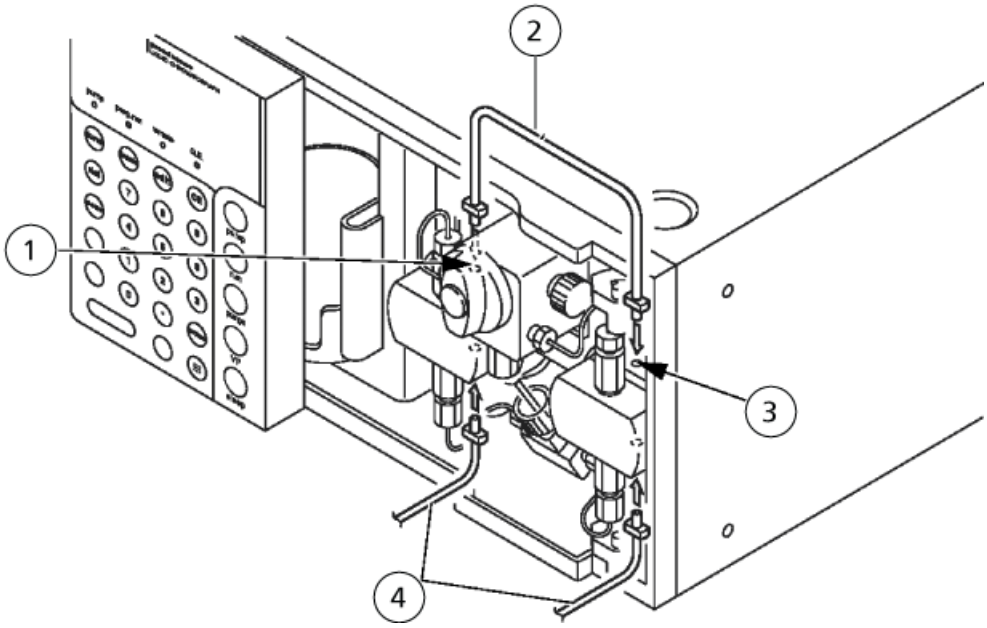
Figure 5-34 Transparent Tubing



Item	Description
1	Rinsing tubing (1)
2	Rinsing tubing (2)
3	Tubing joint

3. Connect the rinse solution outlet of the head holder on the left and right using rinse tubing (2).

Figure 5-35 Connecting the Rinse Tubing



Item	Description
1	Left rinse solution outlet (head holder)
2	Rinse tubing (2)
3	Right rinse solution outlet (head holder)
4	Rinse tubing (1)

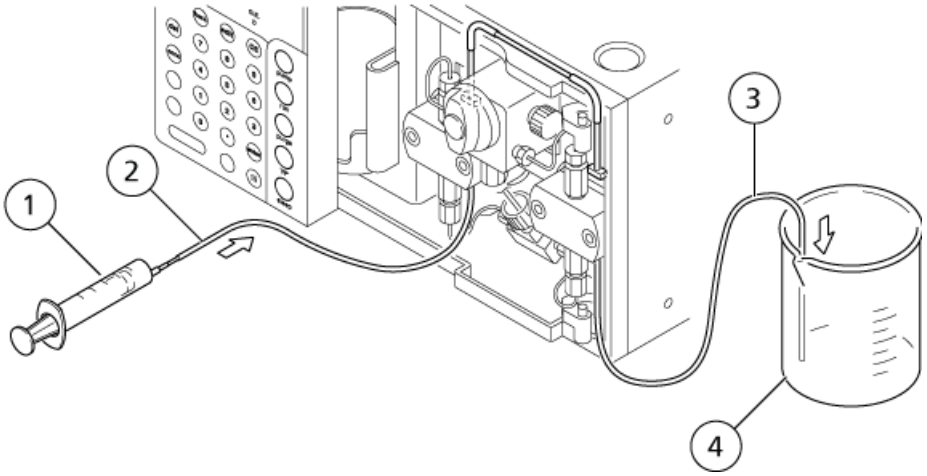
4. Connect rinse tubing (1) to the left rinse-tubing inlet and then connect the disposable syringe (accessory).

WARNING! Puncture Hazard. Take care when handling the syringe. The tip of the syringe is extremely sharp.

Tip! Attach a syringe needle to the tip of the disposable syringe before use.

5. Connect rinse tubing (1) to the right rinse-tubing inlet and then insert the end of the tubing into a beaker.

Figure 5-36 Connecting the Rinse Tubing (continued)



Item	Description
1	Disposable syringe
2	Left rinse tubing inlet
3	Right rinse tubing
4	Container (beaker)

6. Remove the disposable syringe from the rinse tubing.
7. Draw rinse solution into the disposable syringe and then reconnect it to the rinse tubing.
8. Inject rinse solution into the rinse flow line using the disposable syringe.

Prime the System

CAUTION: Potential System Damage. Do not deliver pressurized solvent to the degassing unit. Doing so could damage the degassing unit.

1. Turn on the power switch of the LC pump. The vacuum pump inside the degasser starts running and the **Control** LED on the front panel of the degasser illuminates.

Note:
The LED changes as follows after the power supply is turned on.:

- Red LED flashes

  As soon as the power is turned on, the pressure in the vacuum lines is reduced to the set upper pressure limit. If the specified vacuum pressure is not reached within 10 minutes, the red LED illuminates and the degasser stops due to an error.

- Green LED stays illuminated

  The vacuum lines are being controlled at the control pressure. (This indicates that the degasser is ready to operate.)

- Red LED stays illuminated

  The degasser is stopped due to an error because the specified vacuum pressure is not attained. Refer to *Degasser Issues*.

The LED changes as follows after the green LED stays illuminated:

- Red LED flashes

  The specified vacuum pressure is not reached. If this condition continues for 6 minutes, the red LED illuminates and the degassing unit stops due to an error.

- Red LED stays illuminated

  The degasser is stopped due to an error because the specified vacuum pressure is not reached. Refer to *Degasser Issues*.

2. Prepare the mobile phase to be used and connect the degassing unit, the LC pump, and the reservoir. Refer to *Degasser*.

WARNING! Puncture Hazard. Take care when handling the syringe. The tip of the syringe is extremely sharp.

3. Connect the disposable syringes provided with each LC pump to the drain outlet of the LC pump.
4. Open the LC pump drain valves. Slowly draw the solvent into a disposable syringe.

   - For more information, refer to *Purge the Pump on page 74*.
   - When drawing the solvent into the syringe, pull it slowly so that the flow rate is 10 mL/min or less. If the solvent is drawn at a high flow rate, then the degassing membrane might be overloaded, resulting in damage to the degassing chamber.

5. Remove the disposable syringe from the drain tubing, put the end of the drain tubing into the waste container, and then purge the LC pump.

Note: If a low-pressure gradient unit is connected, then turn on the solenoid valve A to D in order and repeat step *4* and step *5* for each flow line of the solenoid valve.

6. Close the drain valve.

Purge the Autosampler

Air bubbles are likely to occur in the tubing when the autosampler has been inactive for a prolonged period or when the room temperature changes. Air bubbles inside the flow lines adversely affect sample injection precision. Use a degasser and connect the degasser to the low pressure valve port No. 4 with stainless tubing.

Before starting analysis, purge the air bubbles.

Also, purge the autosampler when:

- The autosampler has not been used for a long period.
- The rinse solution has been changed.
- The room temperature has changed.

Note: When replacing the solvent with an incompatible solvent, first replace with a compatible solvent as an intermediate rinse solution before replacing with the required solvent. Refer to *Replace the Mobile Phase on page 85*.

1. Press **CE** to show the initial screen.

Note: When the RINSE SPEED is 35 µL/s, the purging flow rate is about 1.0 mL/min. We recommend that the PURGE TIME be set to 25 min to replace the solvent in the flow line completely.

2. Use a manual syringe and draw three types of rinse solution into the flow line.
3. To purge with three types of rinse solution, set RINSE SPEED to **2** (internal/external rinsing of the needle).
   a. Press **CE**.
   b. Press **func**.
   c. On the keypad, press **2**, and then press **enter**.
4. Press **purge**.

   Rinse solution is applied to purge the flow lines.

Note:

- To stop purging in mid-operation, press **purge** again. Purging stops as soon as the pump has discharged all of its rinse solution.
- If the rinse solution flow line is connected to a degasser with a large internal capacity, then the whole flow line might not be filled with rinse solution with one purge operation. In this case, repeat the purge operation two or three times until rinse solution is discharged from the drain outlet.

5. Set the **RINSE TYPE** to the appropriate value for analysis.

Value	Description
0	No rinsing
1	Perform external rinsing of the needle (default)
2	Perform internal/external rinsing of the needle
3	No rinsing (fast)

Prepare the Sample

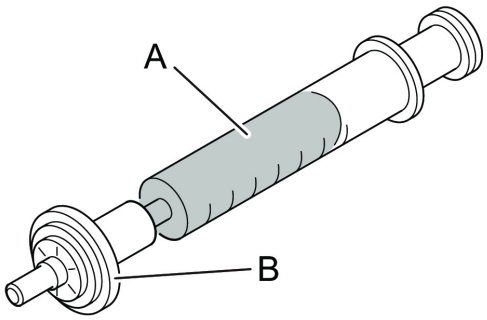
Put the Sample In a Sample Vial

CAUTION: Potential System Damage. Filter the sample in advance using a membrane filter (0.45 µm or less) to remove solid matter and insoluble materials, including dust. Solid matter and insoluble materials such as dust in the sample can cause the flow lines for the needle, needle seal, high-pressure valve stator and rotor, the outlet tubing of the module outlet tubing, and so on, to clog. Also, it might damage the sliding surfaces of the stator and rotor of the high-pressure valve, resulting in liquid leakage in a short period of time.

CAUTION: Potential System Damage. Dilute high viscosity samples before use. High viscosity samples might not be aspirated properly according to the set injection volume. In such cases, use the sample at low concentrations or set a smaller sample aspiration rate.

1. Completely dissolve the sample (A) with a solvent equivalent in composition to the mobile phase.

Figure 5-37 Sample and Membrane Filter



2. Filter the sample through the membrane filter (B).

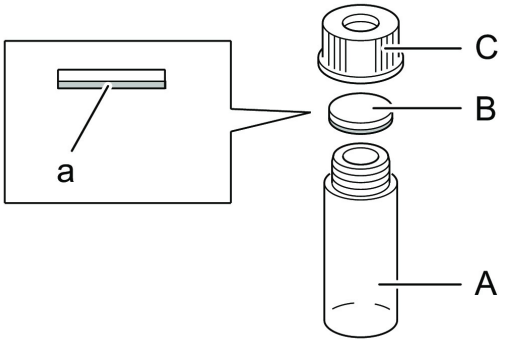
CAUTION: Potential System Damage. When using a sample vial, attach the cap with the PTFE surface of the silicone septum turned down (turned to the liquid side). If the PTFE surface is turned up, the sample solvent might melt the silicone rubber.

CAUTION: Potential System Damage. Use a genuine SCIEX septum. If the septum is not a genuine part, the flow line might be clogged with septum shavings or the needle might not be able to penetrate the septum.

3. Fill the sample vial (A) or the well of the microtiter plate or deep-well plate with the sample.

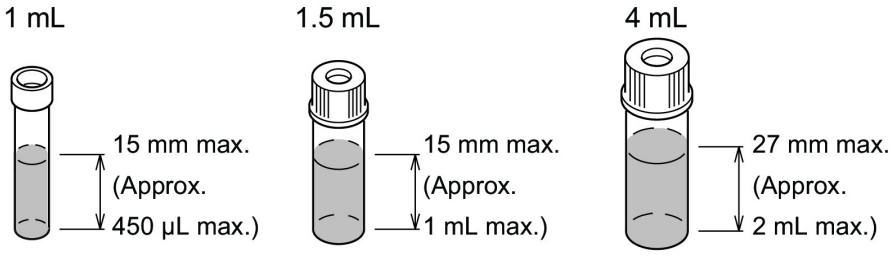
Note: When using a sample vial, attach the cap (C) with the PTFE sheet surface (a) (deep color) of the septum (B) turned down.

Figure 5-38 Sample Vial



Note: When the sample is cooled, the liquid level should be as indicated in the *Figure 5-39*. If it is higher, then the sample might not be sufficiently cooled.

Figure 5-39 Liquid Level



Put the Sample in the Autosampler (Using Sample Racks)

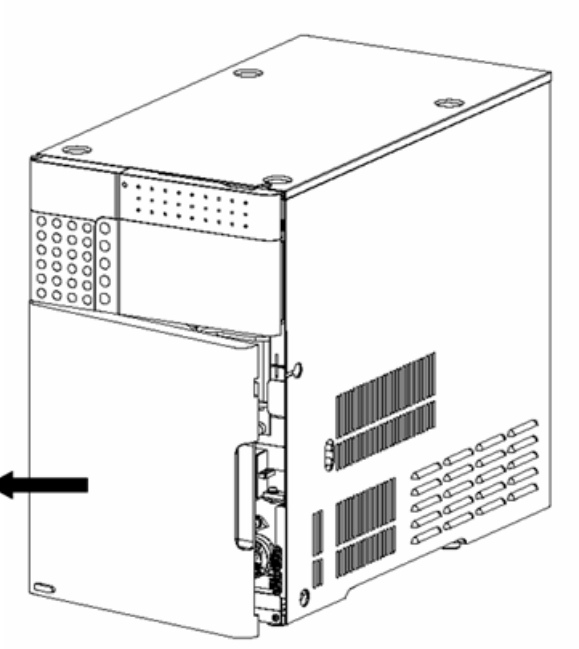
For information about using a rack changer, refer to the *ExionLC™ Rack Changer Operator Guide*.

Note: Condensation might occur if the door is left open while the cooler is performing temperature regulation. Also, when using the door sensor, the autosampler does not operate if the front door is open.

Note: The upper surface of the rack is marked with numbers at the vial positions. Specify these numbers when setting sample number parameters.

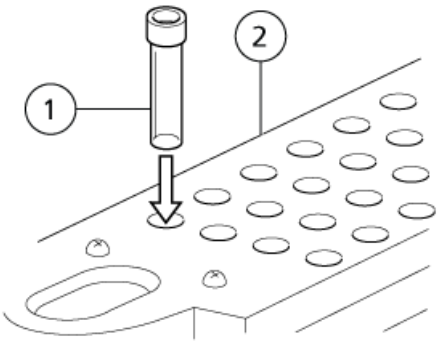
1. Open the autosampler door.

Figure 5-40 Opening the Autosampler



2. Put the vial in the sample rack with the cap facing up.

Figure 5-41 Putting the Vial In the Rack



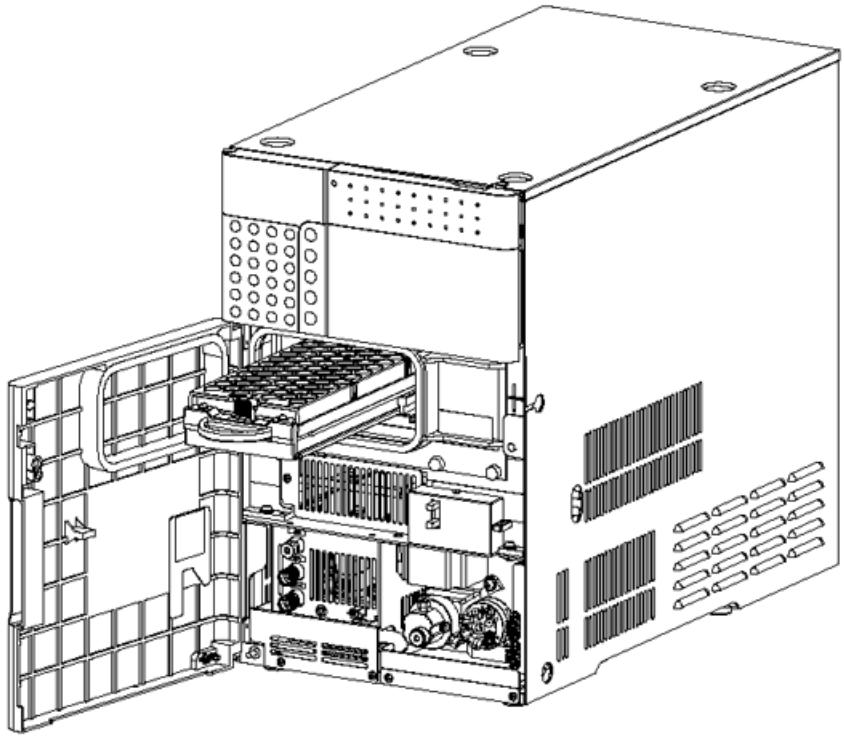
Item	Description
1	Vial
2	Sample rack

CAUTION: Potential System Damage. Insert the sample rack fully. If it is improperly inserted, the needle might pierce the wrong position and damage the instrument or become clogged. In addition, the needle might pierce the cap for the sample upon sample aspiration and cause an error.

3. Install the sample rack on the guides and then push it all the way to the back of the autosampler.

   The sample rack clicks into place when it is inserted correctly.

Figure 5-42 Installing the Rack in the Autosampler



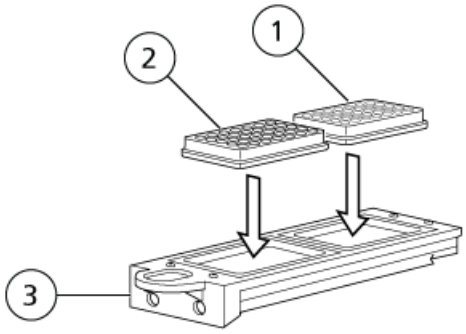
4. Close the door.

Put the Sample in the Autosampler (Using Microtiter Plates)

When a microtiter plate is used for the first time or replaced with a different type of microtiter plate (96-well, 384-well, deep well), the sampling position intervals must be calibrated. This is referred to as the teaching procedure.

1. Open the autosampler door.
2. Put the microtiter plates (MTPs) in the MTP rack. Make sure that the A1 well is at the front left.

Figure 5-43 Installing the MTPs in the Rack



Item	Description
1	Microtiter plate 2
2	Microtiter plate 1
2	MTP rack

Note: Up to two microtiter plates can be used.

3. Install the MTP rack on the guides and then push it all the way to the back of the autosampler.

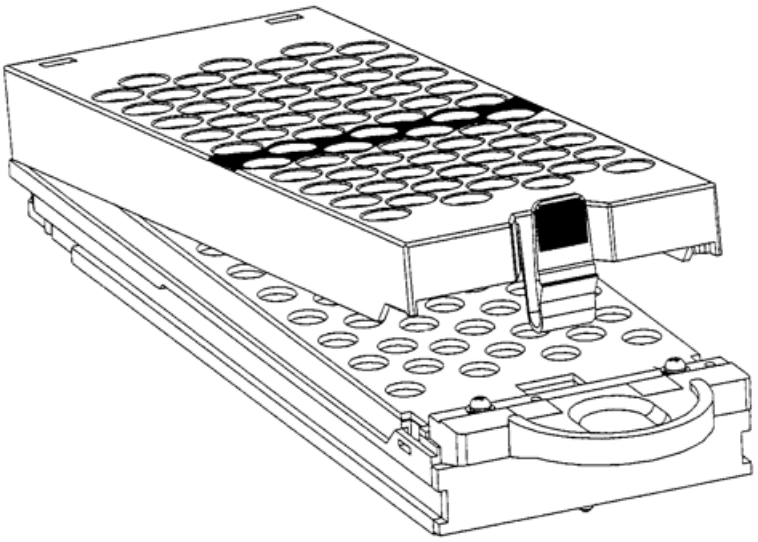
   The MTP rack clicks into place when it is inserted correctly.

Put the Samples in a Sample Cooler

The **cooler** LED illuminates if the sample vials are cooled.

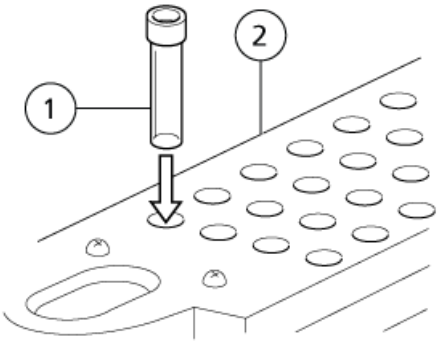
1. Open the autosampler door.
2. Press the latch on the front side of the cooler rack cover to open the cover.

Figure 5-44 Cooling Rack with Cover Open



3. Put the vial in the sample rack with the cap facing up.

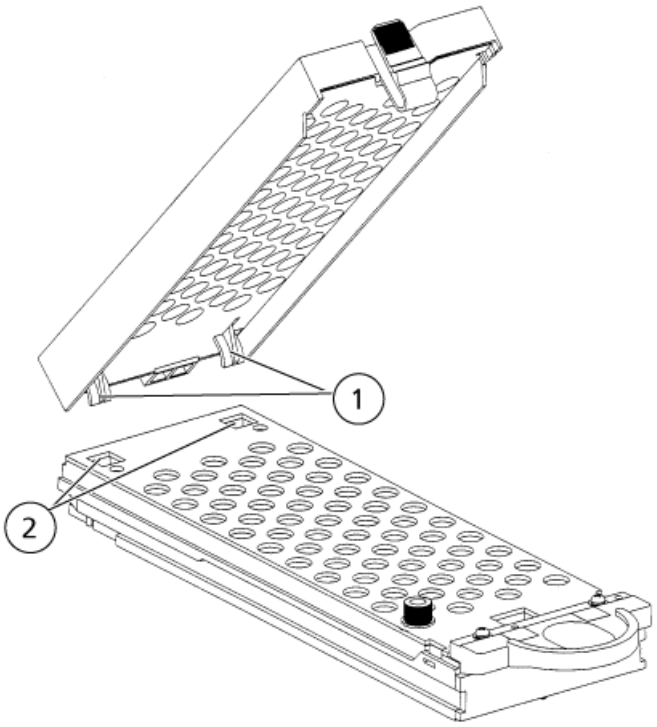
Figure 5-45 Putting the Vial In the Rack



Item	Description
1	Vial
2	Sample rack

4. Insert the hooks on rear side of the cover in the square holes at the rear side on the sample rack.

Figure 5-46 Installing the Cover

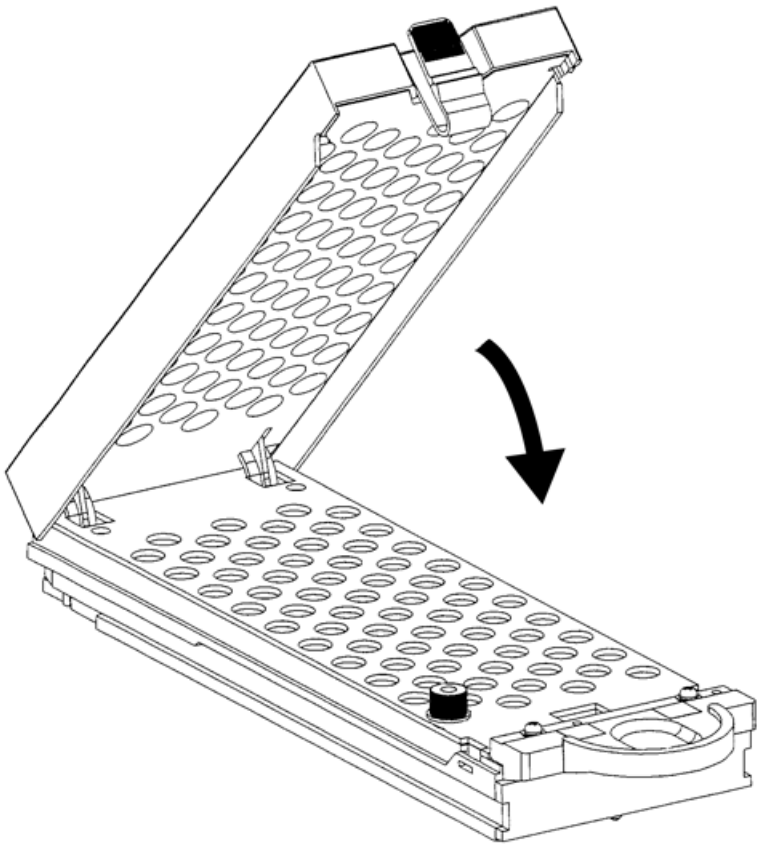


Item	Description
1	Hooks
2	Holes

5. Close the cover.

   The cover clicks if closed correctly.

