228-92686
Sep. 2017

SHIMADZU HIGH PERFORMANCE LIQUID CHROMATOGRAPH

Prominence-i
LC-2030 Plus
LC-2030C Plus
LC-2030C 3D Plus

System Guide

Read this manual thoroughly before you use the product.
Keep this manual for future reference.

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Introduction

Read this Instruction Manual thoroughly before using the product.

Thank you for purchasing this product.

This manual describes the basic operation and troubleshooting for this product. Read this manual thoroughly before using the product and operate the product in accordance with the instructions in this manual. The following instruction manuals are included with the product. PDF documents are included in the instruction manual CD-ROM.

System Guide (Booklet/PDF)	This instruction manual. Describes the basic operation and troubleshooting for this product.
Integrity Guide (PDF)	Describes "validation" for verifying that this product meets "CHECK CRITERIA" and "calibration" for adjustment so that this product meets the CHECK CRITERIA, in order to secure the reliability of analysis data.
Operation Guide (PDF)	Describes the operation of the operations screen and the operational method for the Web screen, iPhone, and iPad for this product.
Maintenance Guide (PDF)	Describes the maintenance for this product, including inspection, part replacement, and rinsing.

Read "Introduction" in this section thoroughly before using the product. "Introduction" describes the information about the warranty, after-sales service, safety instructions and precautions to ensure safe operation of the instrument.
For information on the operation, hardware validation, and accessories and options for this product, refer to "Integrity Guide", "Operation Guide" and "Maintenance Guide".
Keep this manual for future reference.

Important

- If the user or usage location changes, ensure that this manual is always kept together with the product.
- If this manual or a product warning label is lost or damaged, immediately contact your Shimadzu representative to request a replacement.
- To ensure safe operation, read "Safety Instructions" P.iv thoroughly before using the product.
- To ensure safe operation, contact your Shimadzu representative if product installation, adjustment, re-installation (after the product is moved), or repair is required.

Original version is approved in English.

Notice

- Information in this manual is subject to change without notice and does not represent a commitment on the part of the vendor.
- Any errors or omissions which may have occurred in this manual despite the utmost care taken in its production will be corrected as soon as possible, although not necessarily immediately after detection.
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- Some portions of illustrations in this manual might be different from the instrument used.
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  Other company names and product names mentioned in this manual are trademarks or registered trademarks of their respective companies. The ™ and ® symbols are omitted in this manual.
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Indications Used in This Manual

Warnings, cautions, and notes are indicated using the following conventions:

Indication	Meaning
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or possibly death.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor to moderate injury or equipment damage.
NOTE	Emphasizes additional information that is provided to ensure the proper use of this product.

The following symbols are used in this manual:

Indication	Meaning
Prohibition	Indicates an action that must not be performed.
Instruction	Indicates an action that must be performed.
Hint	Indicates information provided to improve product performance.
Reference	Indicates the location of related reference information.

Safety Instructions

To ensure safe product operation, read these important safety instructions carefully before use and follow all WARNING and CAUTION instructions given in this section.

■ Product Applications

⚠ WARNING

Instruction

Use this instrument ONLY for the intended purpose.

This instrument is a high performance liquid chromatograph system. Using this instrument for any other purpose could cause accidents.

Instruction

Safety regulations and standards

For notifications on installation and safety controls, follow the necessary procedures in compliance with the laws and regulations applicable in the country where the product is used.

■ Installation Site

⚠ WARNING

Prohibition

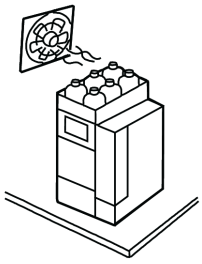
Use of open flame in the vicinity of this instrument must be strictly prohibited.
Do NOT install the instrument in the same room with any other equipment that emits. Otherwise could potentially emit sparks, since sparks could cause a fire.

High performance liquid chromatograph uses large amounts of flammable organic solvents.
Provide fire extinguishers for use in case of fire.

Instruction

The room where the instrument is installed should be well ventilated.

Otherwise, solvent vapors could cause poisoning or ignite and cause a fire. The solvents used in high performance liquid chromatograph are flammable and toxic.



Instruction

Provide sink washing equipment as close to the instrument as possible.

If solvent gets into the eyes or onto the skin, it must be flushed away immediately.

⚠ CAUTION

Prohibition

Avoid installation sites that are exposed to corrosive gases or excessive dust.

These adverse conditions may be detrimental in maintaining the instrument's performance and may shorten its service life.

Prohibition

Keep away from equipment generating strong magnetic fields.

Do NOT install the instrument near equipment that generates strong magnetic fields. If the power supply line is subject to high electrical noise, install a surge protector.

Prohibition

When transporting the instrument, do not hold it by the front panel.

Otherwise, it may cause the front panel to get damaged or detached.

Instruction

During installation, consider the entire mass of this system combined with other components.

- Model without a sample cooler: 58 kg
- Model with a sample cooler: 63 kg

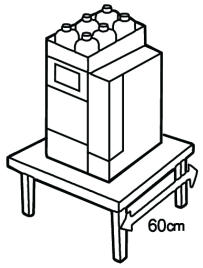
The mass of this system is as described above. Please set up this instrument in consideration of the entire mass combined with other components, PC, the monitor, and the printer, etc.

Reference "7 Technical Information" P.184

Instruction

The lab table on which this instrument is installed should be strong enough to support the total mass of the system. It should be leveled, stable and have depth of at least 600 mm.

Otherwise, the instrument could tip over or fall off the table.



Instruction

Keep at least 100 mm between the rear of the instrument and the wall.

This allows for sufficient air circulation and ventilation from the grille to provide cooling and prevent the instrument from overheating and impairing the performance.