Figure 5-47 Closing the Cover



Post-Analysis Procedures

Rinse the Flow Line

CAUTION: Potential System Damage. After analysis using a buffer solution as the mobile phase, clear the flow line with distilled or purified water to prevent blockages in the flow line caused by crystals formed due to dehydration of the buffer solution.

For safe use of the system, be sure to rinse the flow line after analysis finishes.

Flow line rinsing after analysis utilizes the autopurge function in the same way as before analysis. After that, perform rinsing of the whole flow line through pumping.

Rinse the Mobile Phase Flow Lines

1. Replace the mobile phase in the reservoir with HPLC-grade water.
2. Remove the column from the flow line, run the pump until the mobile phase in the flow lines shown in the figure above has been completely purged with water.
3. Stop the pump.
4. Replace the water in the reservoir bottle with methanol.
5. Run the pump again, until the water in the mobile phase flow lines has been completely replaced with methanol.
6. Stop the pump.

Rinse the Sample Flow Lines

1. Replace the water in the rinse solution container with HPLC-grade water.
2. Press **purge**.
3. Replace the water in the rinse solution container with methanol.
4. Perform manual priming in the flow line replaced with methanol, and then purge the flow line for 10 minutes.

Turn Off the System

CAUTION: Potential Data Loss. Do not operate the main power switch. Operating the main power switch during analysis or operation might cause corruption or failure when saving the settings data.

CAUTION: Potential Data Loss. Do not press and hold the power button for 4 or more seconds as this forces the module to power off. Forcing the power off might cause corruption or failure when saving the settings data to fail.

Use this procedure in an emergency, or if any issue is detected, such as a burning smell.

Note: After an emergency, such as a power outage or equipment failure, always inspect the system thoroughly before turning it on. If necessary, contact a SCIEX representative.

1. Press the power button.

   If the power button is pressed for four seconds or more, then the system power goes off. This might cause corruption of the settings data.
   The **Confirmation** screen opens.
2. Press **OK**.

3. Make sure that the power button is orange.
4. Turn off the main power switch.
5. Disconnect the mains supply cable at the rear of the system.

Service and Maintenance 6

WARNING! Electrical Shock Hazard. Always turn off the power and then unplug the instrument prior to performing inspection and maintenance. Otherwise, fire, electric shock, or a malfunction might occur.

WARNING! Toxic Chemical Hazard. Before disconnecting parts in the flow line, stop the LC pump and make sure that the pressure of the mobile phase is decreased to zero.

WARNING! Hot Surface Hazard. Do not open the column oven door if the high temperature lamp is blinking. The internal temperature of the column oven is (60 °C or greater).

CAUTION: Potential System Damage. Do not allow spilled water to remain on the instrument surface and do not use alcohol or thinner-type solvents to clean the surfaces. Doing so can cause rusting and discoloration.

CAUTION: Potential System Damage. Only use the replacement parts specified in the *Hardware User Guide*. Use of any other parts might result in instrument damage and malfunction.

Maintenance Schedule

Contact an FSE for inspections and parts replacement.

Note: The replacement and maintenance periods listed in this table are only guidelines. They will vary depending on usage conditions.

Table 6-1 Maintenance Based on Frequency of Use

Maintenance Task	Frequency
Replacement of needle seal	Replace after approximately 40 000 injections. Contact an FSE.
Replacement of low pressure valve rotor	Replace after approximately 1 000 000 injections.[2] Contact an FSE.
Replacement of low pressure valve stator	Replace after approximately 1 000 000injections. [2] Contact an FSE.
Replacement of high pressure valve rotor	Replace after approximately 10 000 times. Applies when a mixture of water and organic solvent is used. [2] [3] Contact an FSE.
Replacement of high pressure valve stator	Replace after approximately 20 000 times. Applies when a mixture of water and organic solvent is used. [2] Contact an FSE.
Cleaning the high pressure valve	Clean after approximately 10 000 times. Contact an FSE.
Replacement of sample loop	Replace after approximately 40 000 injections. Refer to *Replace the Sample Loop on page 140*.
Needle replacement	Replace after approximately 40 000 injections. Refer to *Replace the Needle on page 138*.
Replacement of rinsing port cap	Replace after approximately 10 000 injections. [4] *Replace the Rinse Port Cap on page 142*.
Replacement of vial detection spring	Replace after approximately 40 000 injections. Contact an FSE.
Rinsing pump (optional)	Replace after approximately 700 000 seconds. Contact an FSE.

[2] Rinse the flow line sufficiently with HPLC-grade water. When using the needle internal rinsing function, replace these parts at least once a year.

[3] Some types of buffer solution crystalize or leave insoluble residue. Using these types of buffer solution as a mobile phase and then subsequently leaving the module unused for a long period might significantly reduce the lifespan of the rotor. To prevent this, cleanse the flow path thoroughly with HPLC-grade water after the use.

[4] If cross contamination is excessive, replace the rinsing port cap.

Table 6-2 Scheduled Maintenance

Maintenance Task	Frequency			Remarks
	One Year	Two Years	Three Years	
Inspection and replacement of vacuum pump intake air filter	x			If the filter is fouled badly, replace it. Contact an FSE.
Inspection and replacement of vacuum tubing filter	x			If the filter is fouled badly, replace it. Contact an FSE.
Inspection and replacement of vacuum pump[5]			x	Inspect for and remove condensation from the vacuum line, and if the vacuum pressure is still unstable, replace it. Contact an FSE.
Inspection and replacement of vacuum tubing[5]			x	If the vacuum tubing is hardened or cracked, replace it. Contact an FSE.
Inspection and replacement of degassing chamber[5]			x	Inspect for and remove condensation from the vacuum line, and if moisture is still visible inside the vacuum tube, replace it. Contact an FSE.

[5] Inspect every year, beginning three years after the date of installation.

Table 6-2 Scheduled Maintenance (continued)

<table>
<tr><th rowspan="2">Maintenance Task</th><th colspan="3">Frequency</th><th rowspan="2">Remarks</th></tr>
<tr><th>One Year</th><th>Two Years</th><th>Three Years</th></tr>
<tr><td colspan="5">Pump</td></tr>
<tr><td>Replacement of plunger seal</td><td>x</td><td></td><td></td><td>Sealing efficiency decreases when seals are worn.
Replace when the plunger is replaced. As a guideline, seals should be replaced after delivery of the respective volumes listed below. (VP function, L(R) SEAL DELIVERED, shows the total delivered volume.)
<table><tr><th>Pumping Pressure</th><th>Total Delivery</th></tr><tr><td>10 MPa (102 kgf/cm^2)</td><td>90 L</td></tr><tr><td>30 MPa (306 kgf/cm^2)</td><td>30 L</td></tr><tr><td>60 MPa (612 kgf/cm^2) (not applicable for HPLC pumps)</td><td>15 L</td></tr></table>Contact an FSE.</td></tr>
<tr><td>Replacement of plunger</td><td>x</td><td></td><td></td><td>Contact an FSE.</td></tr>
<tr><td>Replacement of diaphragm</td><td>x</td><td></td><td></td><td>Replace when the plunger is replaced.</td></tr>
<tr><td>Replacement of outlet check valve</td><td>x</td><td></td><td></td><td>Contact an FSE.</td></tr>
<tr><td>Replacement of inlet check valve</td><td>x</td><td></td><td></td><td>Contact an FSE.</td></tr>
</table>

Table 6-2 Scheduled Maintenance (continued)

Maintenance Task	Frequency			Remarks
	One Year	Two Years	Three Years	
Replacement of line filter		x		Particulates in mobile phase clog the filter in prolonged use. Contact an FSE.
Replacement of suction filter		x		Particulates in mobile phase clog the filter in prolonged use. Refer to *Inspect, Replace, and Clean the Suction Filter on page 115*.
Replacement of drain valve			x	Sealing efficiency decreases when the drain valves are worn. Contact an FSE.
Pump assembly lubrication			x	Contact an FSE.
Fuse replacement			x	Refer to *Replace Fuses on page 116*.
Grease up maintenance for plunger driving cam	x			Contact an FSE.
Replacement of pump head		(x)		(Not applicable for HPLC pumps) Pumping mobile phase mixtures containing acids such as trifluoroacetic acid or formic acid at high pressures (in general, above 70 MPa) can cause leakage due to internal damage in the pump head. In such cases, replace the pump head every two years, as a general guideline. Pump heads do not need to be replaced if only mobile phases without added acid are pumped. Contact an FSE.

Table 6-2 Scheduled Maintenance (continued)

Maintenance Task	Frequency			Remarks
	One Year	Two Years	Three Years	
Replacement of measuring pump plunger seal	x			Contact an FSE.
Replacement of measuring pump plunger	x			Contact an FSE.
Replacement of suction filter	x			Refer to *Inspect, Replace, and Clean the Suction Filter on page 115*.
Replacement of SUS tubing	x			Replace when the clogging does not remove after reverse cleaning.
Replacement of panel F			x	Replace if there is excessive condensation. Refer to *Remove Panel F on page 137*.
Cleaning and oiling of the needle drive section (Z mount)	x			Refer to *Inspect, Replace, and Clean the Suction Filter on page 115*.
Cleaning and oiling of other drive sections			x	Contact an FSE.
Fuse replacement			x	Contact an FSE.

Prior to Inspection and Maintenance

- Replace the mobile phase in the flow lines with HPLC-grade water.
- Wipe away any dirt from the front panel and the main cover.
- Wipe away any dirt from the keypad with tissue paper or a soft cloth moistened with water.

After Inspection and Maintenance

- After inspection and maintenance is complete, inspect for leaks during pumping.

Clean the Module Surfaces

Required Materials

• Dry, soft rags, or tissue paper
• For persistent stains
  • Diluted, neutral detergent
  • Water

1. Wipe the module surfaces with the rag or tissue paper.
2. If the stains persist, follow these steps:
   a. Moisten a rag in the diluted, neutral detergent and then wring it dry.
   b. Wipe the module surfaces, scrubbing as necessary to remove the stains.
   c. Moisten a rag in water and then wring it dry.
   d. Wipe the module surfaces.
   e. Dry with a dry rag.

CAUTION: Potential System Damage. Do not allow spilled water to remain on the instrument surface and do not use alcohol or thinner-type solvents to clean the surfaces. Doing so can cause rusting and discoloration.

Clean the Reservoir Tray

The reservoir tray can hold up to seven 1 L reservoirs of mobile phase.

CAUTION: Potential System Damage. Wipe up any liquid if liquid is spilt in the reservoir tray. The reservoir tray is made from PBT and some liquids, for example THF (tetrahydrofuran) or methylene chloride, can discolor the reservoir tray.

Required Materials
• Rag

- Wipe the reservoir tray with a clean, dry rag.

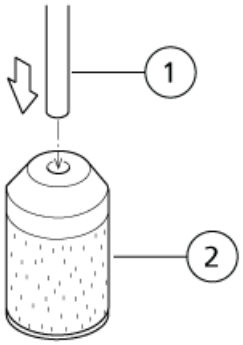
Inspect, Replace, and Clean the Suction Filter

Prerequisite Tasks
• Turn off the module and then disconnect it from the mains power supply

Required Materials
• Isopropanol • HPLC-grade water

1. Pull the suction filter out of the suction tubing.

Figure 6-1 Suction Filter



Item	Description
1	Suction tubing
2	Suction filter

2. Clean the suction filter in a bath of isopropanol, in an ultrasonic cleaning device for 5 minutes.
3. Insert the suction tubing into the suction filter.
4. Plug the module into the mains power supply and then turn on the power.

   The initial screen is shown.
5. Use a syringe to draw three different types of rinse solution from the reservoir into the three flow lines.
6. Make sure that air bubbles do not accumulate inside the solvent tubing.

   If they do, then the tubing must be replaced.
7. Install the suction tubing in the reservoir, making sure that the filter is on the bottom of the bottle.

Replace Fuses

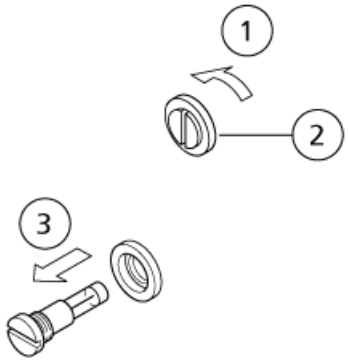
WARNING! Electrical Shock Hazard. Always turn off the power and then unplug the instrument prior to performing inspection and maintenance. Otherwise, fire, electric shock, or a malfunction might occur.

WARNING! Electrical Shock Hazard. Before replacing fuses, turn off the power and unplug the module. For replacement, only use fuses of the correct type and rating. Failure to heed the above could result in fire, electric shock or short circuits.

Required Materials
• Flat-bladed screwdriver

1. Pull out the fuse holder by using, for example, a flat-head screwdriver.

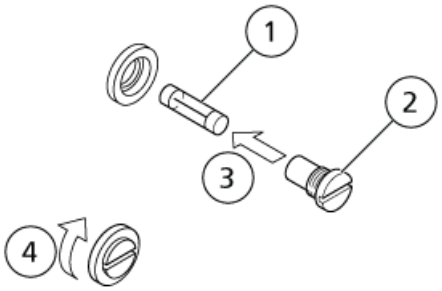
Figure 6-2 Removing the Fuse



Item	Description
1	Loosen (counter-clockwise)
2	Fuse holder
3	Remove

2. Install the new fuse in the fuse holder.
3. Install the fuse holder and then secure it with a flat-bladed screwdriver.

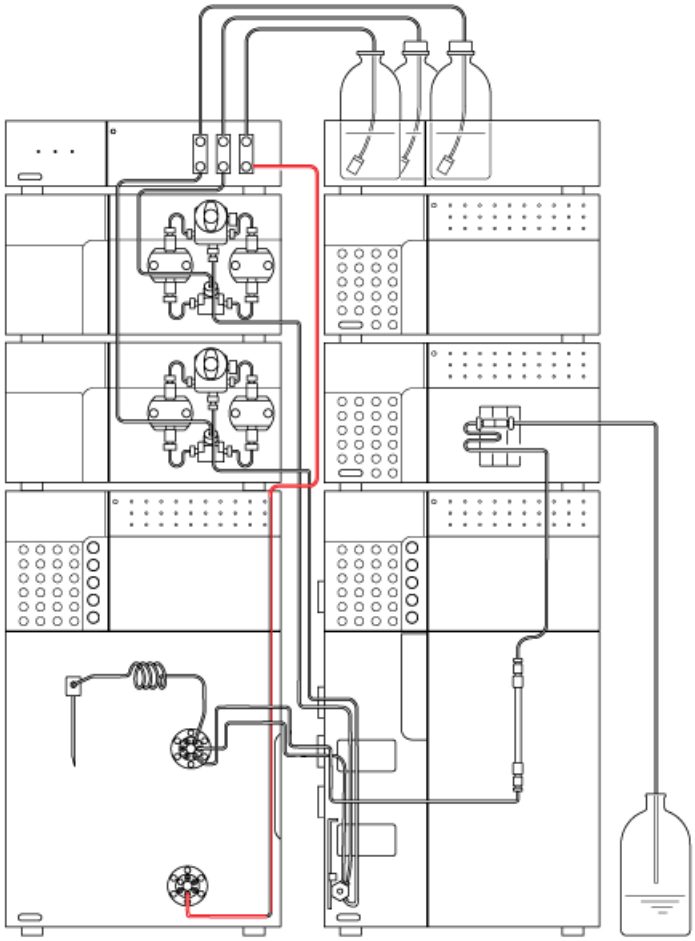
Figure 6-3 Installing the Fuse



Item	Description
1	Fuse
2	Fuse holder
3	Install
4	Tighten

Plumbing

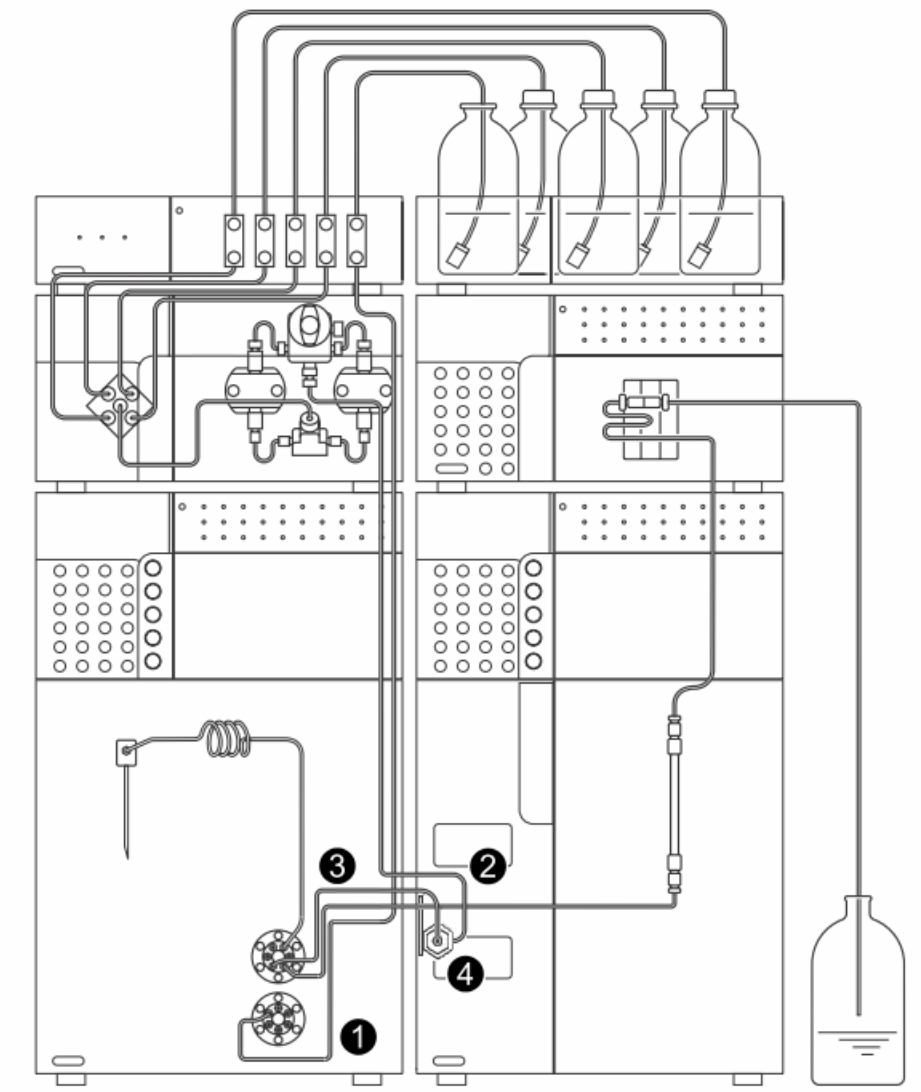
Figure 6-4 Plumbing for High-Pressure Gradient System



Note:
Connect stainless tubing (shown in red) to the No. 4 port of the low-pressure valve and for tubing parts attached to the degasser.

If resin tubing is used, then the injection volume accuracy or other performance might be reduced.

Figure 6-5 Plumbing for Low Pressure Gradient System



Item	Description
1	Connect stainless tubing to the No. 4 port of the low-pressure valve and to the degasser. If resin tubing is used, then injection volume accuracy or other performance might be reduced.
2	Use the supplied SUS tubing 1.6 mm o.d. × 0.3 mm i.d. (2 m), cut it to 700 mm, for plumbing between the pump and the mixer (item 4).

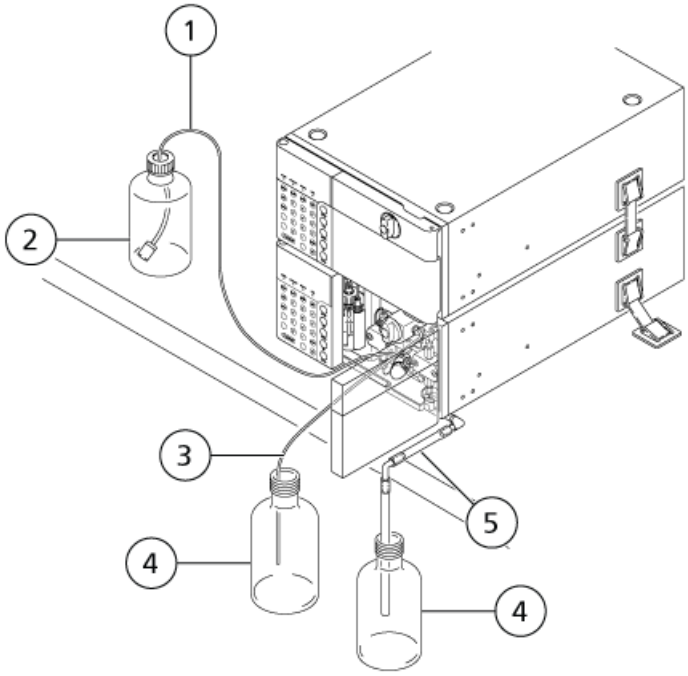
Item	Description
3	Use the standard tubing (1 m) for the autosampler, cut to 500 mm, for the plumbing between mixer and the No. 6 port of the high-pressure valve.
4	Mixer

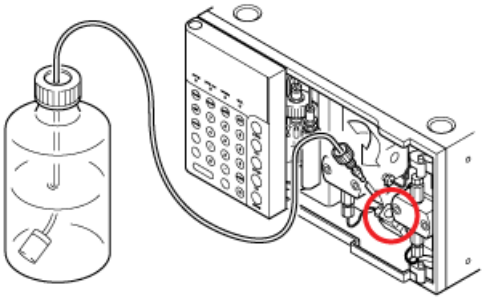
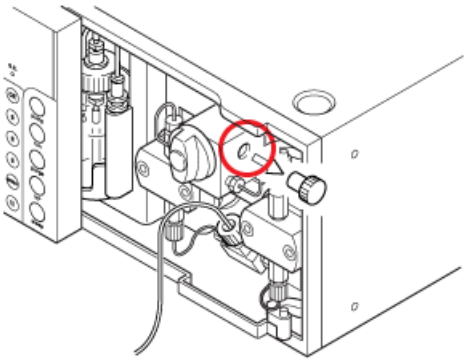
Pump

The necessary plumbing is as follows:

- Plumbing of suction filter: Plumbing to form the flow line from the reservoir bottles to the pump.
- Plumbing of drain tubing: Plumbing to verify the performance of the module before operation.
- Plumbing of tubing for leakage: Plumbing to evacuate any leaks that might occur in any module in the stack, this tubing directs it down to the lowest device in the stack, and from there to a waste container.

Figure 6-6 Pump Plumbing



Item	Description
1	Suction filter. Connect one end of the suction filter tubing to the suction filter, and then connect the other end to the pump inlet. Refer to *Inspect, Replace, and Clean the Suction Filter on page 115*. **Figure 6-7 Pump Inlet** 
2	Reservoir. The reservoir should be made of glass and have a capacity of at least 500 mL.
3	Drain tubing. Connect one end of the drain tubing to the drain tubing connection port on the pump, and put the other end into the waste container. **Figure 6-8 Drain Tubing Connection Port** 
4	Waste container. Install the waste container lower than the instrument (for example, on the floor). If the container is higher than the instrument, then the liquid will not drain and it will leak from the connections.
5	Leakage drain tubing. The system is designed so that if leaks occur internally (except in the column oven), the leaked liquid flows down to the lowest level of the module and is drained into the waste container. Refer to *Replace the Leakage Drain Tubing on page 129*.

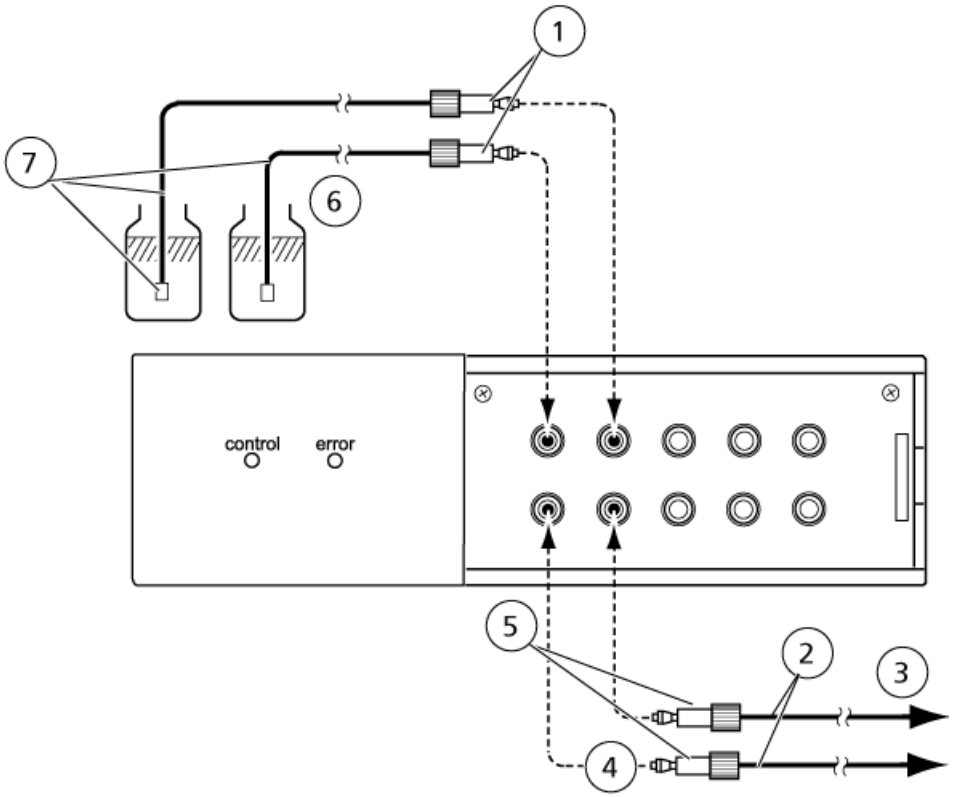
Degasser

Configure the tubing between the reservoirs and degasser and between the degasser and LC pump (or low pressure GE unit). Refer to *Connect to a Low Pressure GE Unit (Optional LPGE) on page 123*.

When the degasser is not used for an extended period of time, these stop joints are necessary for preventing dust and debris from entering the flowlines.

1. Before connecting the tubing, remove the stop joints that are installed on the solvent IN/OUT ports of the degasser.
2. Leave the stop joints installed on the flow lines that are not being used. Save the stop joints that were removed.
3. Connect the mobile phase solvent line to the degasser inlet.

Figure 6-9 Connecting the Degasser to the System



Item	Description
1	Flangeless fittings provided with the degasser.
2	Use the FEP tubing provided with each LC pump, cut to the appropriate length. (3 mm o.d. × 1.5 mm i.d. FEP tubing)

Item	Description
3	Connection to the inlet on LC pump (or the inlet on low pressure GE unit).
4	Ferrule
5	Flangeless fittings provided with the degasser.
6	Mobile phases
7	Suction filters and tubings provided with the LC pump.

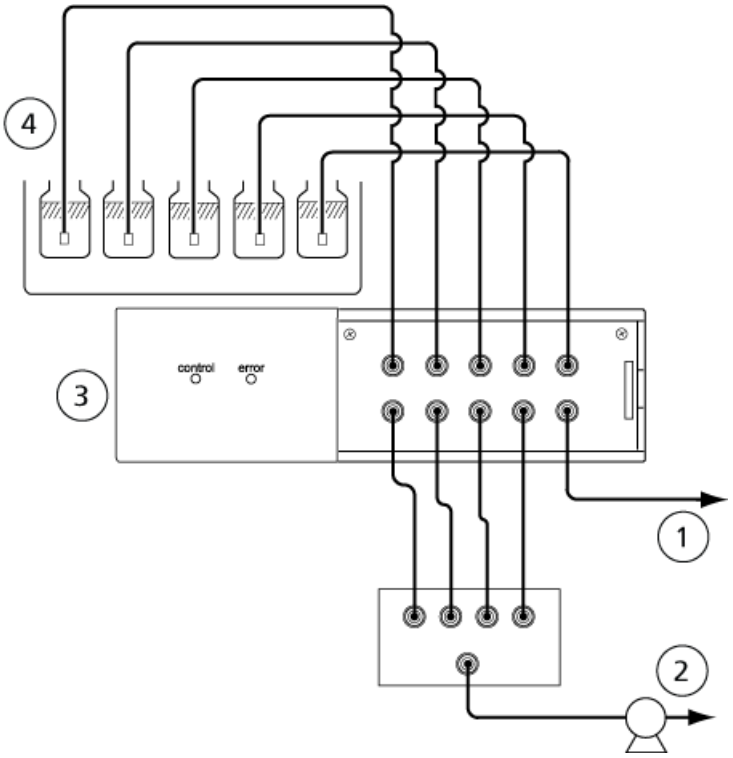
Note:

- Cut the FEP tubing at a right angle. When connecting lines to the solvent IN/OUT ports on the degasser, be careful to orient the ferrule correctly. Refer to *Figure 6-9*. Make sure that the FEP tubing end is pushed in until it contacts the far side of the joint and then firmly tighten the flangeless fitting so the ferrule securely grips the tubing. It is secured when the flangeless fitting no longer turns. Do not force the nut beyond that point, because the flangeless fitting could break.
- The FEP tubing leading from the degasser OUT ports to the LC pump inlet or from the degasser OUT ports to the low pressure GE unit should not be too long. If the tubing is unnecessarily long, it could suction out the air from inside the FEP tubing.
- When connecting lines to the inlet of the LC pump, use the connector joints used with each LC pump.

Connect to a Low Pressure GE Unit (Optional LPGE)

For use with the optional LPGE, connect the mobile phase lines to the degasser as shown in the following figure.

Figure 6-10 Low Pressure GE Unit



Item	Description
1	Autosampler rinse solution
2	LC pump
3	Low pressure GE unit
4	Mobile phases

- When generating binary or ternary gradients, connect the unused ports on the low pressure GE unit to one of the mobile phase reservoirs. If air fills an unused flowline, then the air will mix with the mobile phase and prevent the gradient from being generated correctly. Always keep flow lines filled with liquid by keeping unused lines connected. Refer to *Figure 6-10*.

Autosampler

Tubing Diameter

Sample diffusion in tubing used after the autosampler has an impact on the chromatogram. The longer the tubing is and the greater the inner diameter, the more sample diffusion and poor peak separation affect the chromatogram.

This impact varies depending on the NTP (number of theoretical plates) of the column in use, mobile phase flow rate, and peak retention time. Using a column with a large NTP and a low mobile phase flow rate greatly affects peaks with early retention times.

The effect of sample diffusion in tubing on chromatogram is shown in a table format to assist with tubing selection. This table shows the NTP (number of theoretical plates) of a chromatogram in isocratic analysis with the effect of sample diffusion added and its ratio against the NTP with no diffusion in tubing (12 000). Compare this table with the analysis conditions, and the select the tubing to be used accordingly.

Table 6-3 NTP on Chromatogram and Their Ratio

			Retention Time (min)				
			1	2	5	10	20
Tubing: 0.1 mm i.d., 600 mm length							
Flow rate (mL/min)	0.2	NTP	7875	10610	11754	11937	11984
		Ratio	65.60%	88.40%	97.90%	99.50%	99.90%
	0.5	NTP	11072	11754	11960	11990	11997
		Ratio	92.30%	97.90%	99.70%	99.90%	100.00%
	1.0	NTP	11754	11937	11990	11997	11999
		Ratio	97.90%	99.50%	99.90%	100.00%	100.00%
Tubing: 0.17 mm i.d., 1000 mm length							
Flow rate (mL/min)	0.2	NTP	1225	3752	8877	11030	11742
		Ratio	10.20%	31.30%	74.00%	91.90%	97.80%
	0.5	NTP	4985	8877	11361	11834	11958
		Ratio	41.50%	74.00%	94.70%	98.60%	99.60%
	1.0	NTP	8877	11030	11834	11958	11989
		Ratio	74.00%	91.90%	98.60%	99.60%	99.90%

Guidelines for Changing Plumbing

After verifying the items described in *Countermeasures for Clogging in Tubing on page 173*, determine whether or not replacement is necessary by considering the application.

In the following examples no problem arises if the tubing is the optional 0.17 mm ID tubing, because use of plumbing of small diameters has little advantage in such cases.

- **When only Columns of Wide Bore (6 mm ID or more) Are Used:** In this case, the plumbing contributes little to band broadening, and it has little influence to analysis data.
- **When Analysis Through-put has Priority over Protection of Columns from Clogging (that is, sample filtration):** When column clogging from particles in samples is acceptable to the customer, for example, when an extremely large number of samples must be analyzed in a short time, use of wide bore plumbing helps minimize equipment downtime due to clogged tubing.

Replace Tubing

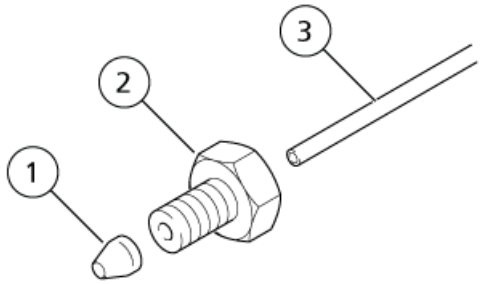
CAUTION: Potential System Contamination. Do not use resin parts for the high-pressure tubing while pumping at high pressures. Pumping at high pressure might cause resin tubing to be ruptured or disconnected, which could result in mobile phase leaks. Note the maximum withstand pressure of each part when resin parts are used for the high-pressure tubing.

The tubing and connectors used for the plumbing are made of stainless steel (SUS) or resin.

Stainless Steel (SUS)	Resin
• Stainless steel tubing 1.6 O.D. × 0.3 I.D. • Male nuts, 1.6 MN • Ferrules 1.6F	• FEP tubing, PTFE tubing, ETFE tubing, PEEK tubing, PE tubing, and so on • Male nut PEEK • PEEK ferrules • PTFE ferrules

1. Mount a male nut and a ferrule to the tubing.

Figure 6-11 Tubing and Fittings



Item	Description
1	Ferrule
2	Male nut
3	Tubing

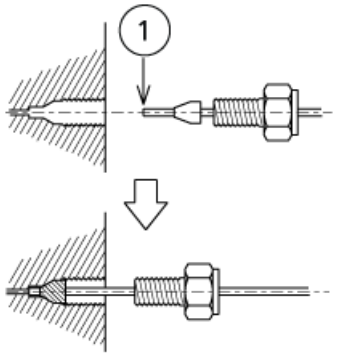
CAUTION: Potential System Damage. Install stainless steel male nuts and ferrules on SUS tubing, and resin nuts and ferrules on resin tubing. If resin male nuts are mounted on SUS tubing, the connection can be loosened easily and leakage might occur.

CAUTION: Potential Wrong Result. Insert the tubing completely into the opening, until it butts against the end of the opening. Otherwise, dead volume will be created and might cause chromatographic peak broadening.

CAUTION: Potential System Damage. Do not overtighten the male nut. Otherwise, the threads will be damaged.

2. Insert the end of the tubing, with the ferrule on it, in the appropriate opening. Then tighten the male nut. The ferrule is secured on the tubing.

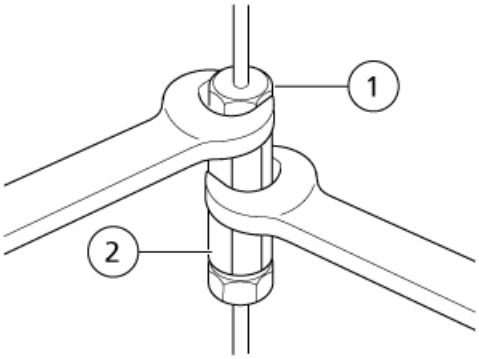
Figure 6-12 Installing the Tubing



Item	Description
1	Perpendicular

Note: For an SUS male nut, use the open-end wrench (provided) to tighten and loosen the nut. If the nut is to be connected to a union or to another part that is not secured, then use a second wrench to secure the union.

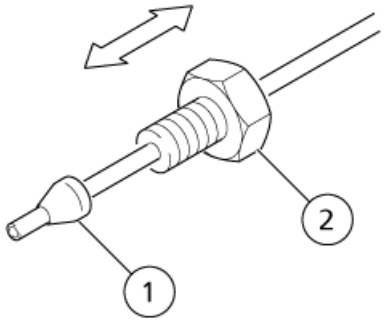
Figure 6-13 Tightening a SUS Nut



Item	Description
1	Male nut
2	Coupling

3. Loosen and then move the male nut slightly to verify that the ferrule is secured on the tubing.

Figure 6-14 Properly Installed Nut

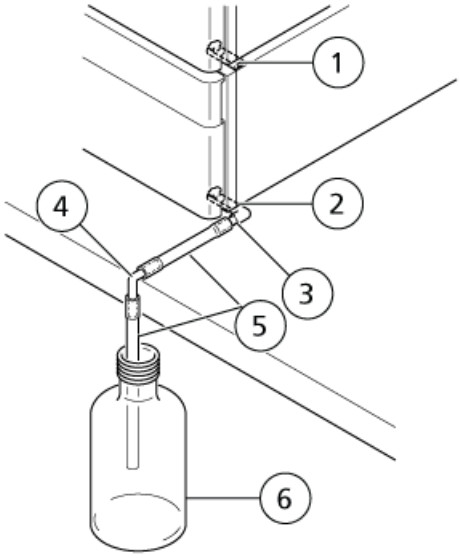


Item	Description
1	Does not move
2	Moves

Replace the Leakage Drain Tubing

Except for the waste container, all parts shown in *Figure 6-15* are standard accessories.

Figure 6-15 Drain Tube Plumbing

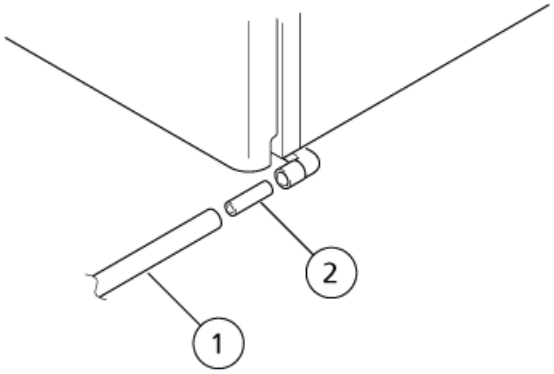


Item	Description
1	Drain adapter
2	Drain OUT
3	Straight tubing connector
4	L-joint
5	Silicone tubing
6	Waste container

Required Materials
• Silicone tubing • Knife

1. Connect one end of the silicone tubing adapter to the drain OUT, STD with a straight tubing connector.

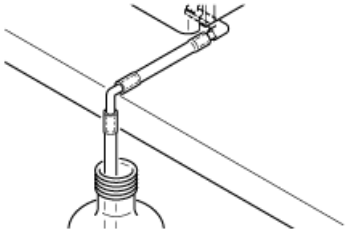
Figure 6-16 Connecting the Silicone Tubing



Item	Description
1	Silicone tubing
2	Straight tubing connector

2. Insert the straight tubing adapter in one end of the silicone tubing.
3. Cut the silicone tubing at the edge of the table and then connect an L-Joint, directing the L-Joint downward.

Figure 6-17 L-Joint



4. Insert the other length of the silicone tubing in the L-joint, and then put the other end in the waste container.

Note: Make sure that the silicone tubing does not touch the liquid surface in the waste container.

5. Pour some water near the drain outlet of the top unit, and then verify that the water flows to the waste container.

Storage and Handling

Column

If an analysis will not be performed for three or more days, then leaving used mobile phase in the column might lead to deterioration of the column. Drying the column can cause a gap inside or can cause the column packing to become cracked. To prepare the column for storage, replace the liquid in the column with column sealing liquid, remove the column from the system, and then store the column.

- Refer to the instruction manual for the column.

Pump

Protective plugs prevent dirt and dust from entering the pump when it is not in use.

- Install protective plugs in the inlets and outlets of the pump when it will not be used for an extended period.

Table 6-4 Plug Type

Plug Type	Procedure
Stop	Use the wrench provided to install and tighten the plugs.
Resin	Remove and replace the plugs manually.

Degasser

If the LC pump will not be used for a long period, turn off the LC pump power and then perform the following procedure.

1. Suction out all of the solvent out of the degasser using the LC pump.

   Do not use a method that would pressurize the degasser.

   WARNING! Puncture Hazard. Take care when handling the syringe. The tip of the syringe is extremely sharp.

2. Remove the inlet tube and then completely extract the solvent inside the degasser using a syringe.

   When drawing the solvent using a syringe, slowly pull it to achieve at a flow rate of 10 mL/min or less. If the degasser is used at a high flow rate, the degassing membrane might be overloaded, resulting in a shortened degassing chamber service life.

3. If buffer solutions have been used, clean the degasser with HPLC-grade and then replace the water with a solvent such as isopropanol.

   Buffer solutions can leave salt deposits, algae, or microorganisms inside the degasser (on the membrane), depending on the type of solvent used.

   Note: Before using the unit again, thoroughly remove the solution (isopropanol or similar solvent), using a syringe.

4. Store the degasser by plugging the solvent IN/OUT ports using the stop joints provided.

Autosampler

If the autosampler is not used for a long period, raise the needle to prevent a reduction in the service life of the needle seal.

1. Turn the power on.
2. From the initial screen, press  until the **Z HOME** screen is shown.

3. Press **enter.**

   The needle rises to the highest position and then moves to the center of the autosampler.

4. Turn the power off.

Pump Maintenance

WARNING! Electrical Shock Hazard. Always turn off the power and then unplug the instrument prior to performing inspection and maintenance. Otherwise, fire, electric shock, or a malfunction might occur.

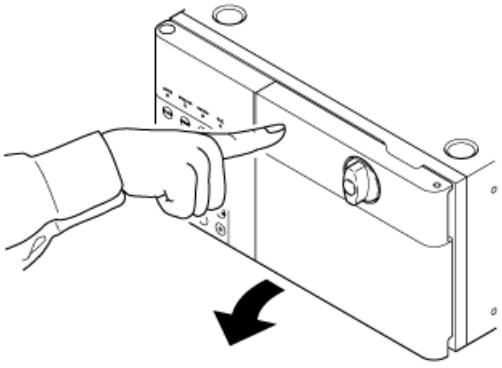
CAUTION: Potential System Damage. Only use the replacement parts specified in the *Hardware User Guide*. Use of any other parts might result in instrument damage and malfunction.

Remove the Front Cover

The front cover must be removed to provide access to the plumbing.

1. Press on the cover at the position shown in *Figure 6-18*, and then release to open the front cover.

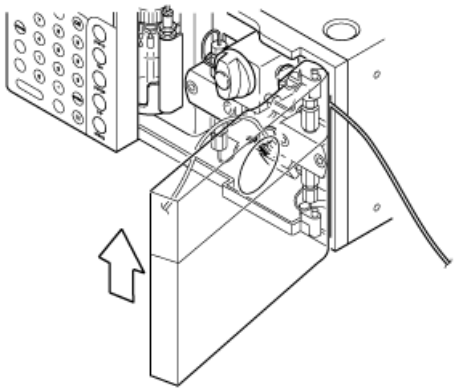
Figure 6-18 Opening the Pump Cover



2. Lift the cover and then remove it.

   The front cover can be removed when it is open to 120 degrees.

Figure 6-19 Lifting the Cover



Clean the Leak Tray

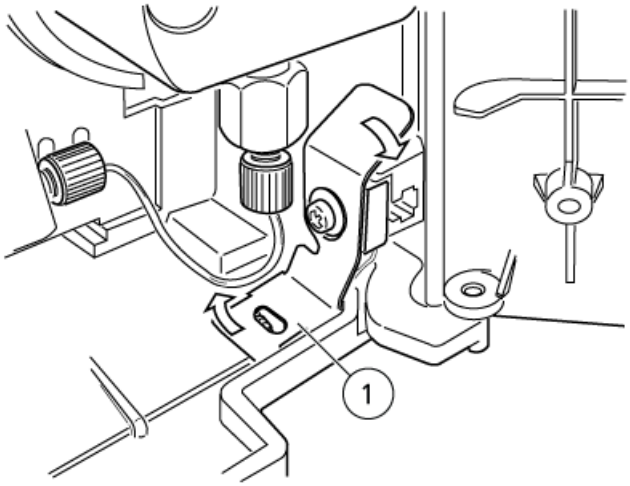
The protective plate is attached to the leak tray to protect the leak sensor and to guide any leakage to the sensor and drain outlet. Wipe away any leakage on the leak tray completely.

Note: When a buffer solution is used as the mobile phase, it might deposit crystals on the leak tray when it evaporates. Clean the leak tray by following this procedure.