Instruction

Install the instrument in a location that satisfies the following conditions to preserve its performance:

- The room temperature is maintained between 4 and 35 °C, with minimal temperature variation during a day.
- Air currents from heating or air conditioning equipment are not directed onto the instrument.
- Ensure that Instrument is not exposed to direct sunlight.
- There is no vibration.
- Humidity is maintained within 20 to 85 %.
- There is no condensation.
- The location conforming to the installation environment (IEC)
  (Installation category II, Pollution degree: 2, Altitude: Up to 2000 m, Indoor)

⚠ CAUTION

Instruction

Install the product in locations where the power switch can be easily operated.
The power switch must be turned off in case of an emergency.

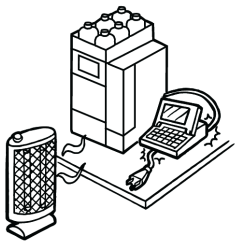
■ Installation

To ensure safe operation, contact your Shimadzu representative if product installation, adjustment, or re-installation (after the product is moved) is required.

⚠ WARNING

Prohibition

Do NOT place heavy objects on the power cord. Do NOT keep any hot items in the vicinity.
Do NOT modify the cord in any way. Do NOT bend it excessively.
Otherwise, fire, electric shock or malfunction may occur.
If the cord is damaged, contact your Shimadzu representative.

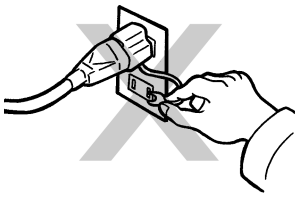


Prohibition

Use only the specified cable.
Arrange the cables as specified.
Otherwise, fire, electric shock or malfunction may occur.

Prohibition

Do NOT insert the adapter's grounding lead into the power outlet or allow it to make contact with the power outlet.
Otherwise, fire or electric shock may occur.

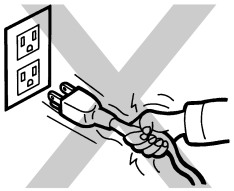


Prohibition

Do NOT connect the grounding lead to the gas tube, the water service tube or the telephone line.
Otherwise, accidents or malfunction may occur.

Instruction

To unplug the instrument, pull the plug itself, NOT the cord.
Before connecting the cable, turn off the power and unplug the instrument.
Otherwise, fire, electric shock or malfunction may occur. If the cord is damaged, contact your Shimadzu representative.



Instruction

Take measures to prevent the instrument from falling in the event of an earthquake or other disaster.
Strong vibrations could cause the instrument to fall over, resulting in injury.

⚠ WARNING

Instruction

Ground the instrument.

Grounding is necessary to prevent electric shock in the event of an accident or electrical discharge, and important for ensuring stable operation.
To prevent electric shock and to maintain stability in operation of the product, be sure to ground the product.
The product will be grounded when the provided 3-wired power plug is inserted into a 3-wired power socket equipped with a ground terminal.

Instruction

Connect the instrument only to a power supply of indicated voltage in consideration of total power consumption of this instrument, other LC components, PC, monitor, and printer, etc.

Otherwise, fire or electric shock could result.
Check that the power supply voltage is stable and that its current capacity is sufficient to operate all the components of the system. If not, the instrument will not operate at its rated performance, affecting not only this instrument, but other instruments connected to the same power supply. Connect the instrument to a power supply that complies with the capacity and use a power cord that complies with the capacity.
Please refer to the following for power supply voltage and power consumption of this product.

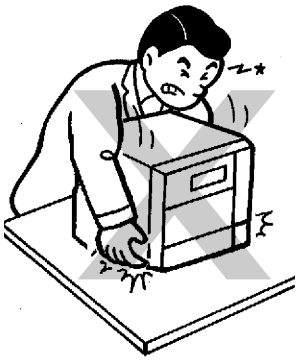
Reference "7 Technical Information" P.184

⚠ CAUTION

Instruction

When installing the instrument, be careful not to pinch your fingers between the system components.

Otherwise, injury may result from pinching your fingers, because the clearance between the components is only 20 mm.



Instruction

When opening the doors, be careful not to pinch your fingers as this could result in injury.

Instruction

Before plugging in the instrument, make sure that the main power switch on the side of the instrument is OFF.

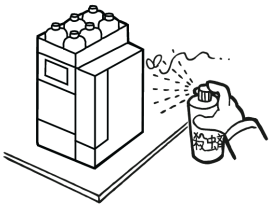
■ Operation

⚠ WARNING

Prohibition

Do NOT use flammable sprays (hair sprays, insecticide sprays, etc.) near the instrument.

Otherwise, they could ignite and cause a fire.



Prohibition

Never use a cracked reservoir bottle.

If a helium degassing unit is used, pressure is exerted on the reservoir bottles and may cause cracks in the bottles. It could break the reservoir bottles and cause injury.

Prohibition

Do NOT apply water to office equipment such as the PC as well as the instrument.

Instruction

Before removing any high pressure flow line part, such as tubing, the sample loop, the needle, and the needle seal, follow the safety precautions below:Be sure to stop the pump and confirm the pressure of the mobile phase has fallen to zero.

Removing any of these parts while high pressure remains could cause the mobile phase and the clogging particles to eject rapidly and injury could occur. Confirm that the pressure has fallen to zero before removing these parts. If the pressure has not fallen to zero, the high-pressure flow line might be clogged. After confirming the end of the drain tubing is in the waste container, open the drain valve and release the pressure of the mobile phase.

Instruction

Take thorough measures to prevent buildup of static electricity.

Static electricity could result in fires or explosion.

Reference "Static Electricity Precautions" P.xi

Instruction

Always wear protective gloves and protective goggles when handling solvents and samples.

If solvent gets into the eyes, it can result in blindness.
Should solvent get into the eyes, flush immediately with large amounts of water and get medical attention.