Required Materials
• Water • Rag

1. Rotate the protective plate, to make the leak tray and the leak sensor visible.

Figure 6-20 Protective Plate



Item	Description
1	Protective Plate

CAUTION: Potential System Damage. Do not twist or pull on the leak sensor.

2. Use a rag soaked in water to wipe away the leakage around the leak sensor and on the leak tray completely.

CAUTION: Potential System Damage. Make sure that the protective plate is rotated back into position. If it is not in position, the leak sensor might not detect leaks.

3. Rotate the protective plate back into position.

Degasser Maintenance

WARNING! Electrical Shock Hazard. Always turn off the power and then unplug the instrument prior to performing inspection and maintenance. Otherwise, fire, electric shock, or a malfunction might occur.

Prepare for Inspection and Maintenance

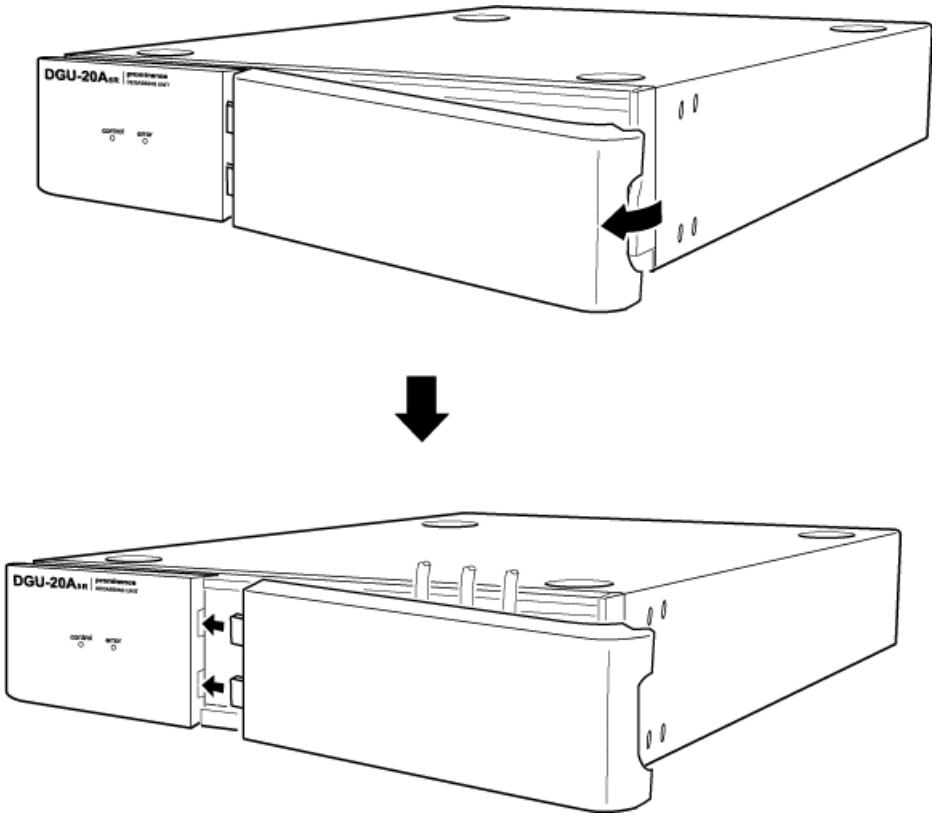
1. Replace the mobile phase in the flow lines with HPLC-grade water.

2. Wipe away any dirt from the front panel and the main cover.

Mounting and Dismounting the Front Panel

1. To connect the tubing from reservoirs or LC pump to the degassing unit, remove the front panel, as shown in *Figure 6-21*.

Figure 6-21 Front Panel



2. After connecting the tubing, replace the front panel to protect and to fix the tubing connectors. Align the two lugs at the left of the front panel with the recesses in the unit.

Autosampler Maintenance

WARNING! Electrical Shock Hazard. Always turn off the power and then unplug the instrument prior to performing inspection and maintenance. Otherwise, fire, electric shock, or a malfunction might occur.

CAUTION: Potential System Damage. Do not lift the autosampler by the front panel.

CAUTION: Potential System Damage. Only use the replacement parts specified in the *Hardware User Guide*. Use of any other parts might result in instrument damage and malfunction.

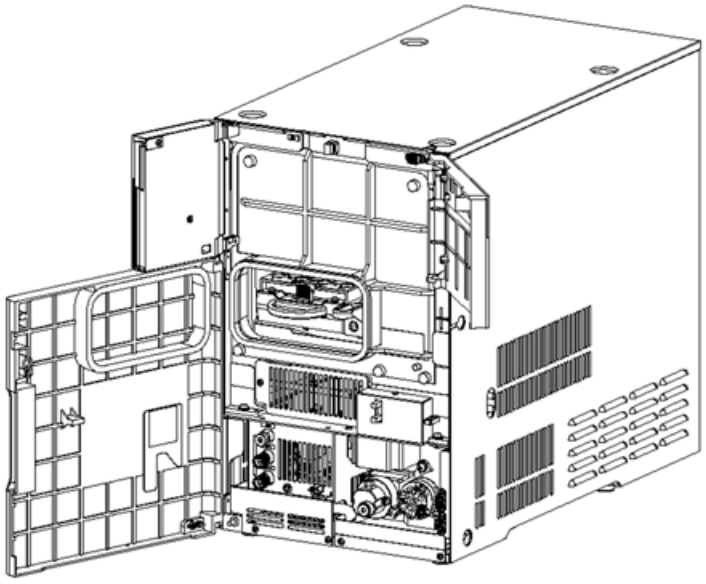
Remove Panel F

WARNING! Crushing Hazard. Be careful not to pinch fingers when opening the doors.

1. From the initial screen, press  to show the **Z HOME** screen.
2. Press **enter**.

   The needle rises to the highest position and then moves to the center of the autosampler.
3. Turn off the autosampler.
4. Disconnect the mains supply cable from the mains supply.
5. Open the door and then remove the sample racks.
6. Loosen the screws (5 points) and then slide the Panel F a little to the right before pulling it forward to remove it.

Figure 6-22 Panel Removed



Replace the Needle

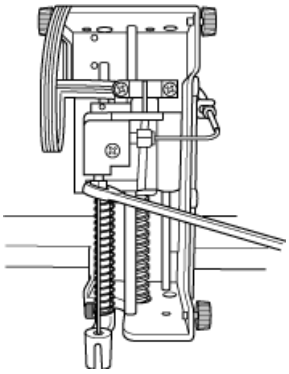
Prerequisite Procedures
• *Remove Panel F on page 137*

Required Materials
• Needle

WARNING! Puncture Hazard. Handle the needle with care. The tip of the needle is extremely sharp.

1. Loosen the 3 mounting screws, and then pull the cover of the Z mount forward to remove it.
2. Remove the male nut of the needle with a wrench.

Figure 6-23 Removing the Male Nut



CAUTION: Potential System Contamination. Insert the needle fully into the connection, then tighten with a wrench. If the needle is not inserted fully in the hole, a dead volume is created resulting in peak diffusion or cross-contamination.

WARNING! Toxic Chemical Hazard. Tighten the nut well. A loose fitting might leak.

WARNING! Toxic Chemical Hazard. Be sure to use the correct ferrule (supplied with the new needle). Using in incorrect ferrule might cause a leak.

3. Attach the male nut and the ferrule to a new needle, finger-tighten the male nut, and further turn it 180 degrees using a wrench.
4. Replace the Z mount cover, with its screws.
5. Install the panel F.
6. Connect the module to the AC mains supply.
7. Turn the module on.
8. Open the right cover of the autosampler, and verify the position at which the needle is lowered into the injection port. Adjust the needle position if it is incorrect. Use the ADJUST INJ PORT VP function. Refer to *Autosampler VP Functions on page 211*.

Note: If contamination increases after the original needle is installed after maintenance, replace the needle with a new one.

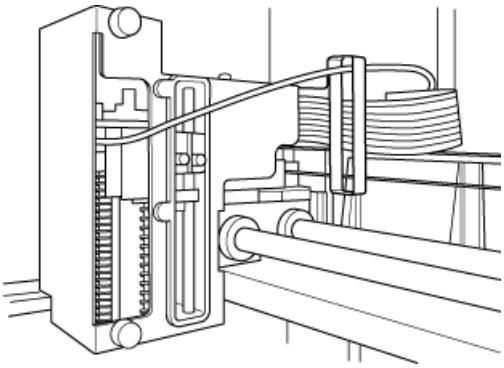
Replace the Sample Loop

Prerequisite Procedures
• *Remove Panel F on page 137*

Required Materials
• Sample loop

1. Loosen the male nut at port 1 of the high pressure valve, which secures the sample loop, and then remove it.
2. Remove the three screws from the Z mount cover and then remove the cover.
3. Using a wrench, remove the male nut on the other end of the sample loop, the end opposite the needle.
4. Remove the sample loop from the two hooks on the back of the front upper section of the plastic cover inside the autosampler.
5. Remove the sample loop from the hooks on the left side of the autosampler interior.
6. Remove the sample loop from the hook of the square hole at the back of the Z mount, and then take the sample loop out of the autosampler.

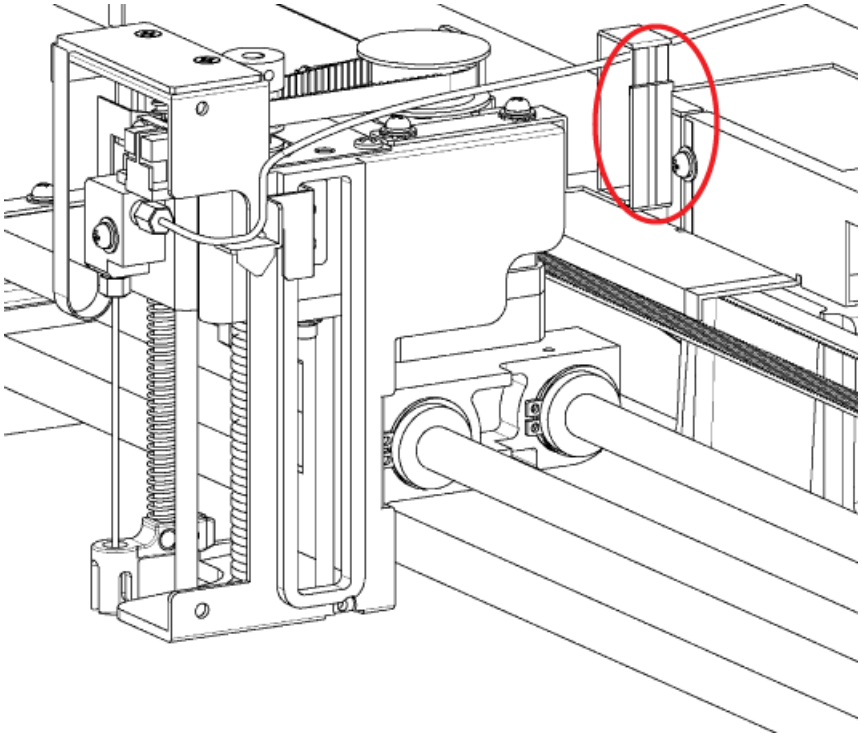
Figure 6-24 Disconnecting the Sample Loop from the Z Mount



7. Route the new sample loop through the square hole at the back of the Z mount, and then insert it through the positioning hook on the right side of the Z mount.

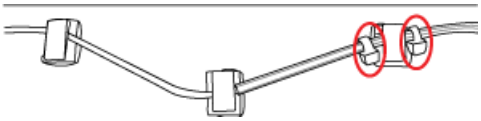
8.

Figure 6-25 Square Hook



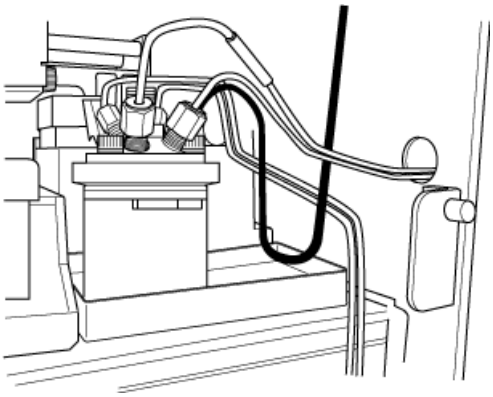
9. Attach a male nut and a ferrule to the sample loop, and then use a wrench to secure them to the joint on the needle side.
10. After attaching the part positioned with the sample loop band to the hook in the back on the left side of the autosampler interior, secure the sample loop to the hooks at the center and front in sequence.

Figure 6-26 Fixed Portion of Sample Loop Band



11. Attach the sample loop to the hooks (two places) on the back of the front upper section of the plastic cover inside the autosampler.
12. Secure the sample loop, with the male nut and ferrule attached, to port 1 of the high-pressure valve.
13. Adjust the plumbing for the sample loop attached to port 1 as shown in *Figure 6-27*. Bend the tubing downwards along the right side of the high-pressure valve and then route it along the right side of the resin cover.

Figure 6-27 Tubing Routed Along the High Pressure Valve



14. Replace the Z mount cover, and then tighten the screws.
15. Install panel F and then close the front door.
16. Connect the power cable to the mains power supply and then turn on the power.
17. During initialization, open the panel at the top right of the autosampler and make sure that there is no interference between the sample loop and other parts. In particular, make sure that there is no interference between the sample loop and other parts, such as port 1 of the high-pressure valve and the bottom of the Z mount.
18. When an optional sample loop assembly is installed, change the maximum injection volume to the corresponding value. The default setting is 50 µL. Refer to *Autosampler VP Functions on page 211*. When the standard 50 µL sample loop assembly is reinstalled, reset the maximum injection volume to 50 µL.

CAUTION: Potential Wrong Result. When using the 50 mL sample loop assembly, set SAMPLE SPEED to 5 mL/sec or less. If the speed is fast, the injection volume might not be precise or it might be reproducible.

Replace the Rinse Port Cap

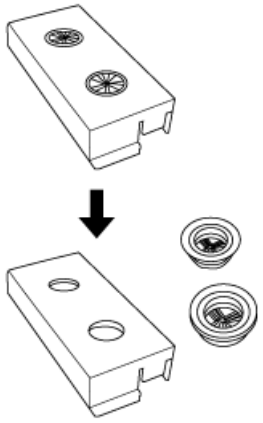
Prerequisite Procedures
• *Remove Panel F on page 137*

Required Materials
• Rinse port cap

1. Remove the rinsing port cover from the rinsing port.

2. Remove the two caps on the rinsing port cover.

Figure 6-28 Removing the Rinsing Port Caps



CAUTION: Potential System Damage. Make sure that the caps are fully installed. If they are loose, they might touch the Z mount.

3. Install the new caps on the rinsing port cover.

CAUTION: Potential System Damage. Make sure that the cover is fully installed. If it is loose, it might touch the Z mount.

4. Install the rinsing port cover.
5. Manually and gently move the Z mount, and then make sure that it does not touch the rinsing port cover. Leave a gap of 1 mm (minimum).

Figure 6-29 Gap

6. Install the panel F.
7. Connect the mains supply cable to the mains supply outlet.
8. Turn on the autosampler.
9. Press **rinse**, and then make sure the rinse completes without any issues.

Clean the Rinsing Port and Rinsing Port Cover

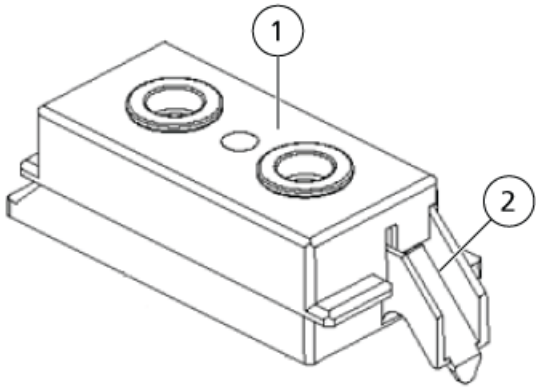
Follow this procedure if a leak occurs at the rinsing port slope or the rinsing port slope becomes dirty.

1. Make sure that the tip of the drain tubing is not immersed in the waste.

Tip! Use the drain tube clamp to prevent the immersion of the tip of the drain tubing.

2. Remove the rinsing port cover.
3. Clean the rinsing port cover, rinsing port slope or other dirty portions using a soft cloth or paper soaked with water.

Figure 6-30 Rinsing Port



Item	Description
1	Rinsing port cover
2	Rinsing port slope

4. Replace the rinsing port cap. Refer to *Replace the Rinse Port Cap on page 142*.

Rinse the Flow Lines

Rinse the Needle and Sample Loop

If there is clogging inside the needle or the sample loop, or if there is contamination on the needle surface, then rinse the inside and outside of the needle with the mobile phase.

1. Press **CE** to show the initial screen.
2. Press **VP** repeatedly until the **MAINTENANCE** screen is shown.
3. Press **func** repeatedly until the **NDLE FLUSH** screen is shown.
4. On the pump, press **pump**.
5. Pump at 2 mL/min for 5 minutes, and then stop pumping.
6. Press **enter**.

   The message NDLE is moving is shown, the needle moves to the rinsing port, and the high-pressure valve switches to **INJ**. The LC pump and the needle become connected.
7. Pump mobile phase with the LC pump to wash away any clogging or contamination in the needle.

Note: Replace the needle if it is not possible to remove the clogging or the contamination.

8. When rinsing the inside of the needle is completed, stop the pump by pressing **pump**.
9. Press **enter**.

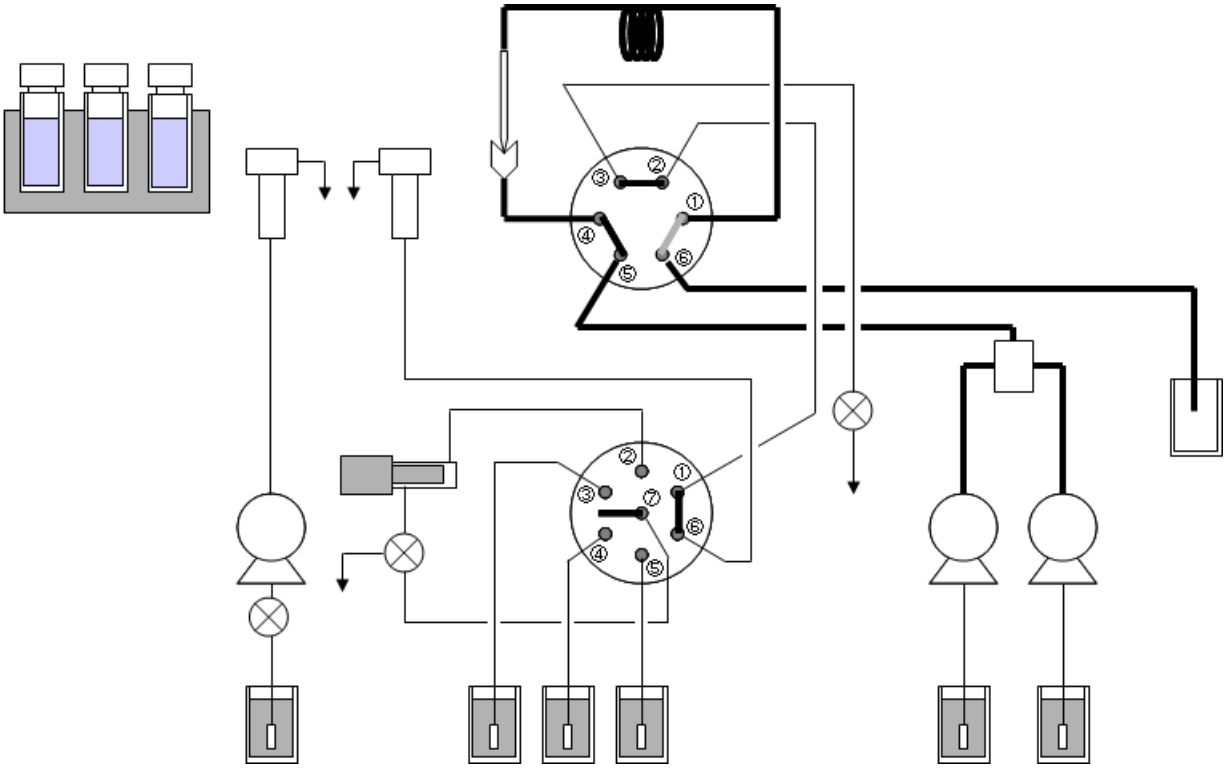
   The needle returns to the injection port.
10. Press **CE** to return to the initial screen.

Reverse Rinse the Flow Lines

If clogging is observed in flow lines inside the autosampler, then it might be possible to remove the clogging by pumping with the inlet tubing and outlet tubing connected in reverse.

1. Disconnect the inlet tubing and the outlet tubing.
2. Connect the end of the outlet tubing that was originally connected to the column to port 6 of the high pressure valve.

Figure 6-31 Tubing Connections



   Mobile phase flows from the other side (originally connected to the high-pressure valve) of the outlet tubing. Collect it in a beaker or similar container.
3. Pump isopropanol into the autosampler from the LC pump at 2 mL/min to 5 mL/min.
4. Return the plumbing to the original state.

Replace the Outlet Tubing

WARNING! Toxic Chemical Hazard. Be careful not to bend tubing repeatedly at the same location. This can cause ruptures or cracks, which can result in mobile phase leaks.

Before replacing the clogged outlet tubing, complete the procedure in *Reverse Rinse the Flow Lines on page 146*. If the clogs remain, then replace the outlet tubing.

Note: Depending on the column type or manufacturer, the connection port shape might vary. If cross-contamination occurs or peaks are affected due to the difference in the connection port shape, then replace the outlet tubing or use the column connection attachment included with the accessory.
At the peak for which the retention time is 0.6 minutes or shorter, the number of theoretical plates of the column is reduced by about 5%.

Prerequisite Procedures

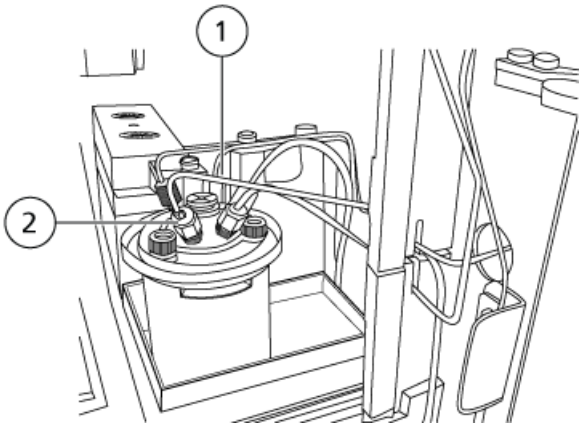
- *Remove Panel F on page 137*

Required Materials

- SUS tubing (0.1 mm i.d. × 600 mm)
  - 0.1 mm i.d.× 600 mm (standard)
  - 0.17 mm i.d. × 1000 mm (optional)
- Preheat block

1. Disconnect the outlet tubing from the column.
2. Move the column oven to the right and then make room between the autosampler and the column oven.
3. Loosen the male nut at port 5 of the high-pressure valve, and then remove the outlet tubing.