⚠ CAUTION

Prohibition

Do NOT bend any tubing of the instrument at the same position repeatedly.

Otherwise, a rupture or cracks of the tubing are likely to occur, and might result in solvent leaks.

■ Inspection and Maintenance

⚠ WARNING

Never remove the main cover.

Otherwise, this may cause injury or malfunctioning of the instrument.
The main cover does not need to be removed for routine maintenance, inspection and adjustment. Have your Shimadzu representative perform any repairs requiring removal of the main cover.

Do NOT allow spilled water to remain on the instrument surface, and do not use alcohol or thinner-type solvents to clean the surfaces.

Otherwise, these can cause rusting and discoloration.

If the power cord plug gets dusty, remove the plug from the power outlet and wipe away the dust with a dry cloth.

Otherwise, fire may occur.

Replacement parts must be of the specifications given in "Component Parts" or "Maintenance Parts" of the instruction manuals such as the System Guide and the Maintenance Guide.

Use of any other parts may result in instrument damage and malfunction.

Dispose of the waste liquid properly and in accordance with the instruction by your administrative department.

■ Repair, Disassembly and Modification

⚠ CAUTION

Do NOT modify or disassemble the product without permission.

Otherwise, electric shock or short-circuit accidents may occur. This may also cause injury or malfunctioning of the instrument.

When repair is necessary, request through your Shimadzu representative.

Failing to do so may result in an ignition, electric shock, or injury.

■ In an Emergency

If any problem is detected, such as a burning smell, take the following action:

Emergency Shutdown Procedure

1. Turn the power to the instrument OFF.
2. Disconnect the power cable at the rear of the instrument.

When the instrument is used again, inspect the instrument and, if necessary, contact your Shimadzu representative to request servicing.

■ During a Power Outage

Take the following measures in the event of a power outage.

1. Turn the power to the instrument OFF.
2. After confirming all related items in this section "Installation" P.vi and "Operation" P.viii, use the standard startup procedure to start the instrument.

Static Electricity Precautions

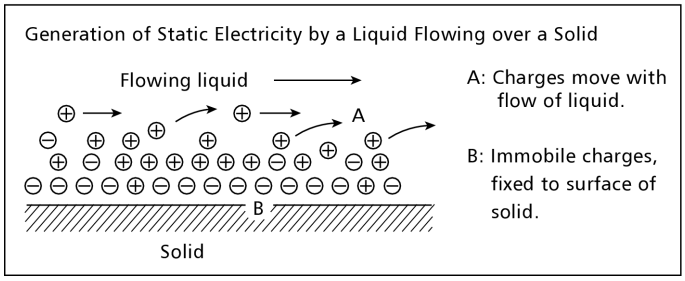
A liquid chromatograph (LC) uses flammable organic solvent(s) as the mobile phase. LC systems are also often used where large amount of flammable substances are present. Thus, an accident can produce large scale damage. Operators must be constantly on guard against accidents involving fire or explosion.
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, since such accidents occur as a result of several simultaneous incidents. Recommended methods for preventing static electricity accidents are provided below. Take thorough safety measures based on this information.

■ Typical Cause of Static Electricity Accidents

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

Generation of static electricity

When liquid is passed through thin tubing at high flow rates, as in liquid chromatograph, the electrostatic charges of the flowing matter generate static electricity.



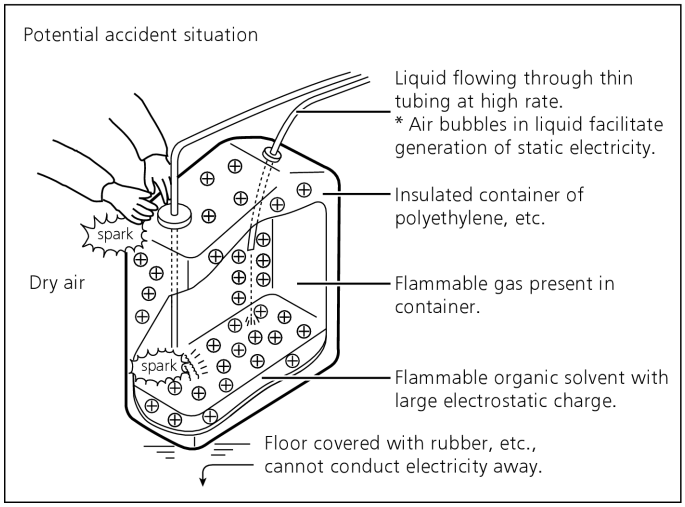
Accumulation of static electricity

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.

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 which will ignite any flammable gas of sufficient density in the vicinity.

Ignition of flammable substances



Preventing Static Electricity Accidents

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

⚠ CAUTION

Instruction

It is important to take multiple preventive measures simultaneously.

If large amounts of flammable solvents are collected in a large container, implement preventative measures 1, 2, and 3 below.

Instruction

Keep the room at a proper humidity.

Ambient humidity exceeding 65 % will prevent static.

■ Preventive Measure 1

Use a metal container for the waste liquid, and ground the container.

This will ensure that the electrical charges of the container and liquid pass to the ground.

Accessories for this measure

(1)	Grounding wire with clip	Part No. S228-21353-91
(2)	18-L metal container	Part No. S038-00044
(3)	4-L metal container	Part No. S038-00043-01

⚠ CAUTION

Instruction

Be sure to ground the metal waste container properly.

If the grounding wire is not properly attached or connected to the ground, static electricity can build up in the container.

Instruction

Be sure to verify, using a tester, that the waste container is properly grounded.

Some metal containers have surfaces that are oxidized or laminated. Such a container may not conduct electricity.