Figure 6-32 Male Nut and Outlet Tubing



Item	Description
1	Outlet tubing
2	Male nut at port 5

4. Remove the preheat block from the column oven with a screwdriver.
5. Stretch the round shape portion of the packed outlet tubing shown in *Figure 6-33*.

Figure 6-33 Stretching the Outlet Tubing

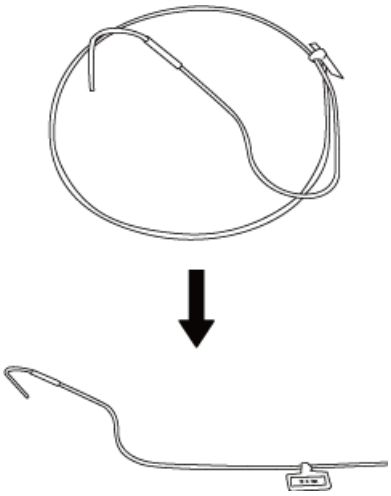
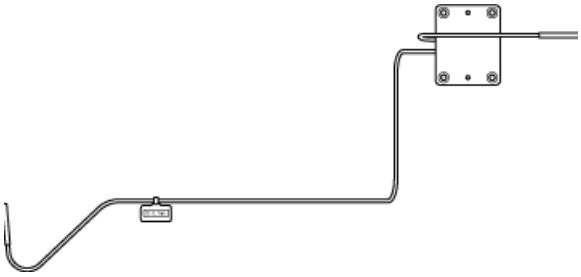
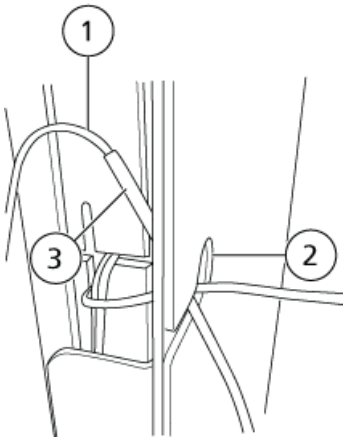


Figure 6-34 Outlet Tubing for the ExionLC AD Column Oven



6. Insert the bent end of the outlet tubing (the end with the identification tag) through the round hole in the side panel of the autosampler.

Figure 6-35 Outlet Tubing Inserted



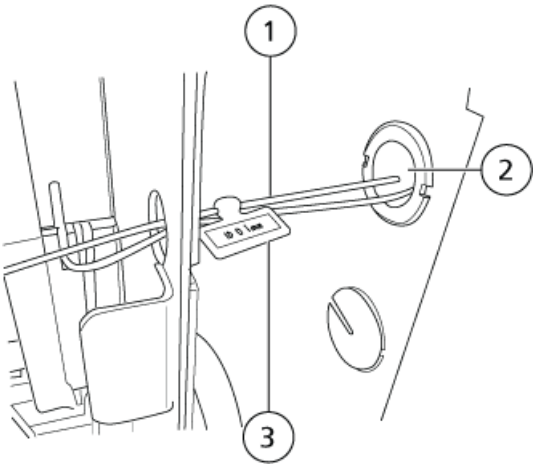
Item	Description
1	Outlet tubing
2	Hole in the side panel of the autosampler
3	Identification tag

CAUTION: Potential System Damage. Do not leave the identification tag inside the column oven. The tag might melt because of the high temperature.

7. Insert the outlet tubing through the round hole on the left side panel of the column oven.

   Position the ID identification tag as necessary to properly install the tubing. After the tubing is installed, move the tag back to the original position.

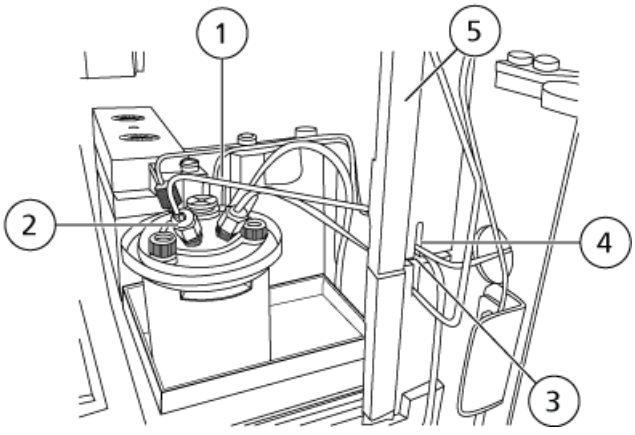
Figure 6-36 Outlet Tubing Routed to Column Oven



Item	Description
1	Outlet tubing
2	Round hole in the side panel of the column oven
3	Identification tag

8. Install a stainless steel male nut and a ferruleUHPLC fitting on the tubing and then connect the tubing to port 5 of the high-pressure valve. Pass the tubing through upper side of "+" shaped slit of the plastic cover.

Figure 6-37 Tubing Correctly Routed



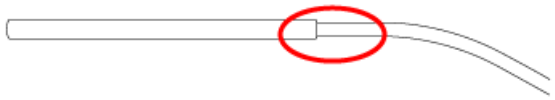
Item	Description
1	Outlet tubing
2	Male nut on port 5
3	+ shape slit
4	Route tubing through the upper part of the slit
5	Plastic cover

9. Install the preheat block back in the column oven.
10. (Optional) If the column connection attachment is being used:
    a. Install a stainless steel ferrule and male nut on the end of the outlet tubing and then connect it with the coupling to the column connection attachment.
    b. Route the tubing through the +-shaped slit notch in the side of the autosampler, and then connect the other end of the column connection attachment or the outlet tubing to the column.
11. Install the panel F.

Note:

- The tubing is more likely to break at the ends where the diameter is reduced. Be careful not to bend the tubing more than 45 degrees.

Figure 6-38 Tubing Break Point



- When bending the SUS tubing, making a bending radius (curvature radius) too small will deform the inner diameter of the tubing, and this could cause clogging or pressure increases in the tubing. Do not bend the tubing excessively, such as pinching it using pliers or similar tools and bending it to an acute angle. Also, do not bend and straighten at the same point repeatedly. This weakens the tubing, and might cause it to break.

Remove Condensation

If the autosampler is used with the sample cooler temperature lower than the room temperature, then visible moisture might form between the sample rack and the rack cooling plate. Follow this procedure to remove the condensation.

1. From the initial screen, press  until the **Z HOME** screen is shown.

2. Press **enter.**

   The needle rises to the highest position and then moves to the center of the autosampler.

3. Remove the sample rack.
4. Remove panel F.

WARNING! Puncture Hazard. Avoid contact with the needle. It is sharp.

5. Wipe water off of the rack cooling plate with soft cloth or paper.
6. Install panel F.
7. Install the sample rack.
8. Press **enter**.

   The needle moves back to the injection port.

Reset the Counters

1. Turn on the autosampler.
2. From the initial screen, press **VP** twice.

   The maintenance information group screen is shown.

3. Press **func** until the appropriate component is shown.

   The usage frequency and the replacement alert value are shown.

4. Press **0** and **enter** to reset the counter to 0.
5. Press **enter** to return to the initial screen.

Clean the High Pressure Valve

The 0.1 mm i.d. tubing is likely to be clogged with wear debris, which is produced from the high-pressure valve. If the tube is clogged, follow this procedure.

1. Disconnect the tubing (outlet tubing) from high-pressure valve port 5 and make sure that there is no clogging in the upstream flow line.
2. Clean the outlet tubing by reversing the flow to remove blockages. If the blockages cannot be removed, then replace the tubing.

Column Oven Maintenance

WARNING! Electrical Shock Hazard. Always turn off the power and then unplug the instrument prior to performing inspection and maintenance. Otherwise, fire, electric shock, or a malfunction might occur.

WARNING! Hot Surface Hazard. Do not open the column oven door if the high temperature lamp is blinking. The internal temperature of the column oven is (60 °C or greater).

CAUTION: Potential System Damage. Only use the replacement parts specified in the *Hardware User Guide*. Use of any other parts might result in instrument damage and malfunction.

Clean Up Leaks in the Column Oven

WARNING! Fire and Toxic Chemical Hazard. Before taking corrective action for solvent leaks, make sure that there are no open flames or other source of fire in the vicinity, and that the room is adequately ventilated. Vapor from the leak could ignite if exposed to a source of fire, and the vapor could cause poisoning if ventilation is inadequate.

WARNING! Crushing Hazard. Be careful not to pinch fingers when opening the doors.

1. Open the doors. Refer to *Open the Doors*.
2. Locate the leak.
3. Wipe away the leakage.
4. Close the left door, and then run the fan for 5 minutes with the right door open.
5. Close the right door, and then press **oven** to start temperature regulation.

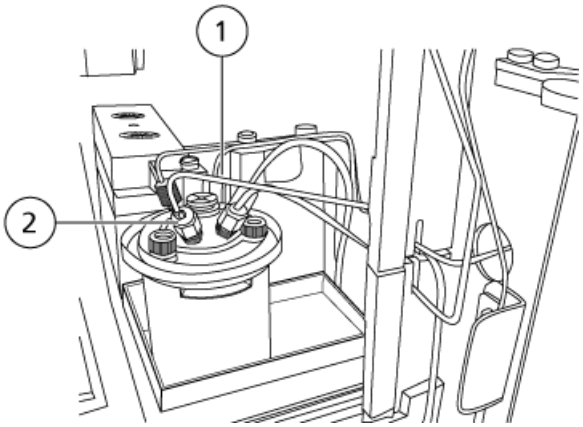
   If the ERR LEAK DETECT message is not shown, then operation can be resumed. If it is shown, then clear the error message by pressing **CE** and then repeat step *1* to step *4*.

Replace Preheat Tubing

WARNING! Crushing Hazard. Be careful not to pinch fingers when opening the doors.

1. Open the doors. Refer to *Open the Doors*.
2. Remove the column from the oven.
3. Disconnect the preheat tubing from the injection valve at the autosampler.

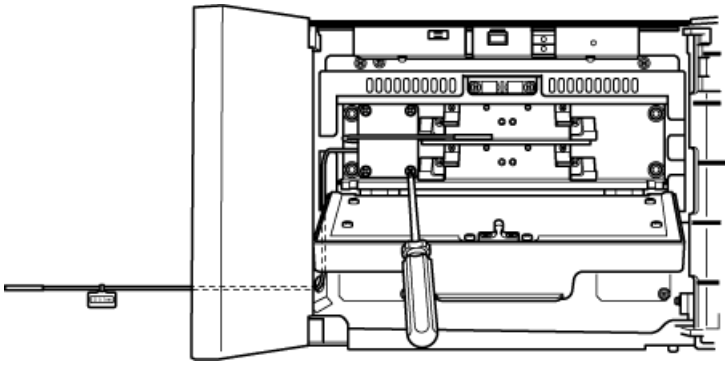
Figure 6-39 Male Nut and Outlet Tubing



Item	Description
1	Outlet tubing
2	Male nut at port 5

4. Remove the clogged preheat block from the heat block of the column oven.

Figure 6-40 Removing the Preheat Block



5. Install a new preheat block on the heat block of the column oven.
6. Connect the preheat tubing to the injection valve at the autosampler, using the ferrule and male nut attached to the preheat block.

Troubleshooting 7

If a problem cannot be resolved by the corrective actions in this section, or if a symptom is not included in the tables in this section, then contact a SCIEX representative.

Configuration Issues

Symptom	Possible Cause	Corrective Action
A link cannot be created to a connected module.	• The module is not connected properly. • The module is not configured properly. • The module is in local mode.	1. Make sure that there is no dirt on the optical-cable connector and that there is no foreign matter inside the connector. 2. Make sure that the optical cable is fully inserted. 3. Make sure that the link address for the module and the optical connector of the system controller are the same. 4. Make sure that the module is not in local mode.
There are discrepancies between the connected-component configuration and the module information shown in the Hardware Configuration. Connected components cannot be controlled.	The module is not configured correctly.	Make sure that **Auto** is selected for the **Unit Configuration** setting in the Hardware Configuration.
Component names and version numbers are not shown.	Depending on the component, the component name and version number are sometimes not shown during the interval between turning power on and the completion of initialization.	N/A

Analysis and Control Issues

Symptom	Possible Cause	Corrective Action
The scheduled end time is different than the time required for the actual analysis.	The scheduled end time is recalculated with the execution of each line in the sequence table. In sequences with lines containing two or more analysis (or injection) processes, only the time for the first analysis is calculated and therefore the scheduled end time will be incorrectly calculated in the following cases: • Racks are replaced frequently with a changer. • Extremely short analyses are executed repetitively. • The oven temperature is changed with each analysis and WaitCTO is shown.	N/A
A P.MAX error occurs during autopurge.	The P-PMAX value is too low.	Verify that the P-PMAX value for the LC pump is appropriate (that is, not too low).
The external input/output terminals on the back of the system controller do not operate properly. The detector is not auto-zeroed when analysis starts.	The Hardware Configuration is incorrect.	Inspect and correct the Hardware Configuration.
System P.Max error occurs.	The P.Max value is incorrect.	Make sure that the system P.Max value for the controller is appropriate.

Pump Issues

Symptom	Possible Cause	Corrective Action
Power does not turn on even after power is turned on.	• The power plug is disconnected. • The power cord internal wires are cut. • The power supply does not meet specifications for this module. • A fuse is blown.	• Connect the plug correctly. • Replace with a new cord of the same type. • Use a power supply that meets specifications for this module. • Replace the fuse.
Key operation is not possible.	 was not pressed.	Press  .
No liquid is pumped. (The pump does not run.)	• The system was not initialized. • Flow rate is set to 0. • Error message (P.MAX, P.MIN, and so on) is shown.	• Deactivate and activate the hardware profile. • Set an appropriate flow rate: 1. Set a flow rate other than 0. 2. Verify the LC method parameters in the Analyst® software. • Press **CE** to clear the message and take corrective actions for errors.

Symptom	Possible Cause	Corrective Action
The pump is running, but no liquid is pumped.	• Air bubbles are generated inside pump head. • Air bubbles are produced through suction filter and pump inlet. • The check valve is not working properly.	• Get rid of bubbles: 1. Press **purge** to purge the bubbles. 2. Insert the disposable syringe into the drain tubing outlet and draw out the bubbles. • Make sure that the filter bushing is tightly fitted. • Push in isopropanol or a similar solvent from the inlet check valve. 1. Disconnect the PTFE tubing from the inlet check valve. Attach the provided stop joint D to this unplugged PTFE tubing. 2. Connect the provided syringe tubing D to the inlet check valve and push in the solvent.

Symptom	Possible Cause	Corrective Action
Pumping is unstable, with large pump pulsation.	• Air bubbles are generated inside pump head. • Previous mobile phase is still remaining inside pump head. • Air bubbles are generated in filter tubing.	• Get rid of air bubbles in the pump head: 1. Press **purge** to purge the bubbles. 2. Insert the disposable syringe into the drain tubing outlet and draw out the bubbles. • Press **purge** to purge the old mobile phase. • Get rid of air bubbles in the filter tubing: 1. Press **purge** to purge the old mobile phase. 2. Shake the suction filter to drive out the bubbles. 3. Inspect the filter for clogging: take off the filter part of the suction filter and record a pressure waveform. If the pressure waveform becomes ideal when the filter is off, then it is clogged. Clean it in an ultrasonic bath or replace it. 4. Degas the mobile phase.

Symptom	Possible Cause	Corrective Action
Pumping is unstable, with large pump pulsation (continued)	• The check valve is contaminated. • Liquid is leaking from flow line connection. • Liquid is leaking from gap between pump head and head holder, or from rinse flow lines. • Flow line is (partially) clogged. • Plunger seals wear out too quickly.	• Clean the check valve: 1. Push in isopropanol or a similar solvent from the inlet check valve. a. Disconnect the PTFE tubing from the inlet check valve. Attach the provided stop joint D to this unplugged PTFE tubing. b. Connect the provided syringe tubing D to the inlet check valve and push in the solvent. 2. Rinse the check valve by pumping isopropanol at a low flow rate of approximately 0.20 mL/minute. 3. If this does not solve the problem, contact an FSE to clean the valve in an ultrasonic bath or replace it. • Fix the leaks: 1. Tighten the male nuts. 2. Replace the nuts and ferrules. • Contact an FSE to replace the plunger seal or the plunger. • Clean or replace the clogged part: 1. Clean the line filter in an ultrasonic bath or replace it. 2. Identify the clogged part and then replace it. • Contact an FSE to replace the plunger.

Symptom	Possible Cause	Corrective Action
Flow rate is below set value.	• The suction filter is clogged. • The check valve does not work properly.	• Inspect the filter for clogging: take off the filter part of the suction filter and record a pressure waveform. If the pressure waveform becomes ideal when the filter is off, then it is clogged. Clean it in an ultrasonic bath or replace it. • Rinse the check valve by pumping isopropanol at a low flow rate of approximately 0.20 mL/minute. • If this does not solve the problem, contact an FSE to clean the valve in an ultrasonic bath or replace it.
Retention time cannot be reproduced.	The check valve does not work properly.	1. Rinse the check valve by pumping isopropanol at a low flow rate of approximately 0.20 mL/minute. 2. If this does not solve the problem, contact an FSE to clean the valve in an ultrasonic bath or replace it.
In a high-pressure gradient system, the two pump units show different pressures. A difference of up to 2.0 MPa or 5% is normal.	• The line filter of one of the pump units is clogged. • Flow lines are clogged at the junction of the two pump unit flow lines.	• Clean the line filter in an ultrasonic bath, or replace it. • Identify the clogged lines and replace them.
Pressure does not rise.	• The drain valve open. • Liquid is leaking from flow line connections.	• Close the drain valve. • Fix leaks: 1. Tighten the male nuts. 2. Replace the nuts and ferrules.

Symptom	Possible Cause	Corrective Action
Pressure rises too much. Remove the column to inspect.	• The line filter is clogged. • The flow lines are clogged. • The inner diameter (i.d.) of the tubing is too small.	• Clean the line filter in an ultrasonic bath or replace it. • Identify the clogged parts and replace them. • Use tubing with the appropriate i.d.
Ghost peaks appear. The baseline drifts.	Flow lines, line filter or suction filter are fouled.	Rinse the flow lines or filters: 1. Pump 17% phosphoric acid solution through the flow lines at 1 mL/min for 30 minutes (pumping pressure: 1 MPa to 5 MPa). 2. Pump HPLC-grade water through the flow lines at 5 mL/min for 30 minutes (pumping pressure: 1 MPa to 5 MPa).

Automatic Rinsing Kit Issues

Symptom	Possible Cause	Corrective Action
Volume of rinse solution increases during pumping.	A plunger seal is leaking.	1. Remove the rinsing kit. 2. Determine whether the left or right plunger seal is leaking. 3. Contact an FSE to replace the plunger seal.
Volume of rinse solution decreases during pumping.	A diaphragm is leaking.	1. Inspect the bottom of the head holder to verify that there is a leak. 2. Contact an FSE to replace the diaphragm.

Degasser Issues

Symptom	Possible Cause	Corrective Action
Bubbles are discharged from a degasser OUT port.	• A solvent IN/OUT port joint is loose and air is sucked in. • The suction filter at the inlet is clogged and the flow resistance is increased. • Flow resistance has increased, due to bent suction tubing. • The amount of solvent in the mobile phase bottle is small and air is sucked in. • Incomplete solvent change has resulted in dissimilar or incompatible solvents being mixed in the flow line, resulting in foaming.	• Securely tighten joints If the joint is damaged, then contact an FSE to replace it with a new one. • Clean or replace the suction filter. • Cut the bent portion of the tubing or replace it with a new one. • Add mobile phase until the suction filter is immersed in the liquid. • Replace the solvent. In particular, when replacing a solvent with low solubility, first thoroughly flush the lines with a solvent that is soluble with to both solvents, and then replace with target solvent.
The solvent does not flow.	• The LC pump has not sent a solvent properly. • The solvent delivery system (including degassing unit and LC pump) is dirty or clogged. • The wrong tubing is used, or it is connected incorrectly.	• Inspect the LC pump. • Especially when replacing buffered solvents, salt deposits might occur depending on the solvent solubility. Clean the lines with an appropriate solvent. • Make sure that tubing is connected to the respective flow lines correctly.

Symptom	Possible Cause	Corrective Action
No power is provided. The LED does not illuminate.	The power cable is connected too loosely to supply the power.	Connect it securely.
The red error lamp is on.	The evacuation capability of the vacuum pump is reduced due to condensation of solvent gas. Liquid might drop from the exhaust port.	The evacuation capability might be unstable temporarily due to condensation of solvent gas in the vacuum line. Refer to *Degasser*. Drain liquid from the degasser, remove the stop joint, turn on the degasser, and then idle the degasser for two or three hours. If the **Error** lamp illuminates and the degassing unit stops during idle running, turn off the LC pump and back it on, and then restart the degasser. In the event that the **Error** lamp illuminates or any liquid continuously flows out even after the restarting is repeated several times, the degasser might have failed. Contact an FSE.

Autosampler Issues

Symptom	Possible Cause	Corrective Action
Power does not turn on when the power button is pressed.	• The power plug is disconnected. • The power cord internal wires are cut. • The power supply does not meet the specifications for this module. • A fuse has blown.	• Connect the plug to the mains supply. • Replace the power cable with a new cable of the same type. • Use a power supply that meets the specifications for this module. • Replace the fuse.
No peaks are visible.	• The mobile phase is not flowing. • The vials contain an insufficient amount of sample. • The LC method is incorrect. • The sample path injection flow lines clogged. • Column performance has deteriorated.	• Determine whether the pump is functioning normally. Take corrective action as necessary. • Add more sample to the vials. • Verify the contents of the LC method. • Inspect flow lines for clogging, and replace plumbing if clogs are found. • Verify column performance under known analysis conditions. If performance has deteriorated, replace column.

Symptom	Possible Cause	Corrective Action

The peak retention time fluctuates.	• Pump flow rates unstable.
	• Column temperature is fluctuating.
	• Column performance has deteriorated.
	• The composition of the mobile phase varies.
	• The room temperature fluctuating.
	• There is clogging in the needle or the plumbing.
	• Rinse solution used for internal rinsing of the needle remains in the high-pressure flow lines such as the needle or sample loop.
		• Determine whether the pump is functioning normally. Take corrective action as necessary.
		• Use a column oven.
		• Verify column performance under known analysis conditions. If performance has deteriorated, replace column.
		• Replace mobile phase, and then verify the composition of new mobile phase.
		• Install the autosampler in a room with minimal temperature variations.
		• Clean by reversing the flow direction. If the issue persists, replace the needle or the plumbing.
		• Configure the rinse settings:
		  • Set 600 mL or more at **MLPURGEVOL** for purging the measuring flow line, and sufficiently purge the flow line with mobile phase (R0)using the measuring pump after internal rinsing of the needle.
		  • Enable **LOOP S. TM** for sample loop equilibration, and purge the flow line with mobile phase using high-pressure rinsing with the pump after internal rinsing of the needle.