Instruction

If the liquid to be drained into the waste container is virtually nonconductive (10^{-10} S/m or less), it will be necessary to add properly conductive, and therefore safe, liquid to the tank.

This conductive liquid may be added to the waste container beforehand.

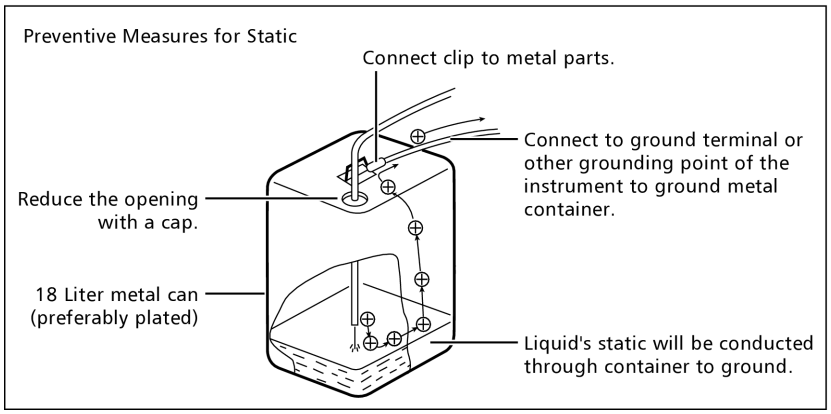
■ Preventive Measure 2

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 will prevent any sparks generated outside the container from getting inside.

Accessories for this measure

Caps for 18-L or 4-L container (with three 3-mm diameter openings)

Part No. S228-21354-91



■ Preventive Measure 3

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

To prevent electrostatic charging of the human body, take the following precautions:

- Wear anti-static clothing and shoes.
- Ground the human body with anti-static wrist straps. (For safety, the wrist strap should be connected to the ground using an intervening resistor of about 1 MΩ.)
- Spread anti-static matting or the like on the floor, to make the floor conductive.

⚠ CAUTION

Instruction

Persons who have not taken anti-static precautions should touch some grounded metal object before coming near the waste liquid container, in order to drain static charges.

■ Preventive Measure 4

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

⚠ CAUTION

Instruction

Periodically check the tubing connections for leaks.

Air bubbles in liquid can multiply the electrostatic charge by a factor of 20, 30 or more.

■ Preventive Measure 5

If it is not possible to use a conductive waste liquid container, take the following precautions:

Ensure that the end of the inflow tubing is always submerged inside the container. Also, place some type of grounded metal object, such as a ground wire connected to the instrument, into the liquid.

⚠ CAUTION

For low conductivity (less than 10^{-10} S/m) liquids, take preventive measures 1 to 4.

For low conductivity (less than 10^{-10} S/m) liquids, preventive measure 5 has no effect.
Use as small a container as possible to minimize damage in the event of fire.

For Reference

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

Precautions for Mobile Phase Selection and Use

⚠ CAUTION

Do NOT use resin parts for the high-pressure tubing while pumping at high pressures.

Pumping at high pressure may cause resin tubing to be ruptured or disconnected, which could result in mobile phase leaks.
Please note the maximum withstand pressure of each part when resin parts are used for the high-pressure tubing.

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 could 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.

Do not use solutions of pH 13 or more.

Some types of mobile phases may damage the flow cell quartz if used for a long period of time at pH10 or more, resulting in transformation of the transmission characteristics. After using this type of mobile phase, pump HPLC grade pure water or other liquid to rinse the flow cell.

The following solvent could damage the system. Never use these solvents in the degassing unit.

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

⚠ CAUTION

If PEEK resin parts are used for tubing connections, do not use the following mobile phases.

These mobile phases weaken PEEK resin, which may lead to cracked tubing and mobile phase leaks.

- Concentrated sulfuric acid
- Concentrated nitric acid
- Dichloroacetic acid
- Acetone*1
- Tetrahydrofuran (THF)
- Dichloromethane
- Chloroform
- Dimethyl sulfoxide (DMSO)
- Fluorine organic solvents such as hexafluoroisopropanol (HFIP)

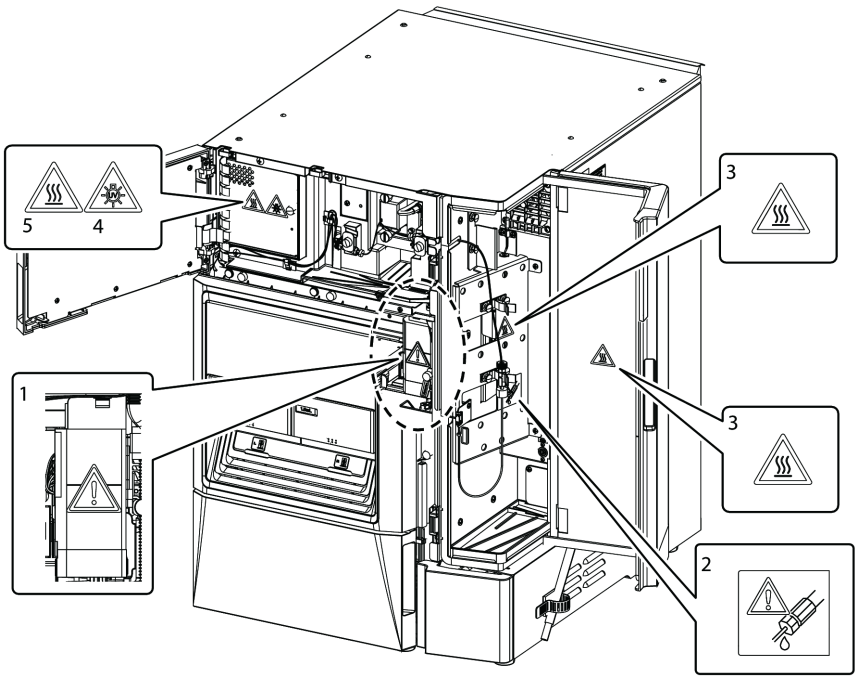
*1 There is no problem with temporarily using low-concentration aqueous solutions with an acetone concentration of 0.5 % or less, e.g. for the purpose of checking the performance of the gradient.

NOTE

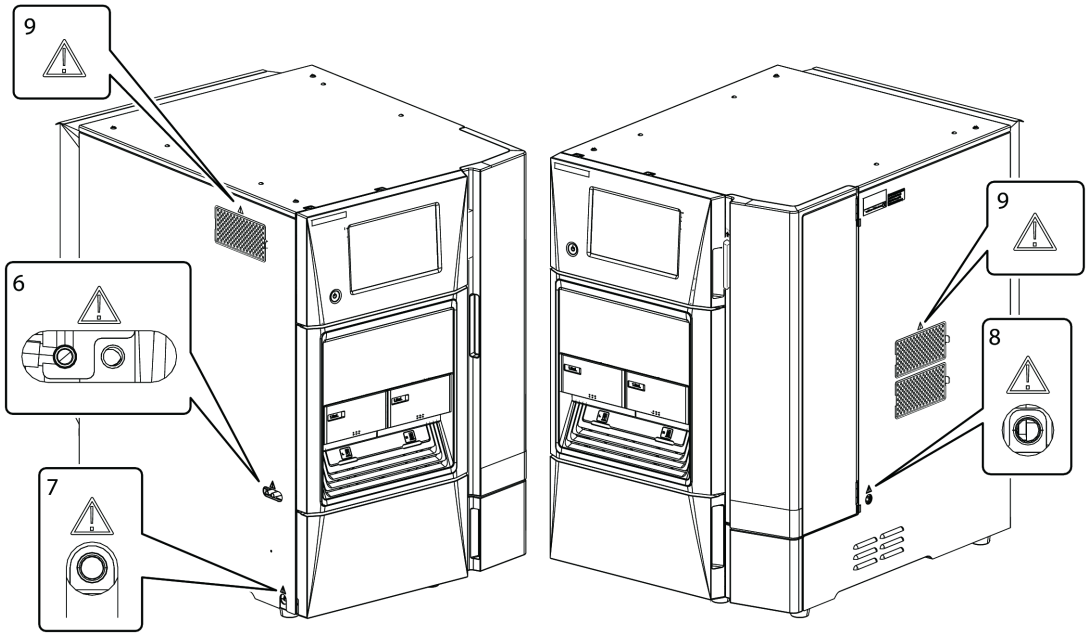
- Use only HPLC grade or comparable mobile phase, and filter it with a filter of 0.45 µm mesh or finer before use to remove particulates and foreign matter.
- Halogen ions can corrode the stainless steel material (SUS316L) used in the plumbing, so if such materials are used for the wetted parts of the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

Warning Labels

In order to ensure safety, warning labels are attached in places requiring caution. If a warning label is lost or damaged, obtain a new label through your Shimadzu representative and attach it in the correct position.



No.	Warning Label	Description
❶		(Part No. S037-72999-02) During operations such as calibration, the autosampler operates even with the front panel open. Do NOT touch the needle moving parts.
❷		(Part No. S228-57699) Do NOT forget to tighten tubing completely. Otherwise, leakage may occur.
❸		(Part No. S206-77586) Be careful not to touch when the operating temperature of the column oven is high (60 °C or over).
❹		(Part No. S037-70854-02) The lamp emits ultraviolet light when illuminated. Do NOT look directly at the lamp light.
❺		(Part No. S037-72999-12) Allow the lamp and lamp mounting parts to cool down adequately before replacing the lamp. The lamp compartment is extremely hot just after turning off the lamp.



No.	Warning Label	Description
❻		(Part No. S228-53303) If a drain tube is not connected, the rinse solution may leak, resulting in malfunction of the instrument. When a model with a sample cooler is used, the condensation water may leak, resulting in malfunction of the instrument.
❼		(Part No. S228-53303) If a drain tube is not connected, leaked solutions will not drain, resulting in malfunction of the instrument.
❽		(Part No. S228-53303) If the column oven temperature is set to below the room temperature, condensation may occur. If a drain tube is not connected, leakage may occur, resulting in malfunction of the instrument.
❾		(Part No. S228-53303) Be careful of dirt on the air filter. If the filter is clogged with dust, the instrument's performance may be impaired.

Warranty

Shimadzu provides the following warranty for this product.

1. Period:

Please contact your Shimadzu representative for information about the period of this warranty.

2. Description:

If a product/part failure occurs for reasons attributable to Shimadzu during the warranty period, Shimadzu will repair or replace the product/part free of charge. However, in the case of products which are usually available on the market only for a short time, such as personal computers and their peripherals/parts, Shimadzu may not be able to provide identical replacement products.

3. Limitation of Liability:

(1) In no event will Shimadzu be liable for any lost revenue, profit or data, or for special, indirect, consequential, incidental or punitive damages, however caused regardless of the theory of liability, arising out of or related to the use of or inability to use the product, even if Shimadzu has been advised of the possibility of such damage.

(2) In no event will Shimadzu's liability to you, whether in contract, tort (including negligence), or otherwise, exceed the amount you paid for the product.

4. Exceptions:

Failures caused by the following are excluded from the warranty, even if they occur during the warranty period.