Symptom	Possible Cause	Corrective Action

Peak shapes are abnormal (peaks are broad, or tailing, and so on).	• Column performance has deteriorated.
	• Plumbing connections between the pump and the column were reversed.
	• Dead volume exists between the flow line connections.
	• Flow lines are leaking.
	• There is clogging in the needle or the plumbing.
	• Rinse solution used for internal rinsing of the needle remains in the high-pressure flow lines such as the needle or sample loop.
		• Verify column performance under known analysis conditions. If performance has deteriorated, replace column.
		• Reconfigure the plumbing.
		• Inspect connections for dead volume. Reconfigure connections to eliminate dead volume.
		• Refer to *Countermeasures for Leakages on page 175*.
		• Clean the flow line components:
		  • Clean the flow lines by reversing the flow direction.
		  • Clean the interior of the needle with a mobile phase NDLE FLUSH.
		  • If the issue persists, replace the needle or the plumbing.
		• Configure the rinse settings:
		  • Set 600 mL or more at **MLPURGEVOL** for purging the measuring flow line, and sufficiently purge the flow line with mobile phase (R0)using the measuring pump after internal rinsing of the needle.
		  • Enable **LOOP S. TM** for sample loop equilibration, and purge the flow line with mobile phase using high-pressure rinsing with the pump after internal rinsing of the needle.

Symptom	Possible Cause	Corrective Action

Ghost peaks appear.	• There is no rinse solution.
	• The rinsing port is contaminated.
	• Previous mobile phase remains in the mobile phase flow lines.
	• Previous rinse solution remains in the rinse flow lines.
	• Rinse solution used for internal rinsing of the needle remains in the high-pressure flow lines such as the needle or sample loop.
		• Verify that rinse solution is present.
		• Increase the RINSE VOL setting.
		• Clean the mobile phase flow lines.
		• Clean the rise solution flow lines.
		• Configure the rinse settings:
		  • Set 600 mL or more at **MLPURGEVOL** for purging the measuring flow line, and sufficiently purge the flow line with mobile phase (R0)using the measuring pump after internal rinsing of the needle.
		  • Enable **LOOP S. TM** for sample loop equilibration, and purge the flow line with mobile phase using high-pressure rinsing with the pump after internal rinsing of the needle.

Symptom	Possible Cause	Corrective Action

Reproducibility is poor.	• Flow lines are not being rinsed sufficiently, or there is no rinse solution.
	• The composition or flow rate of mobile phase varies.
	• Flow lines are leaking.
	• Room temperature is fluctuating.
	• Column performance has deteriorated.
	• The needle seal is worn.
		• Clean the flow lines:
		  • Purge or rinse the flow lines.
		  • Add rinse solution.
		  • Operate **PUMP HEAD FLUSH**.
		• Inspect the pump and mobile phase.
		• Refer to *Countermeasures for Leakages on page 175*.
		• Install the autosampler in a room with minimal temperature fluctuations.
		• Verify column performance under known analysis conditions. If performance has deteriorated, replace column.
		• Contact an FSE to replace the needle seal.

The baseline is drifting.	• Flow lines are dirty. • Room temperature is fluctuating. • Flow rates fluctuate.	• Thoroughly clean the flow lines. • Install the system in a room with minimal temperature fluctuations. • Determine whether the pump is functioning normally. Take corrective action as necessary.

Symptom	Possible Cause	Corrective Action

Large pressure fluctuations occur when the high-pressure valve is switched.	• Flow lines are clogged.
	• The high-pressure valve is clogged.
	• The high-pressure valve does not rotate to the correct positions.
		• Clean the flow lines:
		  • Rinse the flow lines with reverse flow.
		  • Inspect the flow lines and replace the tubing if any clogging is found.
		• Contact an FSE to disassemble and then clean high-pressure valve. If disassembly and cleaning do not unclog the valve, the rotor and stator seal might need to be replaced.
		• The message ERR HPV Home is shown. Contact an FSE.

Column inlet pressure is too high.	• The column is clogged.
	• The flow lines are clogged.
		• Verify column pressure. If the column is clogged, then replace it.
		• Clean the flow lines.
		  • Rinse the flow lines with reverse flow.
		  • Inspect the flow line. Clean or replace any clogged plumbing.

Column Oven Issues

Symptom	Possible Cause	Corrective Action
Power does not turn on even after switching on power.	• Power plug is disconnected. • Power cord internal wires are cut. • Power supply does not meet specifications for this module.	• Connect the plug to the mains supply. • Replace with a new cord of the same type. • Use a power supply that meets the specifications for this module.
Key operation is not possible.	 was not pressed.	Press  . The **oven** LED illuminates
ready LED does not illuminate.	• **oven** LED is not on. • The right door is open. • The ambient temperature is low and the setting temperature is high.	• Make sure that the column oven is configured correctly. • Close the right door. • Set the Ready Range to a higher value.
No error message is shown when mobile phase leaks inside oven during temperature regulation.	The sensitivity is incorrectly adjusted.	Contact an FSE to adjust leak sensor sensitivity.
The pump pressure is high.	The preheat block tubing is clogged.	Replace the preheat block.
The retention time of the target element is greatly different from the one measured using another system.	• No value is set for H.CompFlow. • Temperature calibration is not correct.	• Set a value for H.CompFlow. • Carry out temperature calibration.

Troubleshooting Clogging in Flow Lines

Follow this procedure when there is a pressure increase in the flow line.

1. Disconnect the outlet tubing from the column inlet. If the pressure decreases, then follow these steps:
   a. Inspect or replace the column.
   b. If the pressure remains high, then contact an FSE to inspect the high pressure valve rotor and stator.
2. Disconnect the outlet tubing from the high pressure valve. If the pressure decreases, then follow these steps:
   a. Perform reverse rinsing of the outlet tubing. Refer to *Reverse Rinse the Flow Lines on page 146*.

b. Replace the outlet tubing. Refer to *Replace the Outlet Tubing on page 147*.

c. If the pressure remains high, then contact an FSE to inspect the high pressure valve rotor and stator.

3. Remove the needle from the injection port. If the pressure decreases, then follow these steps:

   a. Replace the needle. Refer to *Replace the Needle on page 138*.

   b. Replace the sample loop. Refer to *Replace the Sample Loop on page 140*.

   c. Contact an FSE to replace the needle seal, high pressure valve rotor, or high pressure valve stator.

4. Disconnect the inlet tubing from the high pressure valve. If the pressure decreases, then follow these steps:

   a. Rinse the high pressure valve with the HPV ROTATION function.

   b. Contact an FSE to replace the needle seal, high pressure valve rotor, or high pressure valve stator.

5. Inspect the mixer and pumps.

Countermeasures for Clogging in Tubing

Cause of Clogged Tubing	Corrective Action
Insoluble matter in the mobile phase.	Especially when a buffer solution is used as the mobile phase, filter the buffer solution before use with a commercially available strainer that has a membrane filter with a bore diameter of 0.45 µm maximum. Insoluble matter contained in salt can clog the tubing. Filtering is also important for protecting the column. **Required Materials:** Membrane filter (with a bore diameter of 0.22 µm max.)
Insoluble matter in the sample.	If the sample solution is turbid or contains insoluble matter, use a commercially available disposable filter to filter the sample solution before analysis. Insoluble matter contained in the sample can cause clogging in the tubing or the column, just as with insoluble matter in the mobile phase. **Required Materials:** Disposable filter
Suspended particulates or dirt in the environment.	Avoid a dirty or dusty environment when working with the system panels open. Small dirt or dust in the environment can enter from the injection port and cause clogging. Normally, this is not an issue because analysis is performed with the front panel of the system closed.

Cause of Clogged Tubing	Corrective Action
Shavings of the needle seal installed in the injection port.	The injection port has a needle seal installed. Should a needle become misaligned even a little due to some cause, the needle might cut the needle seal. If this generates needle seal shavings, then these shavings might clog the tubing. If the tubing is clogged, then the misalignment of the needle can be confirmed on the injection port by selecting the **TEST INJ PORT** function to move the needle up and down. If misalignment of the needle is observed, then adjustment of the injection port is necessary.
Shavings of the septum used for a sample vial.	Use approved septa and sample vials. Some septa used for sample vials can have shavings that might cause the needle to become clogged. There are various types of septa, and depending on the type, the coating and material of the septum surface might vary. Approved septa have passed continuous injection tests and resistance to solvents tests. Usually a thin membrane of solvent-resistant material (such as PTFE) is coated on the septum surface, but if using a different septum than approved by SCIEX, then when the needle penetrates the septum, septum shavings might be peeled off, which can cause clogging.
Abrasion powder from the PEEK rotor seal for the high-pressure valve.	Disassemble and clean the high-pressure valve approximately once every 10 000 injections. Clogging in the tubing can be avoided by increasing the inside diameter of the tubing. This cannot be a fundamental countermeasure and is essentially not desirable, because foreign particles accumulate at the column inlet instead of the tubing. Therefore, first check the above point and the countermeasures. **Required Materials:** Methanol or isopropanol

Cause of Clogged Tubing	Corrective Action
Microscopic particles coming out of the LC pump.	• When installing a new part, before connecting it to the system, be sure to rinse it by pumping methanol or isopropanol (5 mL/min for 15 minutes), to remove particles from flow line parts. • Replace the line filter periodically to remove particles from worn plunger seals. **Required Materials:** Methanol or isopropanol
Particles from the tubing.	When replacing tubing, before connecting, rinse the new tubing completely. To rinse tubing, pump methanol or isopropanol (5 mL/min, 15 minutes). If a high pressure of 66 MPa or above is applied to the tubing, use the tubing parts specific to the ExionLC™ AD system. Do not cut the tubing parts when using them. Regardless of the pressure level, do not use any stainless steel tubing that is cut to length, for example, using a file (for cutting stainless steel tubing). Metal powders produced during cutting enter the flow line and could lead to pressure buildup or clogging of the tubing. **Required Materials:** Methanol or isopropanol

Countermeasures for Leakages

Symptom	Possible Cause	Corrective Action
High-pressure valve leaking.	Rotor and stator sealing ability has deteriorated.	Replace the rotor seal, inspect the stator and replace it if necessary (refer to Note).
Low-pressure valve leaking.	Rotor and stator sealing ability has deteriorated.	Inspect the rotor and stator and replace them if necessary (refer to Note).
Flow line connections leaking.	The male nuts are loose or stripped.	• Tighten the male nuts. • If tightening does not stop the leak, replace the male nuts and ferrules.

Note: The high-pressure valve stator is made of specially hard coated material, and the low-pressure valve stator is made of ceramic. If there are no visible scratches, they do not need to be replaced.

Consumables, Options, and Spares A

For consumables and spares for the optional modules, refer to the appropriate operator guide:

- *Multiplate Sampler Operator Guide*
- *Rack Changer Operator Guide*
- *UV Detector Operator Guide*
- *PDA Detector Operator Guide*

Order the parts provided in the tables, or their equivalent.

Consumables

Part Name	Part No.	Remark
Power Cord (for UL/CSA)	071-60821-08	
Power Cord (for EU)	071-60825-51	
Fuse	4425976	Controller
Fuse	4412722	HPLC pump, Pump , Column Oven
Fuse	4412723	Autosampler
Remote Cable	4425081	
PTFE Tubing, OD 7.0 x ID 6.0	4412687	
Drain Tube (EFTE) ASSY	4426026	
20 mL Syringe	4412706	
Syringe Needle	4412820	
Coupling 1.6C	228-16004-13	
Suction filter	4426106	

Sample Vials

To prevent the septum from falling off during injection, tighten the cap before using.

Table A-1 Sample Vials

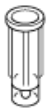
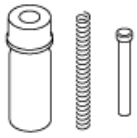
Part Name	Volume	Material	Part Number	Application	Conforming Plate	Description
4 mL Sample Vial 	4 mL	Borosilicate glass	4413362	General	4 mL sample vial plate	With cap/silicon rubber septum, 100 pieces
4 mL Sample Vial [6]	4 mL	Polypropylene	4425149	General	4 mL sample vial plate	With cap/silicon rubber septum, 100 pieces[7]
1.5 mL Sample Vial 	1.5 mL	Borosilicate glass	228-15652-92	General	1.5 mL sample vial plate[8]	With cap/silicon rubber septum, 100 pieces
1.1 mL Sample Vial [6] 	1.1 mL	Borosilicate glass	4413360	General / small volumes	1.5 mL sample vial plate[8]	With cap/silicon rubber septum, 100 pieces
1 mL Sample Vial	1 mL	Vial: Borosilicate glass Cap: Polyethylene	4425389	General	1 mL sample vial plate	With cap, 250 pieces

[7] Care must be taken when handling the polypropylene sample vials.

[6] For models with sample cooler, depending on the difference of thermal conductivities due to the shapes or materials, the set temperature of the sample cooler might differ from the temperature in the sample vial.

[8] Set the needle stroke to 45 mm or less.

Table A-1 Sample Vials (continued)

Part Name	Volume	Material	Part Number	Application	Conforming Plate	Description
1 mL Sample Vial[6] 	1 mL	Vial: Polypropylene Cap: Polyethylene	4425150	General / small volumes Disposable	1.5 mL sample vial plate[8]	With cap, 200 pieces [7]
0.3 mL Sample  Vial[6]	300 µL	Borosilicate glass	4412816	Small capacity vial	1.5 mL sample vial plate[8]	With cap/silicon rubber septum, 100 pieces
0.3 mL Sample Vial (Spare)[6]	300 µL	Borosilicate glass	4412817	Small capacity vial	1.5 mL sample vial plate[8]	100 pieces (glass vials only)
0.3 mL Sample Vial[6] 	300 µL	Borosilicate glass	228-21284-91	Small capacity vial	4 mL sample vial plate	With spring, 100 pieces Used in 4 mL sample vials
0.3 mL Sample Vial (Spare)[6]	300 µL	Borosilicate glass	4413361	Small capacity vial	4 mL sample vial plate	100 pieces (glass vials only)
0.2 mL Sample Vial [6] 	200 µL	Vial: Polypropylene Cap: Polyethylene	4425340	For small capacity Disposable	1.5 mL sample vial plate[8]	With cap, 100 pieces [7]

Sample Vial Material

Table A-2 Sample Vial Material

Type	Characteristic	Appropriate Sample Solvent
Glass Sample Vial	Ionic material such as an acid or base might be adsorbed to the surface of the glass. Analyzing the ionic material in such a status would deteriorate the accuracy and precision, affecting the reliability of the analysis. In that case, adjust the sample solvent to restrain adsorption of the material. Also, alkali or hydrogen fluoride might corrode the glass material.	• 10 mmol/L to 100 mmol/L perchloric acid aqueous solution or mixtures of such with an organic solvent. For the organic solvent, use acetonitrile, methanol, or ethanol. • 10 mmol/L trifluoroacetic acid (TFA) organic solvent. For the organic solvent, use acetonitrile, methanol, or ethanol. Trifluoroacetic acid is detected when n absorbance is detected between 200 nm and 220 nm.
Plastic Sample Vial	The hydrophoby of the material will be a cause of surface adsorption. The accuracy and precision of the analysis will deteriorate, and sample solvents with a higher polarity will be more affected. Using a low polarity sample solvent will restrain the hydrophobic substance from being adsorbed, but if the polarity is too low, then the additives in the plastic might elute from the surface of the sample vial. An organic solvent might denaturalize plastic.	Mixtures of water or a buffer solution with an organic solvent. Organic solvent composition ratio: 20 % to 50 % (V/V). (For the organic solvent, use acetonitrile, methanol, or ethanol.)

Septum

Table A-3 Septum

Part Name	Appearance	Material	Part Number	Conforming Sample Vial	Description
Silicone Rubber Septum		Silicone rubber w/PTFE cover	4412734	• 1.5 mL sample vial (228-15652-92) • 1.1 mL sample vial (228-21283-91) • 0.3 mL sample vial (228-16847-92)	100 pieces
PTFE Septum		PTFE	4426178		100 pieces

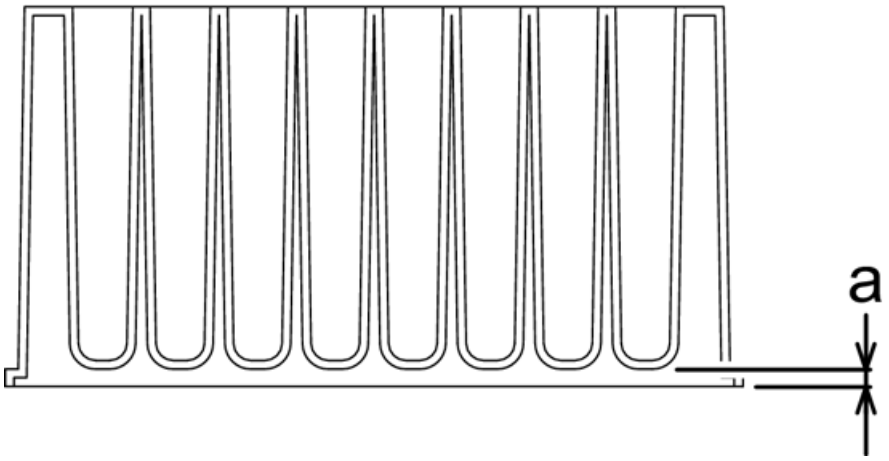
Table A-3 Septum (continued)

Part Name	Appearance	Material	Part Number	Conforming Sample Vial	Description
Silicone Rubber Septum		Silicone rubber w/PTFE cover	228-21290-91	4 mL sample vial (228-21287-91) (228-31537-91)	100 pieces
PTFE Septum		PTFE	4426273		100 pieces

Microtiter Plate

When using a sample cooler, use one with a gap of 2 mm or less between the well bottom and the bottom surface of the outer shape part (a). If one with a raised bottom that has a gap (a) exceeding 2 mm and a shallow well bottom is used, then condensation water might be generated between the cooling plate on the sample rack and the microtiter plate or deep-well plate, thus obtaining incorrect analysis results.

Figure A-1 Microtiter Plate



The microtiter plates, deep-well plates, and plate mats recommended for this system are as follows:

Table A-4 Well-fitted Sealings and Compatible Plates

Plate Type	Product	Contact	Description
Microtiter Plate	267245 series	Nalge Nunc International (Thermo Fisher Scientific)	Material: Polypropylene Volume: 0.5 mL
Deep-Well Plate	278752		Material: Polypropylene

Table A-4 Well-fitted Sealings and Compatible Plates (continued)

Plate Type	Product	Contact	Description
			Volume: 2 mL
	AXYGEN P-DW-20-C	Greiner	Nalge Nunc International (Thermo Fisher Scientific)
Mat	AXYGEN AM-2ML-RD		Material: Silicone Too much filled volume in the well might cause the mat to rise to the surface over time.
	276011	Nalge Nunc International (Thermo Fisher Scientific)	
	276002 series		Material: Thermoplastic elastomer

Table A-5 Heat Sealing Mats and Compatible Plates

Plate Type	Product	Contact	Description
Microtiter Plate	4titude 4Ti-0110	AB gene	Material: Polypropylene Volume: 0.3 mL
Deep-Well Plate	4titude 4Ti-0130		Material: Polypropylene Volume: 1.85 mL
Mat	ABgene Easy Peel AB-0745		Material: Foil
	4titude Peel-Seal 4Ti-0521		Material: Foil
	4titude Pierce-Seal 4Ti-0531		Material: Foil
	Permanent sheet PP 298-37851	Wako Pure Chemical Industries	Material: Foil

Table A-6 Adhesive Sealing Mats and Compatible Plates

Plate Type	Product	Contact	Description
Microtiter Plate	267245 series	Nalge Nunc International (Thermo Fisher Scientific)	Material: Polypropylene Volume: 0 .5 mL
Deep-Well Plate	278752		Material: Polypropylene

Table A-6 Adhesive Sealing Mats and Compatible Plates (continued)

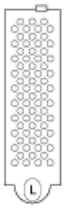
Plate Type	Product	Contact	Description
			Volume: 2 mL
	AXYGEN P-DW-20-C	Greiner	Material: Polypropylene Volume: 2 mL
Mat	USA SCIENTIFIC NAL-96 Sealing Film 2923-5000	USA Scientific	Material: Polyethylene (upper layer) Polypropylene (lower layer) • There is no adhesive for the well part. • Used exclusively for 96 well plates. • Too much filled volume in the well might cause the mat to rise to the surface over time.

Note: Take care when using mats with the following characteristics because they can cause the flow lines for the needle or the needle seal to clog.

- Mats with adhesive attached to the entire back side (the side in contact with the plate).
  Regardless of the type of solvent, if such a mat is used, then the adhesive tends, over time, to become attached to the outer surface of the needle and the inside of the flow line hole. This prevents aspiration of the sample, thus clogging the flow line or preventing the correct peak area value from being obtained.
- Mats made of polyethylene terephthalate (PET).
  When using an acetonitrile-based or DMSO-based solvent, the sample solvent tends to swell and cause wrinkles in the mat after the mat is sealed, which might prevent airtightness from being maintained.

  When the sample solvent is water-based or methanol-based, these mats cause no significant issues.