(1) Improper product handling

(2) Repairs or modifications performed by parties other than Shimadzu or Shimadzu designated companies

(3) Product use in combination with hardware or software other than that designated by Shimadzu

(4) Computer viruses leading to device failures and damage to data and software, including the product's basic software

(5) Power failures, including power outages and sudden voltage drops, leading to device failures and damage to data and software, including the product's basic software

(6) Turning OFF the product without following the proper shutdown procedure leading to device failures and damage to data and software, including the product's basic software

(7) Reasons unrelated to the product itself

(8) Product use in harsh environments, such as those subject to high temperatures or humidity levels, corrosive gases, or strong vibrations

(9) Fires, earthquakes, or any other act of nature, contamination by radioactive or hazardous substances, or any other force majeure event, including wars, riots, and crimes

(10) Product movement or transportation after installation

(11) Consumable items

Recording media such as CD-ROMs are considered consumable items.

* If there is a document such as a warranty provided with the product, or there is a separate contract agreed upon that includes warranty conditions, the provisions of those documents shall apply.

After-Sales Service and Availability of Replacement Parts

■ After-Sales Service

If any problem occurs with this product, perform an inspection and take appropriate corrective action as described in "6 Troubleshooting" of the System Guide.

If the problem persists, or the symptoms are not covered in the troubleshooting section, contact your Shimadzu representative.

■ Replacement Parts Availability

Replacement parts for this product will be available for a period of seven (7) years after the product is discontinued. Thereafter, such parts may cease to be available.

Note, however, that the availability of parts not manufactured by Shimadzu shall be determined by the relevant manufacturers.

■ Hardware Validation

Each unit in the instrument and the entire LC system should be checked periodically to ensure that they function normally, else the analysis data may not be reliable.
Therefore, it is necessary to carry out periodic hardware validation and keep records of the validation.
Before shipment from the factory, this instrument was rigorously inspected. The results are summarized in the Inspection Certificate accompanying the instrument. To inspect the instrument performance after installation, repeat the Hardware Validation as described in "2 Validation" of the Integrity Guide.

■ Hardware Validation Contract

This is a contract under which a qualified Shimadzu-approved engineer performs periodic validation, and provides reports of the results.
Details of the contract can be obtained from your Shimadzu representative.

Maintenance, Inspections, and Adjustment

In order to maintain the instrument's performance and obtain accurate measurement data, daily inspection and periodic inspection/calibration are necessary.

- For daily maintenance, inspection, and replacement parts, refer to the System Guide and Maintenance Guide.
- Periodic inspection/calibration should be requested to your Shimadzu representative.
- Replacement cycles described for periodic replacement parts are rough estimate. Replacement may be required earlier than the described replacement cycles depending on usage environment and frequency.

Disposal Precautions

When disposing of the instrument, contact your Shimadzu representative.
If you dispose them yourself, do so in accordance with the processing standards determined by law, separately from general industrial waste and household garbage.

Precautions on Handling Deuterium (D2) Lamp

■ When Disposing of the Lamp

If the deuterium (D2) lamp should be broken or its life is finished, dispose of the lamp separately from general garbage. When disposing of the deuterium (D2) lamp provided from Shimadzu Corporation, select a method, which will not harm the environment or cause bodily injury. Consult your local Government Agencies for a proper disposal method.

The materials of deuterium (D2) lamp are as follows:

- Metals (Tungsten, Aluminum)
- Quartz glass
- Ceramic
- Plastic

California Regulations Concerning Perchlorate

NOTE For California,USA Only
This product contains a battery that contains perchlorate material.
Perchlorate Material - special handling may apply.
See www.dtsc.ca.gov/hazardouswaste/perchlorate

Contents

Introduction

1 Overview

2 Configuration

3 Analysis

4 Various Operations

7 Technical Information

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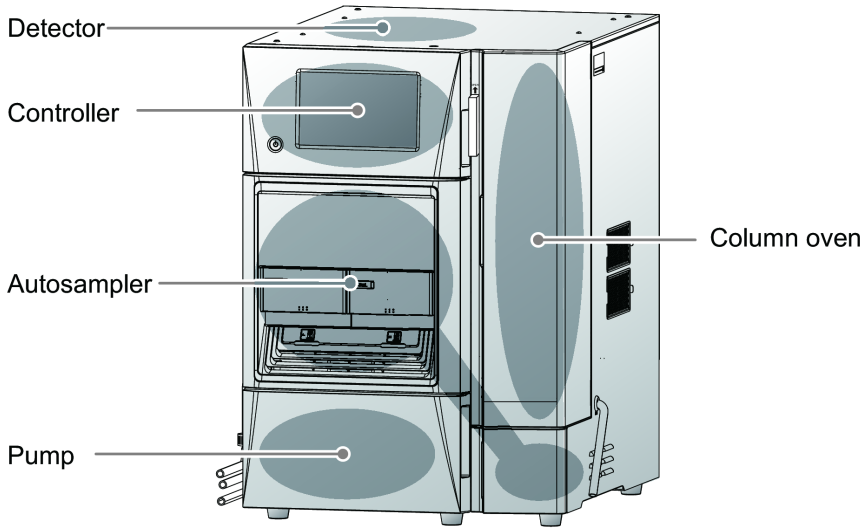
1 Overview

The LC-2030 Plus series is an integrated high performance liquid chromatograph model manufactured by Shimadzu that integrates a pump (quaternary low-pressure gradient), autosampler, column oven, and detector and realizes a comfortable operating environment while automating testing (validation).



There are three types of models, depending on the equipped detector and whether it has a sample cooler or not, as follows:

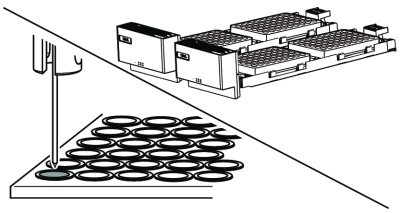
Model Name	Part No.	Detector	Sample Cooler
LC-2030 Plus	S228-65800-58	UV detector	None
LC-2030C Plus	S228-65801-58	UV detector	Standard equipment
LC-2030C 3D Plus	S228-65802-58	PDA detector	Standard equipment

1.1 Features

■ High throughput-compatible

Both high-speed sample injection and polyspecimen processing realized

In this series, the minimum injection cycle time is reduced to 14 seconds (under the specified conditions). In addition, it supports a maximum of 336 sample vials (1 mL sample vials) or a maximum of 4 microtiter plates (MTPs) (for a maximum of 1536 specimens). High-speed injection of polyspecimen samples has improved the throughput of analysis.