Sample Vial Racks, Microtiter Plate Racks

Name	Screen Display	Sample Vial Type, Volume	Capacity	Part Number
1 mL sample vial rack 	1 mL-C	Glass 1 mL	175 vials	228-37614-92
1.5 mL sample vial cooling rack 	1.5 mL-C	• Glass 1.5 mL • Glass 1.1 mL • Glass with spacer 0.3 mL • Plastic (PP) 1 mL, 0.2 mL	70 vials	228-44617-92
1.5 mL vial cooling rack(105 vials) 	1.5 mL	• Glass 1.5 mL • Glass 1.1 mL • Glass with spacer 0.3 mL • Plastic (PP) 1 mL, 0.2 mL	105 vials	228-50761-92
4 mL sample vial rack 	4 mL-C	• Glass 4 mL • Plastic (PP) 4 mL 0.3 mL to accommodate 4 mL sample vials	50 vials	228-37616-92

Name	Screen Display	Sample Vial Type, Volume	Capacity	Part Number
Microtiter plate rack 	MTP-96, MTP-384	Microtiter plates (96-well, 384-well)	2 plates	228-37545-92
Deep well plate rack 	DWP-96, DWP-384	Deep-well plates (96-well, 384-well)	2 plates	228-37546-92
Control vial rack	CntR	• Glass 1.5 mL • Glass 1.1 mL • Glass with spacer 0.3 mL • Plastic (PP) 1 mL • PP 0.2 mL	10 vials	228-44634-91
Rack-changer rack	Changer	For optional rack changer	1 plate	228-4599-92

Temperature Control Performance

Sample Rack name	Temperature Control Performance
Sample vial rack for 1 mL vials	Vial bottom temperature = temperature setting ±3 °C
Sample vial cooling rack for 1.5 mL vials	Vial bottom temperature = temperature setting ±3 °C
Sample vial rack for 4 mL vials	Vial bottom temperature = temperature setting ±3 °C
Microtiter plate rack	Well bottom temperature = temperature setting ±6 °C
Deep-well MTP rack	Well bottom temperature = temperature setting ±6 °C

Cooling Performance

Sample Rack Name	Environment	Liquid Volume	Vial Used	Measurement Site
Sample vial rack for 1 mL vials	30 °C 70%	Water 700 mL	Flat bottom glass vial	Vial bottom center
Sample vial cooling rack for 1.5 mL vials	30 °C 70%	Water 1 mL	Glass vial	Vial bottom center
Sample vial rack for 4 mL vials	30 °C 70%	Water 3 mL	Glass vial	Vial bottom center
Microtiter plate rack	30 °C 70%	Water 200 µL	Nalge Nunc round bottom MTP	Well bottom center
Deep-well MTP rack	30 °C 70%	Water 1 mL	Nalge Nunc round bottom MTP	Well bottom center

Controller Spares

Part	Part Number	Description
Bus cable	228-41977	
Power cable	Region-specific	Use the region-specific power cable
LAN cable	088-81104-11	Straight cable
Control cable	228-41797-91	CBM-Lite only

Pump Spares

Part Name	Part Number	Description
Polyethylene Seal	4427161	Utilized when a nonpolarized organic solvent like hexane or a solvent of alkyl sulfonic acid with TFA added is used.
Signal cable	228-35047-92	
Remote cable	4425081	

Autosampler Spares

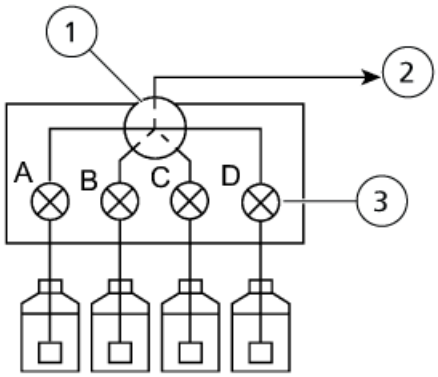
Part Name	Part Number	Description
1.5 mL Sample Vial Plate (2 pcs)[0]	228-50830-92	Plate that holds fifty-four 1.5 mL sample vials. It is possible to install two plates in one sample rack.
ExionLC™ Rack Changer	5036648	
1.5 mL vial plate kit (3 plates)	4463925	Three 1.5-mL vial plates (for one stack) are included. Four kits are required if 12 plates are used.
Sample loop 50 µL	4427179	
Needle Coating 30A	228-41024-95	
Rinsing Port Cover	228-48328-01	
Rinse port cap (without holes)	4426125	For use when rinse solution contains highly volatile acids, such as formic acid, TFA, or acetic acid. Ten per kit.
Rinse port cap (with holes)	4426132	For use with other rinse solutions. **Note:** Use caps with holes even when using highly volatile acids, if there is a risk of cross-contamination.
SUS tubing HP IN (0.3 × 300 mm)	228-53184-92	
SUS tubing HP OUT (0.1 × 600 mm)	228-53184-94	For loop injection
Preheat block (0.1 × 800)	228-52597-43	0.1 mm i.d., 800 mm length, with preheat block (for
Panel F	228-50487-92	
Ferrule	228-16000-10	
Male nut, 1.6 MN	4412795	Stainless steel nut
Ferrule, 1.6F, 316L	4462590	Stainless steel ferrule, 3 pieces
Male nut, 1.6 MN, W6	4412813	
1.5 mL cooling rack cover	228-50759-91	
Vial detection spring	4412698	

Column Oven Spares

Part Name	Part Number	Description
Preheat block single	228-52597-43	
UHPLC fitting (1 piece)	50372801	Fittings reusable 20 times with a pressure resistance of 130 MPa. For information on how to attach, refer to the instruction manuals of the fittings.
Preheat block dual	228-52597-42	Option
Gas sensor	061-84301	

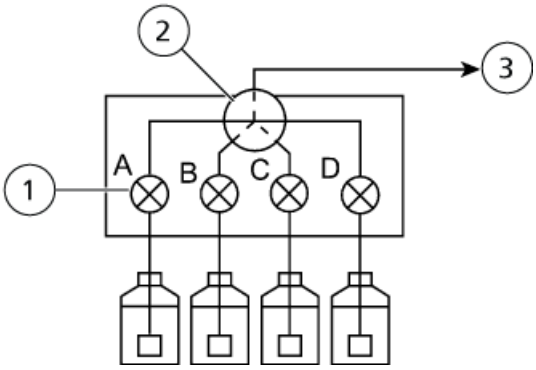
Options

Part Name	Part Number	Description
ExionLC™ UV Detector	5036652	
ExionLC™ Rack Changer	5036648	
ExionLC™ HPLC Pump	5036658	

Part Name	Part Number	Description
Low pressure gradient unit (HPLC pump)	228-45040-91	Can switch between up to four pump unit liquids of low-pressure gradient or mobile phases. Used for automatic rinsing of block column and flow lines. Installed inside the system. **Figure A-2 LPGU**  **Item** / **Description** 1 — 5-way switching block 2 — To pump unit 3 — 2-way solenoid valves

<table>
<tr><th>Part Name</th><th>Part Number</th><th>Description</th></tr>
<tr><td>Low pressure gradient unit</td><td>228-45180-43 (with mixer) or 228-45180-44 (without mixer)</td><td>

Can switch between up to four liquids of low pressure gradient or mobile phases
Used for auto rinsing of column and flow lines.
Installed inside the system.
Available with our without a dedicated mixer (inner volume 180 µL) built into the column oven.

Figure A-3 Low Pressure Gradient Unit


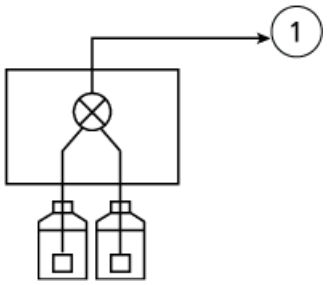
<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>1</td><td>2-way solenoid valves</td></tr>
<tr><td>2</td><td>5-way switching block</td></tr>
<tr><td>3</td><td>To pump unit</td></tr>
</table>
</td></tr>
<tr><td>Low volume low pressure gradient unit</td><td>228-45205-41</td><td>AD pump only

A quaternary low-pressure gradient unit capable of high speed gradient analysis due to system delay volume of less than 470 mL.
Installed inside the system.
Includes a built-in dedicated mixer (inner volume 40 mL) and specialized low-volume tubing.

Refer to Figure A-3.</td></tr>
</table>

<table>
<tr><th>Part Name</th><th>Part Number</th><th>Description</th></tr>
<tr><td>Reservoir switching valve</td><td>228-45167-42
HPLC pump: 228-45049</td><td>

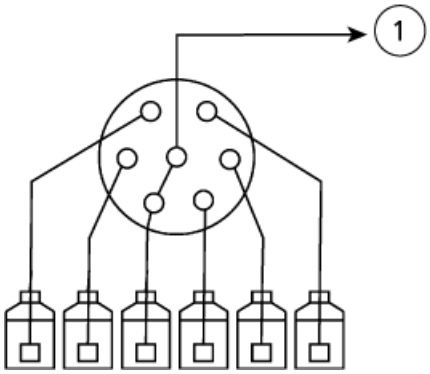
Switches between two liquids. For example, switches between mobile phase and rinse solution.
Installed inside the system.

Figure A-4 30A


<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>1</td><td>To pump</td></tr>
</table>
</td></tr>
<tr><td>FCV-12AH</td><td>228-45013</td><td>Switches between two columns.</td></tr>
</table>

<table>
<tr><th>Part Name</th><th>Part Number</th><th>Description</th></tr>
<tr><td>Reservoir switching valve FCV-13AL</td><td>228-45016</td><td>

Auto mobile-phase switching valve with 7 ports and 6 positions.
Can switch between up to 6 reservoir bottles.
FCV-13AL can be controlled by the Analyst® . software.

Figure A-5 FCV-13AL


<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>1</td><td>To pump</td></tr>
</table>
</td></tr>
<tr><td>FCV-14AH</td><td>228-45014</td><td>Switches between up to six columns.</td></tr>
<tr><td>Reservoir tray</td><td>228-45041-91</td><td>Holds up to seven 1-liter bottles</td></tr>
<tr><td>Mixer SUS 0.5-2.6 mL HP</td><td>228-45093-93</td><td>(HPLC pump only) A static mixer for high or low pressure gradient elution analysis.</td></tr>
<tr><td>Mixer MR 20 µL</td><td>228-45168-41</td><td>The mounting plate included in the mixer package cannot be used.</td></tr>
<tr><td>Mixer MR 40 µL</td><td>228-45168-44</td><td></td></tr>
<tr><td>Mixer MR 100 µL</td><td>228-45168-45</td><td></td></tr>
<tr><td>Mixer MR 180 µL</td><td>228-45168-46</td><td>The mounting plate included in the mixer package cannot be used.</td></tr>
<tr><td>Set of two mixers: MR 40 µL and MR 180 µL</td><td>228-45204-41</td><td></td></tr>
<tr><td>Set of two mixers: MR 100 µL and MR 180 µL</td><td>228-45204-42</td><td></td></tr>
</table>

Part Name	Part Number	Description
Set of three mixers: MR 40 µL, MR 100 µL and MR 180 µL	228-45204-43	
Mixer MR300 LPGE	228-45210-42	Gradient mixer for exclusively low-pressure gradient. Can be installed inside theExionLC™ AD Oven. This option can be used for solvents that are hard to mix, such as trifluoroaceticacid (TFA), or for reducing the baseline fluctuation of the ExionLC™ PDA Detector.
Semi-micro mixer	228-35830-93	(HPLC pump only) A static mixer for semi-micro HPLC.
CBM-Lite	5036644	The CBM-Lite module can be installed in the pump module.
Loop injection base kit	228-45421-91	Major parts: SUS tubing (loop - LPV#1), SUS tubing HP IN (0.1 × 600 mm) **Note:** No sample loop is included in the loop injection base kit. Order a sample loop suitable for the injection volume.
Sample loop 5 µL	228-52612-42	
Sample loop 20 µL	228-52612-43	
Sample loop 100 µL	228-45402-95	

Other

Part Name	Part Number	Description
Grounding wire with clip	4413363	For static electricity preventative measure one
Caps for 18-L or 4-L container (with three 3-mm diameter openings)	228-21354-91	For static electricity preventative measure two

Error Messages B

Each message is classified as shown in *Table B-1*.

Table B-1 Message Classifications

Type	Description
Fatal	The module stops operating. Pressing **CE** does not clear the error message.
Alarm	The module stops operating. Press **CE** to clear the error message.
Warning	The module does not stop operating. Press **CE** to clear the error message. For the column oven, this is a set temperature error.

Pump

Error Message	Type	Cause	Action
ROM FAILURE	Fatal	ROM error (electronic failure).	Turn off the power and then contact the FSE.
RAM FAILURE	Fatal	RAM error (electronic failure).	Turn off the power and then contact the FSE.
ERROR OVER HEAT (overheating)	Fatal	Interior temperature has risen to an abnormal level.	1. Make sure that the internal fan can move, and that the rear exhaust vent is not blocked. 2. If this does not solve the issue, turn off the power and then contact the FSE.

Error Message	Type	Cause	Action
ERROR P-MAX (Maximum pressure limit error)	Alarm	Pump discharge pressure has exceeded the set maximum pressure limit. Pumping automatically stops, unless the S-PROT function has been activated, in which case pumping will continue at half flow rate.	1. Inspect for clogging in the flow line. 2. Set the maximum pressure limit. Refer to the *ExionLC™ System Software User Guide*.
ERROR P-MIN (Minimum pressure limit error)	Alarm	Pump discharge pressure has fallen below the set minimum pressure limit. Pumping automatically stops.	1. Inspect for leaks in the flow line. 2. Set the mimimum pressure limit. Refer to the *ExionLC™ System Software User Guide*.
ERROR HOME POS (Home position error)	Alarm	The motor home position cannot be detected, the motor does not run, or the motor is slipping.	1. Turn the power off and on. 2. Press **pump**. 3. If this does not solve the issue, off the power and then contact the FSE..
OPEN DRAIN VALVE (Purge error)	Alarm	Pump discharge pressure has exceeded P-PMAX during purging.	Open the drain valve before pressing **purge**. **Note:** If an error message is shown during auto-purging, inspect for clogging in the flow line. If no clogging is found, then set the appropriate P-FLOW and P-PMAX value. Refer to *Set the Pump Flow Rate on page 77*
ERROR LEAK (Leak error)	Alarm	The leak sensor has detected a leak.	Inspect for leakage in the flow line. Wipe away any liquid around the leak sensor.

Error Message	Type	Cause	Action
ERROR EXTERNAL (External equipment error)	Alarm	An error signal was sent from the external device connected to the external input/output terminal ERR IN.	Inspect the external device, and then eliminate the cause of the error.
WARN : M-PHASE (Mobile phase alarm)	Warning	The remaining volume of mobile phase is less than the alarm level.	Replace the mobile phase and reset the amount of mobile phase.
WARN : DEGAS PRS (Degasser vacuum pressure error)	Warning	Vacuum pressure of degasser has been abnormal for a certain time.	Verify the vacuum pressure of the degasser. • If the vacuum pressure is NG, turn the power off once and then turn it on again. • If the vacuum pressure is OK, then the degasser has automatically returned to normal operation.
ERR NO CONST.PRS	Alarm	A constant pressure pumping mode is set on the system controller with **1:20A** set at **OP MODE**.	

Autosampler

Error Message	Type	Cause	Action
ROM FAILURE	Fatal	ROM error (electronic failure).	Turn off the power and then contact the FSE.
RAM FAILURE	Fatal	RAM error (electronic failure).	Turn off the power and then contact the FSE.
ERR NDLE HOME X (Needle X motor slip error)	Fatal	X-axis (sideways) movement of the needle is incorrect.	Turn off the power and then contact the FSE.
ERR NDLE HOME Y (Needle Y motor slip error)	Fatal	The Y-axis (forward/backward) movement of the needle incorrect.	Turn off the power and then contact the FSE.
ERR NDLE HOME Z (Needle Z motor slip error)	Fatal	The Z-axis (up/down) movement of the needle is incorrect.	Turn off the power and then contact the FSE.

Error Message	Type	Cause	Action
ERR HPV HOME (HPV motor slip error)	Fatal	The high-pressure valve does not operate correctly.	Turn off the power and then contact the FSE.
ERR LPV HOME (LPV motor slip error)	Fatal	The low-pressure valve does not operate correctly.	Turn off the power and then contact the FSE.
ERR PUMP HOME (Pump motor slip error)	Fatal	The measuring pump does not operate correctly.	Turn off the power and then contact the FSE.
ERR P.FILE (P.FILE error)	Alarm	Sample injection was performed incorrectly.	Perform analysis AGAIN after correcting the errors of the rack type or vial number of the sample to be injected.
NO VIAL DETECTED (Vial not detected error)	Alarm	No sample vial was placed in the rack position.	During an analysis sequence, the missing sample vial will be ignored and analysis will proceed using the next vial specified.
ERR LEAK DETECT (Leak detection error)	Alarm	Concentration of organic mobile phase vapor inside the module has exceeded the leak sensor actuation level. • The leak sensor has detected leakage. • The leak sensor is too sensitive.	• Inspect the leakage from the flow line. Clean up spilled liquid after fixing the leakage. • Adjust the leak sensor actuation level.
NDLE PROTECTED (Foreign substance detection error)	Fatal	A foreign substance was detected at the tip of the needle.	Inspect for foreign substances inside the autosampler.
NO PUMP ADJUSTED (Pump motor fine adjustment error)	Fatal	The measuring pump does not operate correctly.	Turn off the power and then contact the FSE.
ERR SLIP X (Needle X slip error)	Fatal	The X-axis (sideways) movement of the needle is incorrect.	Turn off the power and then contact the FSE.
ERR SLIP Y	Fatal	The Y-axis (sideways) movement of the needle is incorrect.	Turn off the power and then contact the FSE.

Error Message	Type	Cause	Action
ERR COOLER (Cooler error)	Fatal	There is an error in the cooling unit of the sample cooler.	Turn off the power and then contact the FSE.
ERR HEATER (Heater error)	Fatal	There is an error in the heating unit of the sample cooler.	Turn off the power and then contact the FSE.
ERR TEMP SENSOR (Temperature sensor error)	Fatal	There is an error in the temperature sensor of the sample cooler.	Turn off the power and then contact the FSE.
ERR TEMP SENS DH (Peltier dehumidifier temperature sensor error)	Fatal	An error has occurred in the Peltier dehumidifier temperature sensor.	Turn off the power and then contact the FSE.
ERR TEMP SENS RM (Room temperature sensor error)	Fatal	• The room temperature sensor detects an abnormally high or low temperature. • A room temperature sensor error has occurred.	• If the room temperature is higher than 50 °C, reduce the room temperature to 40 °C or less. If the room temperature is lower than minus 10 °C, raise the room temperature to 4 °C or higher. • Turn off the power and then contact the FSE.
SYSTEM ERROR xxx (System error)	Fatal	There is an error in the internal circuits of the autosampler.	Turn off the power and then contact the FSE.
DOOR IS OPEN (Door open/close display)	Warning	The front door is open or a panel has been removed.	Close the front door or install the panel.
ERR INJ VOL or CBM-20A ERROR (Injection volume error)	Alarm	The injection volume exceeds the set value for the maximum volume of injection.	Reduce the injection volume to a value less than the set value of the maximum volume of injection.

Error Message	Type	Cause	Action
P FILE NOT EXIST (P.FILE missing error)	Fatal	No description of the specified pretreatment program is found.	Determine whether the specified pretreatment program exists, and if it exists, specify the edit page number on the pretreatment screen for the autosampler method and verify the contents of the pretreatment program.
ERR LINK TIMEOUT	Alarm	The remote connection between the module and the system controller is cut off while analysis is being performed.	Make sure that the cables between the modules are connected correctly.

Column Oven

Error message	Type	Cause	Action
ROM FAILURE	Fatal	ROM error (electronic failure).	Turn off the power and then contact the FSE.
RAM FAILURE	Fatal	RAM error (electronic failure).	Turn off the power and then contact the FSE.
ERR OVER T.MAX (Temperature over limit)	Alarm	The oven temperature has exceeded the value set for **T.MAX**.	• Reduce the oven set temperature. • Set **T.MAX** to a value 5 °C higher than the set temperature. An overshoot might occur before the temperature reaches the set value.

Error message	Type	Cause	Action
ERR OVER T.MAX-L (Temperature over limit)	Alarm	The temperature has of heater L exceeded the value set for **T.MAX**.	• Reduce the column oven set temperature. • Set **T.MAX** to a value 5 °C higher than the set temperature. An overshoot might occur before the temperature reaches the set value.
ERR EXTERNAL (External error)	Alarm	The External Control Connections received an error signal.	Inspect the connections to the external input/output terminals. Refer to the *Peripheral Devices Guide* for the Analyst® software.
ERR GAS DETECT (Gas detection error)	Alarm	The concentrationof organic solvent inside the column oven has exceeded the gas sensor detection level. • Mobile phase has leaked inside the oven. • There is solvent vapor in the air around the unit. • Sensor sensitivity is incorrectly adjusted.	Take the appropriate action: • Take action to stop the leak. Clean up any leakage, and then leave the doors open for 10 minutes to allow the column oven to cool. Close the doors and then press **oven**. If the error does not occur again, then operation can be resumed. • Provide adequate ventilation for the room • Contact an FSE to adjust the sensitivity. Then run the fan for 5 minutes with the right door open. The leak sensor is unstable for 60 seconds after starting up the column oven and errors are not detected during this period.

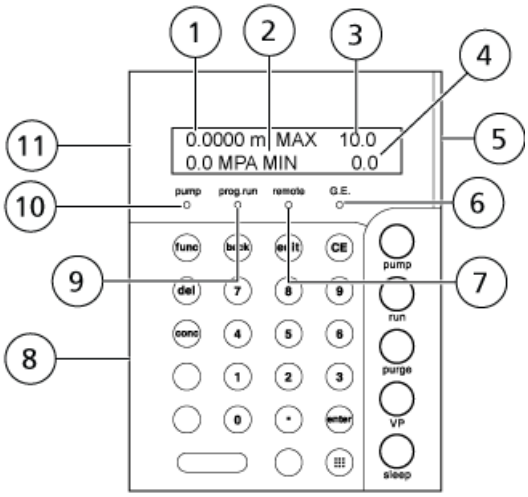
Error message	Type	Cause	Action
ERR LEAK DETECT (Leak detected)	Alarm	Density of solvent vapor inside column oven has exceeded the leak sensor actuation level. This can occur for the following reasons: • Mobile phase has leaked inside the oven. • Sensor sensitivity is incorrectly adjusted.	Take the appropriate action: • Take action to stop the leak. Wipe away any leakage. If the error does not occur again, then operation can be resumed. • Contact an FSE to adjust the sensitivity. Then run the fan for 5 minutes with the right door open. The leak sensor is unstable for 60 seconds after starting up the column oven and so errors are not detected during this period.
ERR SWPS FAN (Power heat exhaust fan error)	Fatal	The power heat exhaust fan is not rotating correctly.	If the cause is obstruction of the fan by tubing or other object, turn the power off and remove the obstruction. If the object cannot be removed, or if the error is due to some other cause, contact the FSE.
ERR POST COOLER Post-column cooler error)	Fatal	The post-column cooler is not rotating correctly.	If the cause is obstruction of the fan by tubing or other object, turn the power off and remove the obstruction. If the object cannot be removed, or if the error is due to some other cause, contact the FSE.
ERR COOLBLK FAN Block cooling fan error	Fatal	The block cooling fan is not rotating correctly.	If the cause is obstruction of the fan by tubing or other object, turn the power off and remove the obstruction. If the object cannot be removed, or if the error is due to some other cause, contact the FSE.
ERR SENSOR H (Thermosensor error)	Fatal	Thermal sensor readings are abnormally high. This might indicate a short circuit in the sensor.	Turn off the power and then contact the FSE.

Error message	Type	Cause	Action
ERR SENSOR L (Thermosensor error)	Fatal	Thermal sensor readings are abnormally low. The sensor might be disconnected.	Turn off the power and then contact the FSE.
COOLER NOT EXIST (Cooler error)	Fatal	The cooler is not mounted or the cable is snapping.	Turn off the power and then contact the FSE.
ERR HEAT OUT (Heat output error)	Fatal	The heater has failed.	Turn off the power and then contact the FSE.
ERR GAS SENS (Gas sensor error)	Fatal	The gas sensor detection value is abnormal.	Turn off the power and then contact the FSE.
ERR LEAK SENS (Leak sensor error)	Fatal	The leak sensor malfunctions (probably due to a broken or disconnected wire).	Turn off the power and then contact the FSE.
ERR DOOR SENS (Door sensor error)	Fatal	The door sensor has failed.	Turn off the power and then contact the FSE.
ERR NO RV-L HOME (Left valve home position error)	Fatal	An automatic column-switching valve has rotated.	Turn off the power and then contact the FSE.
ERR NO RV-R HOME (Right valve home position error)	Fatal	An automatic column-switching valve has rotated.	Turn off the power and then contact the FSE.
WARNING: LOW SET TEMP (Set temp.error)	Warning	An error message is shown, and an alarm sounds, approximately 10 seconds after occurrence of the error. (Temperature regulation is not stopped.) The set temperature value is inappropriate, in one f the following ways: • When use of cooler is enabled(that is, when **COOLER MODE** set to **1** or **2**), set temperature is room temperature minus 10 °C, or lower. • When use of the cooler is disabled: Set temperature is lower than the room temperature.	1. Press **CE**. The alarm and the error message are turned off. 2. Press **temp** until SET TEMP is shown. 3. Set a higher temperature. If the operating temperature is not changed, LOW SET TEMP is shown periodically.

Status Panel and Keypad C

Pump

Figure C-1 Status Panel and Keypad



Item	Description
1	Flow/Pressure. Shows the set flow rate (in mL/min) in constant flow pumping mode, and set pressure (in units set with the PRS-UNIT parameter) in constant pressure pumping mode.
2	Pressure. Shows a reading of pressure sensor (in units set with the PRS-UNIT auxiliary function).
3	P. Max. Shows the pressure upper limit (in units set with the PRS-UNIT auxiliary function).
4	P. Min. Shows the pressure lower limit (in units set with the PRS-UNIT auxiliary function).
5	Status indicator: • Green: Power is on • Red: Error • Orange: In sleep mode
6	Gradient mode LED. Illuminates when the pump is running in gradient mode. Flashes when the analysis mode is set to Fast LC mode.

Item	Description
7	Remote mode LED. Illuminates when the pump is controlled by the Analyst® software.
8	Keypad
9	Program LED. Illuminates when program is being executed.
10	Pump LED. Illuminates when the pump is running.
11	Status panel

Table C-1 Keys

Key	Function
	Shows the operation keys.
pump	Starts and stops the pump.
run	Starts and stops the time program. (If time program is not registered, this key is inoperative.)
purge	Starts and stops purging. Purging stops automatically 3 minutes after it begins. Purging can be stopped also by pressing the **pump** key. The duration of purging can be changed using the P-TIMER auxiliary function.
VP	Changes between the initial screen and VP mode.
sleep	Turns off the status panel screen. This key has no effect on operation.
func	(Function) • Scrolls forward through basic functions. • Scrolls forward through auxiliary functions. • Scrolls during time program editing.
back	• Scrolls backward during time program editing. • Scrolls backward through auxiliary functions setting screens.
edit	Activates edit mode of time program (from the initial screen).
CE	(Clear) • Initializes the screen. • Clears the values input up to that time in entering the values. • Clears error messages and then cancel the alarms.
del	(Delete) Deletes the individual lines of time program on the status panel screen.

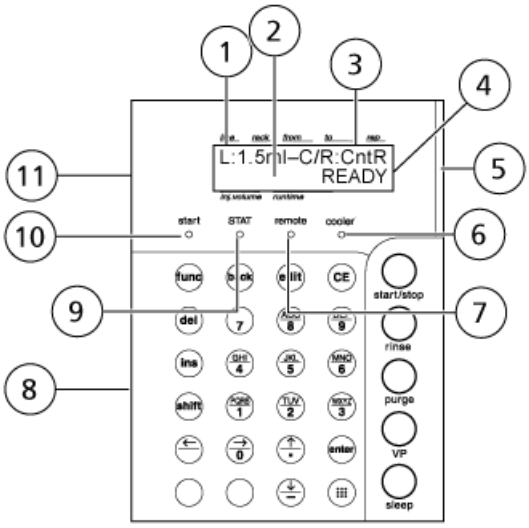
Table C-1 Keys (continued)

Key	Function
conc	(Concentration) Sets the liquid concentrations in gradient analysis.
enter	Validates input values for each parameter.
Numeric keypad	Used to enter numeric values for each parameter.

Autosampler

The status panel screen might become hot when in use.

Figure C-2 Status Panel and Keypad



Item	Description
1	Sample rack information. Shows the model of the sample rack set in the autosampler.
2	Status line 1. When connected to a rack changer and using a rack-changer rack, CHG-LINK is shown. When **20A** is set for **OP MODE**, 20A MODE is shown.
3	Control vial rack information. Indicates whether or not there is a control vial rack.
4	Status line 2. Shows the status of operation.

Item	Description
5	Status indicator • Green: Power is on • Red: Error • Orange: In sleep mode
6	Cooler LED. Illuminates when a sample cooler is used. Flashes if the monitored temperature is not within 1 °C of the set temperature.
7	Remote LED. Illuminates when the autosampler is controlled by the Analyst® software.
8	Keypad
9	Status LED. Priority analysis indicator ON when priority analysis is executed.
10	Start LED. Illuminates when sample injection starts.
11	Status panel

Table C-2 Keys

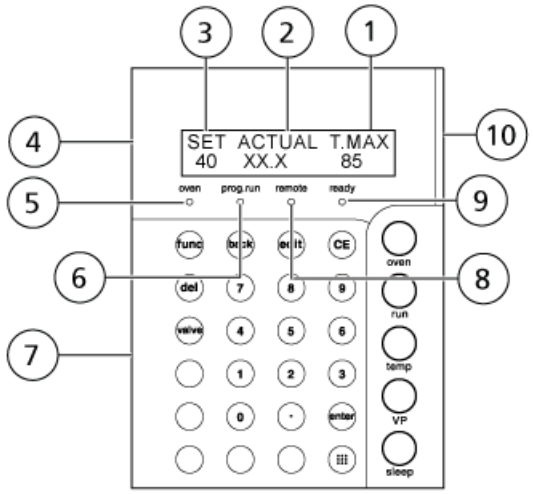
Key	Function
	To show the operation keys.
start / stop	Starts or stops sample injection.
rinse	Rinses the needle in the rinse solution.
purge	Pumps rinse solution through flow lines for a specified period of time.
VP	Changes between the initial screen and VP mode.
sleep	Turns off the status panel screen. This key has no effect on operation.
func	(Function) • Scrolls forward through basic functions. • Scrolls forward through auxiliary functions. • Scrolls during time program editing.
back	• Scrolls backward during time program editing. • Scrolls backward through auxiliary functions setting screens.
edit	Activates edit mode of time program (from the initial screen).

Table C-2 Keys (continued)

Key	Function
CE	(Clear) • Initializes the screen. • Clears the values input up to that time in entering the values. • Clears error messages and then cancel the alarms.
del	(Delete) Deletes the individual lines of time program on the status panel screen.
ins	(Insert) Adds lines to the repeat injection or analysis sequence table.
shift	Performs the alternative functions for the arrow keys. When this key is pressed, Shift pressed is shown on the status panel screen. Press this key again to cancel Shift pressed.
enter	Validates input values for each item setting.
Alphanumeric keypad	• Used to enter numeric values for each item setting. • Used to enter the well number for a microtiter plate or a deep-well microtiter plate.
Cursor keys	Moves the cursor in the parameter setting screens. • Left arrow: Also moves from the initial screen to the special rack removal setting screen (**REMOVE RACK**) when a rack changer is connected. • Up arrow: Also moves from the initial screen to the needle position moving (**ZHOME**) screen. • Down arrow: Also moves from the initial screen to the rinse solution flow line purging (**MANUAL PURGE** screen.
–	Shows a minus sign on the cooler temperature setting screen. Also moves from the initial screen directly to the rinse solution flow line purging **MANUAL PURGE** screen.

Column Oven

Figure C-3 Status Panel and Keypad



Item	Description
1	Set temperature
2	Actual temperature
3	Upper temperature limit
4	Status panel
5	Oven operation LED. On when temperature regulation starts. If the door is opened, temperature regulation stops, and the oven operation LED flashes. Temperature regulation resumes when the door is closed.
6	Program run LED. Time program LED. On when time program is running.
7	Keypad
8	Remote mode LED. Illuminates when the column oven is controlled by the Analyst® software.

Item	Description
9	Ready LED. Turns on during temperature regulation when the difference between the actual temperature and the set temperature stays within the READY RANGE(°C) setting for a period longer than the WAIT TIME(minute) setting. Turns on unconditionally if the WAIT TIME is set to 0.
10	Status indicator: • Green: Power is on • Red: Error • Orange: In sleep mode • Orange (flashing): The door is open while the heat block temperature is greater than 60 °C

Table C-3 Keys

Key	Function
	Shows the operation keys.
oven	Starts and stops the column oven.
run	Starts and stops the time program. (If time program is not registered, this key is inoperative.)
temperature	Switches to the operating temperature setting screen.
VP	Changes between the initial screen and VP mode.
sleep	Turns off the status panel screen. This key has no effect on operation.
func	(Function) • Scrolls forward through basic functions. • Scrolls forward through auxiliary functions. • Scrolls during time program editing.
back	Scrolls backward through parameters. Each time this button is pressed, the previous parameter is shown. Pressing this key after selecting a VP function item switches the VP function setting screen to the previous item.
edit	Activates edit mode of time program (from the initial screen).

Table C-3 Keys (continued)

Key	Function
CE	(Clear) • Initializes the screen. • Clears the values input up to that time in entering the values. • Clears error messages and the cancel the alarms.
del	(Delete) Deletes individual lines of time program on the status panel screen.
valve	Shows the automatic column switching valve setting screen.
enter	Validates input values for each item setting.
Numeric keypad	Enters numeric values for each item setting.

VP Functions D

Pump VP Functions

Command	Function
Mobile Phase Monitor Group	
MOBILE PHASE	Monitors the remaining volume and set volume of mobile phase
ALARM LEVEL	Sets the alarm level of remaining mobile phase.
Product Information Group	
SERIAL NUMBER	Shows the serial number of the module.
S/W ID	Shows the version number of software
Maintenance Information Group	
TOTAL OP TIME	Shows the total cumulative operating time of the module.
L SEAL DELIVERED	Shows the total volume of flow rate through the left seal, and at what volume the seal should be replaced.
R SEAL DELIVERED	Shows the total volume of flow rate through the right seal, and at what volume the seal should be replaced.
PART REPLACEMENT	Records the replaced parts number.
DGU OP TIME	Shows and reset the operating time of the degasser connected to this module.
MAINTENANCE LOG	Shows the maintenance log.
ERROR LOG	Shows the error log.
OPERATION LOG	Shows the operation log.
Validation Support Group	
DATE	Shows or set the date.
TIME	Shows or set the time.
MEMORY CHECK	Runs the memory test.

Command	Function
PULSE CHECK	Runs the pulsation test.
FLOW CHECK	Runs the flow rate test.
GE TEST PROGRAM	Sets the time program to check concentration accuracy by gradient mode
LEAKAGE TEST	Runs the leakage test.
LEAK SENSOR TEST	Runs the leak sensor test.
Calibration Support Group	
Input PASSWORD	Enters the password.
FLOW COMP FACT	Sets the flow rate compensation factor (ALPHA).
PRESS COMP FACT	Sets the pressure sensor sensitivity compensation factor.
LEAK THR	Sets the leak sensor operation level.
SEAL REPLACEMENT	Sets the volume at which seals are replaced.
FAST LC MODE	(Not applicable for HPLC pumps) Selects the analysis mode.
PMAX OVERRIDE	(Not applicable for HPLC pumps) Selects the maximum pressure limit setting procedure.
OP MODE	Selects the operation mode.
INITIALIZE PARAM	Initializes the parameters.
CHANGE PASSWORD	Changes the password.
CBM PARAMETER	Shows or set controller parameters.

Autosampler VP Functions

Command	Description
Product Information Group	
SERIAL NUMBER	Shows the module serial number.

Command	Description
S/W ID	Shows the module name and ROM version.
RC SERIAL NUMBER	Shows the serial number of the rack changer.
RC S/W ID	Shows the program version number of the rack changer.
Maintenance Information Group	
TOTAL OP TIME	Shows the total operating time of the rack changer.
NDL SEAL USED	Shows needle seal usage.
HPV SEAL USED	Shows HPV rotor usage.
HPV STATOR USED	Shows the usage frequency of the high-pressure valve stator.
LPV SEAL USED	Shows LPV rotor usage.
LPV STATOR USED	Shows the usage frequency of the low-pressure valve stator.
EXT PUMP USED	Shows rinsing pump usage.
NDLE FLUSH	Performs internal rinsing of the needle. (Shown when total injection method (**INJECTION TYPE: 0**) is selected.
P-SET	Used to replace the measuring plunger and plunger seal.
HPV ROTATION	Used after HPV rotor replacement.
LPV ROTATION	Used after LPV rotor replacement.
PART REPLACEMENT	Used to enter records of parts replacement.
MAINTENANCE LOG	Shows maintenance log.
OPERATION LOG	Shows operation log.
ERROR LOG	Shows error log.
Validation Support Group	
DATE	Shows or sets the date.
TIME	Shows or sets the time.
MEMORY CHECK	Runs memory check.
POSITION SENS	Executes self-diagnosis by position sensors.

Command	Description
LEAK SENSOR TEST	Runs test on the leak sensor.
Calibration Support Group	
Input PASSWORD	Enters the password.
ADJUST MTP	Adjusts the position of microtiter plates or deep-well microtiter plates.
ERASE MTP ADJ	Deletes microtiter plate position data.
ASP FACTOR	Corrects the injection volume accuracy.
LEAK THR	Sets the operation level of the leak sensor.
NDLE SEAL	Changes the needle seal replacement alert value.
HPV SEAL	Changes the HPV rotor replacement alert value.
HPV STATOR	Changes the HPV valve stator replacement alert value.
LPV SEAL	Changes the LPV rotor replacement alert value.
LPV STATOR	Changes the LPV valve stator replacement alert value.
EXT PUMP	Changes rinsing pump replacement alert value.
CANCEL DOORSW	Configures automatic door open/close detection.
CANCEL RACKDET	Configures automatic rack detection.
CANCEL VIALDET	Configures automatic vial detection.
OP MODE	Configures the mode for communications with the external controller.
INITIALIZE PARAM	Initializes parameters and logs.
CHANGE PASSWORD	Changes the password.
ADJUST RACK	Adjusts the rack position.
ADJUST INJ PORT	Adjusts the position of the injection port.
ERASE RACK.P ADJ	Deletes rack position data.
ERASE INJ.P ADJ	Deletes injection port position data.
TEMP DELTA	Corrects the sample cooler temperature.

Command	Description
INJECTION TYPE	Changes the injection method
CBM Parameter Group	
SERIAL NUMBER	Shows the serial number of the controller.
S/W ID	Shows the program version number of the controller.
INTERFACE	Sets the transmitting medium between the system controller and data processing the module.
ETHERNET SPEED	Sets the transmitting speed of ethernet.
USE GATEWAY	Sets whether or not the DHCP function is used. (If setting is unnecessary the screen is not shown.)
IP ADDRESS	Sets the IP address of the controller. (If setting is unnecessary the screen is not shown.)
SUBNET MASK	Sets subnet mask of the controller. (If setting is unnecessary the screen is not shown.)
DEFAULT GATEWAY	Sets the default gateway address. (If setting is unnecessary the screen is not shown.)
TRS MODE	Sets condition by serial transmission.

Column Oven VP Functions

Command	Function
Product Information Group	
SERIAL NUMBER	Shows the serial number of the module.
S/W ID	Shows ROM version number.
Maintenance Information Group	
TOTAL OP TIME	Shows the total cumulative operating time of the module.
RV-L SEAL USED	Shows the number of times that the left valve has been used.
RV-R SEAL USED	Shows the number of times that the right valve has been used.
PART REPLACEMENT	Records the replaced parts number.
MAINTENANCE LOG	Shows maintenance log.
OPERATION LOG	Shows the operation log.
ERROR LOG	Shows error log.

Command	Function
Validation Support Group	
DATE	Shows/set the date.
TIME	Shows/set the time.
MEMORY CHECK	Runs the memory check.
TEMPERATURE TEST	Runs the automatic test of temperature regulation accuracy and stability.
GAS SENSOR TEST	Runs the gas sensor check.
LEAK SENSOR TEST	Runs the leak sensor check.
Calibration Support Group	
Input PASSWORD *1	Enters password.
TEMP-R1 CAL	Sets the heater R first calibration temperature.
TEMP-L1 CAL	Sets the heater L first calibration temperature.
TEMP-R2 CAL	Sets the heater R second calibration temperature.
TEMP-L2 CAL	Sets the heater L second calibration temperature.
LEAK THR	Sets leak sensor activation threshold.
OP MODE	Selects the operation mode.
INITIALIZE PARAM	Initializes parameters.
CHANGE PASSWORD	Changes password.

Auxiliary Functions E

Pump Auxiliary Functions

Command	Description	Default
Parameter Settings Group		
SV	Switches the solenoid valve to select a mobile phase for an optional reservoir switching valve.	1
EVENT	Controls output relays.	0
COMP	Sets a mobile phase compressibility for compensation (fine adjustment).	0.45
LPGE MODE	(Not applicable for HPLC pumps) Sets low-pressure gradient mode.	0
P-TIMER	Sets a purge execution time.	3
P-FLOW	Sets a purge flow rate.	8
P-PMAX	Sets a maximum pressure limit at purging.	10
File Operation Group		
FILE NUM	Selects a program file No.	0
FILE CPY	Copies a file (including initial conditions and time program).	
FILE DEL	Deletes a time program from a file.	-
Control Settings Group		
P-SET	Used to replace the plunger and plunger seal.	0
ZERO ADJ	Performs zero adjustment of pressure screen.	-
MODE CHANGE	(HPLC pumps only) Changes pumping mode.	Constant flow
System Settings Group		
LOCAL	Selects independent operation or control via system controller.	0
ADRS	Sets address of the pump for control by the system controller.	3
KEY CLOSE	Locks the keypad, preventing unexpected entries.	-

Command	Description	Default
BRIGHT	Sets brightness of the status panel screen.	4
EXT-S	Closes the EVENT1 output terminal at the start of time program, and EVENT2 output terminal on detection of pump error.	0
SYS	Selects a system control mode.	1
S-PROT	Reduces the flow rate without stopping the pumping when the pressure exceeds the P.MAX value.	0
FCV TYPE	Sets a type of flow channel valve connected to the pump.	0
PRS-UNIT	Sets a unit of pressure.	0
RANGE	Sets a full range for pressure signals for the recorder output.	10
CBM LINK	Sets a link destination of system controller.	1
BEEP MODE	Sets the operation of buzzer.	0
Monitor Settings Group		
MON TIME	Used to monitor the elapsed time in running a time program.	0
MON ID	Used to monitor the pump ID.	0
MON SV	Used to monitor the flow line of solenoid valve unit.	0
MON REV	Used to monitor the pump revolution counter.	0
CONDITION	Used to monitor the pumping conditions.	-
DEGAS PRS	Used to monitor the vacuum pressure in degassing unit.	-

Autosampler Auxiliary Functions

Command	Function
Parameter Settings Group	
Note: When this module is controlled by the system controller, values of COOLER TEMP through MTP ORDER must be set on the system controller or in the Analyst® software.	
COOLER TEMP	Sets the sample cooler temperature. The rack changer (if used) is set to the same temperature.
PURGE TIME	Sets the purge time.
RINSE MODE	Selects the needle rinsing method.

Command	Function
RINSE DIPTIME	For entering the needle rinsing time.
RINSE VOLUME	Sets the replacing volume of rinse solution.
RINSE SPEED	Sets flow rate of rinse solution when replacing the solution.
SAMPLE SPEED	Sets flow rate during sample analysis.
NEEDLE STROKE	Sets needle stroke measurement.
MTP WELL	Sets the well number when using a microtiter plate or a deep-well microtiter plate.
MTP ORDER	Sets the sample injection order when using a microtiter plate or a deep-well microtiter plate.
EVENT	Controls the external output terminals.
Repeat Inj Table	Not applicable.
Control Settings Group	
CLEAR SMPTBL	Deletes the sample table.
CLEAR Rep Inj tbl	Deletes the sample table used for interval analysis.
STAT	Sets priority analysis.
PAUSE	Pauses the sequence.
MANUAL PURGE	Draws in rinse solution with the manual syringe.
Z HOME	Raises the needle during transportation.
TEST INJ PORT	Verifies that the needle is lowered correctly into the injection port.
PURGE (Ext Pump)	Purges with a second rinse solution using a rinsing pump (optional).
HPV TEST	Tests the high pressure valve.
System Settings Group	
LOCAL	For separating the autosampler from an external controller.
KEY CLOSE	Locks the keypad, preventing unexpected entries.
BRIGHTNESS	Adjusts the screen brightness.
CNT RACK STRK	Sets the lowering distance of the needle in the control vial rack.
MAX Inj. Volume	Sets the maximum volume of injection.
SELECT EVENT1	Switches the function of event output 1 between event output and start output.

Command	Function
SELECT EVENT2	Switches the function of event output 2 among event output, start output, and shutdown output.
SELECT EVENT3	Switches the function of event output 3 between error output and event output.
RINSE METHOD	Sets the needle rinsing method when using a rinsing pump (optional).
EXT RINSE TIME	Sets the needle rinsing time when using a rinsing pump (optional).
SMALL ID VIAL	Set when using small-capacity vials.
CBM LINK	Sets a link destination of system controller.
BEEP MODE	Sets the operation buzzer.
CUT OFF LOOP	Set when using the loop cut function.
C TIME	Sets the loop cut time.
Changer Settings Group	
DISP RACK STATUS	Shows the status of rack-changer racks 1 to 12.
STACK A CODE	Enters the stack code of rack-changer stack A.
STACK B CODE	Enters the stack code of rack-changer stack B.
STACK C CODE	Enters the stack code of rack-changer stack C.
STACK D CODE	Enters the stack code of rack-changer stack D.
STACK A STRK	Set the needle stroke for stack A.
STACK B STRK	Set the needle stroke for stack B.
STACK C STRK	Set the needle stroke for stack C.
STACK D STRK	Set the needle stroke for stack D.
REMOVE RACK	Set when removing the changer rack from the autosampler.
AUTO EXCHANGE	Changes the rack to the next one during sample analysis of the last well.
REMOVE DUMMY	Set whether or not to remove the rack-changer rack from the autosampler during the time other than analysis.
RC STACK SCAN	Set whether or not to verify the presence or absence of racks when inserting a stack.
Clear RACK INFO	Deletes the rack presence/absence information as well as dummy rack position.

Command	Function
RC INITIALIZE	Verifies the presence or absence of racks at all the stacks.
LED LIGHT	Turns on the LED inside the Rack Changer II for about 10 seconds.

Column Oven Auxiliary Functions

Command	Default	Function
Parameter Settings Group		
SET TEMP	40 (°C)	Sets the operating temperature.
T.MAX	90 (°C)	Sets the upper temperature.
Monitor Settings Group		
AMBIENT	–	Shows the ambient temperature.
System Settings Group		
LOCAL	0	Sets either local control or control by system controller.
LINK ADRS	6	Sets address when control is by system controller.
KEY CLOSE	–	Disables the keypad.
READY RANGE	1	Sets the ready range. When the oven temperature is within this range, it is considered to be at the set temperature.
WAIT TIME	5	Sets the time to elapse between the oven entering the ready range and being ready for operation.
BEEP MODE	0	Sets the operation of buzzer.

Revision History

Revision	Description	Date
A	First release of document.	April 2015