■ Network support

Network support with ETHERNET connection

Because it is equipped with a network function by default and can connect with data processing equipment for Shimadzu high performance liquid chromatographs (workstations), this series allows use of a PC to set, process, and monitor analysis conditions or to perform data processing.

Instrument monitoring function using a smartphone

This function enables monitoring of the operating status of this instrument, status of analysis, and maintenance information not only from the screen of the instrument but also from a smartphone. If the instrument is connected to a network, it is possible to check the instrument's analysis status or progress in real time even remotely.

■ Streamlining tasks by automating operations

Autopurge function

The autopurge function realized through the linkage of the pump with the autosampler enables automatic mobile phase aspiration and replacement without priming by means of manual purging.

Automatic shutdown function

Once analysis finishes, the instrument can be set to a sleeping status after automatically performing the closing tasks such as mobile phase replacement and flow line rinsing.

Automatic validation function

This function enables automatic inspection of the noise, drift, and wavelength accuracy of the detector, and the gradient concentration accuracy of the pump, thus streamlining periodic inspection work.

Automatic pretreatment function

Sample dilution with the set diluent just before the injection is available.

■ Improving reliability

Improving the reliability of analysis data

Improvement to the robustness of the pump and autosampler enables stable analysis over a long time. The sample cooler is equipped with a dehumidification function by default and provides a drain flow line for ejecting condensation water generated inside the instrument. The column oven adopts the air circulation method, reducing the risk of temperature variation dependent on the installation status of the column and realizing stable retention time reproducibility. The detector flow cell is equipped with a temperature control function by default, improving the robustness against changes in analysis conditions and the environment.

Reduced differences between instruments

Because the integrated liquid chromatograph model fixes the flow line tubing beforehand, the capacity differences in the flow line between instruments when multiple LC-2030 Plus series are used becomes extremely small, reproducing highly reliable analysis independently of instruments.

■ Pursuit of ease-of-use

Improved accessibility during maintenance

The consumable parts can be replaced and the instrument adjusted from the front side of the instrument.

Easy-to-use operation system

The operations screen is configured with an intuitive graphical user interface and can be controlled with touch operations.

■ Comfortable working environment provided

Smaller space, energy-saving, and solvent-saving design

The integrated model combining units occupies a smaller space and saves energy. Additionally, the design, suitable for high-speed analysis UFLC and semi-micro LC with less solvent consumed, reduces running costs and environmental loads.

Increased silence

By selecting the silent mode, it is possible to reduce operating noise of the cooling fan, maintaining a quiet working environment.

■ Method transfer function

Start timing adjustment function for concentration gradient

A totally different separation pattern may be shown even if the same column and mobile phase are used in normal analysis because the start timing of the concentration gradient varies due to the difference of inner volume of the instrument. Even with the effort to adjust the inner volumes of the different instruments, it is difficult to adjust them identical. i-Series enables the fine adjustment of the inner volume. In transition of the instruments from the one with smaller volume to the one with larger volume, or from larger to smaller, superior compatibility is maintained.

1.2 Configuration Parts

1.2.1 Accessory

The following parts are accessories.

⚠ CAUTION

For maintenance, be sure to use the accessories, optional parts, recommended items, consumable parts, maintenance parts, replacement parts, and tools described in the instruction manual.

Using other parts may damage the parts and prevent proper use of the instrument.

Reference "7.2 Consumable Parts / Maintenance Parts / Replacement Parts / Tools" P.190

■ Accessories

Part Name	Model Name	Part No.	Remark
Accessory ASSY A Plus	LC-2030 Plus	S228-65810-42	120V power supply
		S228-65810-58	220-240V power supply
Accessory ASSY C Plus	LC-2030C Plus	S228-65811-42	120V power supply
		S228-65811-58	220-240V power supply
Accessory ASSY C 3D Plus	LC-2030C 3D Plus	S228-65812-42	120V power supply
		S228-65812-58	220-240V power supply

Configuration Parts

The 2-digit numbers in the remark column in the table below indicate the Part No. of Accessory ASSY and power supply voltages for the part. -42 indicates use with a 120 V power supply and -58 is a 220-240 V power supply.

Part Name	Model Name	Part No.	Quantity	Remark
Power Cord (for UL/CSA)		S071-60821-08	1	-42
Power Cord (for EU)		S071-60825-51	1	-58
Cable, LD-CT/BU2/RS		S088-81104-84	1	
Remote Cable		S228-28253-91	1	
SIGNAL CABLE EMC, Terminal		S228-35047-92	1	
Drain Tube ASSY	LC-2030 Plus	S228-56223-41	1	
	LC-2030C Plus / 3D Plus	S228-56223-42	1	
Drain Tube, Silicone		S228-25162-04	1	
PTFE Tubing, OD 7.0 x ID 6.0		S016-37507	1	
Drain Tube (EFTE) ASSY		S228-44608-91	1	
Drain Tube Clamper		S228-62077	1	
Reservoir Tray		S228-57714-42	1	
Reservoir Bottle		S228-38435	1	
1.5 mL Sample Vial Plate	LC-2030 Plus	228-46960	4	
1.5 mL Sample Vial Metal Plate	LC-2030C Plus / 3D Plus	S228-61615-42	4	
1.5 mL Sample Vial (5 pcs)		S228-38446-92	1	
Rinsing Port Cover		S228-48328-01	1	
Rinsing Port Cap (Without Hole)		S228-47973-01	2	
Rinsing Port Cap (with Hole)		S228-47973-02	1	
20 mL Syringe		S046-00038-01	1	

Part Name	Model Name	Part No.	Quantity	Remark
Syringe Needle		S228-18216-91	1	
Resistance Tube PEEK		S228-38994	1	
Flangeless Fitting ASSY		228-57652-41	1	
LPGE-OUT Tube (Long)		228-58590-41	1	
Plate Number Identification Label L13R24		S228-56222-01	1	
Rack Teaching Jig		S228-57562-41	1	
Cap/Knob		S037-02820-57	1	
PDA Utility CD-ROM	LC-2030C 3D Plus	S228-57639-41	1	
Touch Pen		S228-58619-41	1	
Coupling 1.6C		S228-16004-13	1	
Male Nut PEEK		S228-18565	2	

Instruction manual

Part Name	Part No.	Explanation
System Guide	S228-92674	This instruction manual
Integrity Guide	-	Contained as PDF documents in the CD-ROM (S228-66079-41).
Operation Guide	-	
Maintenance Guide	-	

1.2.2 Optional Parts

This section introduces optional parts related to the instrument.
For the installation procedure, refer to the instruction manual of each optional part.
Additionally, when optional parts is installed, enter part No. by refering to Maintenance guide "2.2 Recording Replacement History in the Maintenance Log". For details about optional parts, contact your Shimadzu representative.

■ Pump

Part Name	Part No.	Explanation
FCV-11AL	S228-45048-58	Flow line switching valve (3 flow lines) for the mobile phase. FCV-11AL Connection Kit is needed to use FCV-11AL.
FCV-11ALS	S228-45049-58	Flow line switching valve (1 flow line) for the mobile phase. FCV-11AL Connection Kit is needed to use FCV-11ALS.
FCV-11AL Connection Kit	S228-56249-41	Kit containing a relay cable for connecting FCV-11AL and FCV-11ALS.
780 µL Mixer Kit	S228-57313-41	Kit containing a mixer and tubing for mobile phase with ultra-violet absorption ingredient such as TFA.

Part Name	Part No.	Explanation
2 mL Mixer Kit	S228-57313-42	Kit containing a mixer and tubing for mobile phase with ultra-violet absorption ingredient such as TFA.
Low Delay Volume System Kit	S228-57796-42	The system delay volume is approx. 460 µL. The "50 µL sample loop" and "SUS pipe 0.1 x 600 OUT" described in the autosampler options form a set.
Delay Volume-Compatible System Kit	S228-57796-43	The system delay volume is 1100 µL, which is the same as LC-2010.
Mixer MR300 µL		Contained in Delay Volume-Compatible System Kit (S228-57796-43). Mixer for mobile phase with ultra-violet absorption ingredient such as TFA.
Polyethylene Seal	S228-32628-91	Utilized when a nonpolarized organic solvent like hexane or a solvent of alkyl sulfonic acid with TFA added is used.

■ Autosampler

Part Name	Part No.	Explanation
Sample Loop (50 µL)	S228-56074-44	This is the sample loop for 50 µL injections.
Optional Loop (500 µL)	S228-45405-41	Increases the injection volume to 500 µL.
Optional Loop (2 mL)	S228-45405-42	Increases the injection volume to 2 mL.
SUS Pipe 0.1x600 OUT	S228-53184-91	Stainless tubing for the outlet of a high-pressure valve with an inside diameter of 0.1 mm. Easily laid out flexible tubing.
SUS Pipe 0.17x600 OUT	S228-56217-45	Stainless tubing for the outlet of a high-pressure valve with an inside diameter of 0.17 mm.
Male Nut Fitting (2 pcs)	S228-45717-01	Hand-tightened fitting for column inlets. Usable for analyzing at a pressure of 35 MPa max.
Ferrule for Male Nut Fitting (10 pcs)	S228-45717-02	Replacement PEEK ferrules (10 pcs) for male nut fittings.
UHPLC Fitting (1 pc)	S228-56867-41	Fitting for column inlets. Reusable up to 20 times with a pressure resistance of 130 MPa.
UHPLC Fitting (10 pcs)	S228-56867-43	Fittings (10 pcs) for column inlets. Reusable up to 20 times with a pressure resistance of 130 MPa.

Part Name	Part No.	Explanation
Vespel® needle seal XR	S228-50390-41	To use solvents for the GPC method, such as tetrahydrofuran (THF) and chloroform. Applicable pH range is "1-9". **⚠ CAUTION** Instruction **Change the outlet tubing to the stainless one when using above solvents. It is recommended to use stainless tubing (S228-49303-00) with an inner diameter of 0.3 mm and a length of 300 mm.** The PEEK tubing may break and the solvent may splash since it is not strong enough for these solvents. Also, do not use the mobile phase that contains Hexafluoroisopropanol (HFIP) with either PEEK or stainless tubing. It may weaken the resin such as Vespel and PEEK and cause the solvent to splash.
Sample Rack	S228-55735-41	Additional sample rack. Useful for switching quickly between multiple types of plates.
1 mL Sample Vial Plate (2 pcs)*1	S228-56197-41	Plate to set eighty-four 1 mL sample vials. It is possible to set 2 plates to 1 sample rack.
1.5 mL Sample Vial Plate (2 pcs)*2	S228-50830-92	Plate to set fifty-four 1.5 mL sample vials. It is possible to set 2 plates to 1 sample rack.
4 mL Sample Vial Plate (2 pcs)*1	S228-56197-42	Plate to set twenty-eight 4 mL sample vials. It is possible to set 2 plates to 1 sample rack.

*1 For details on plates and sample vials, see "1.2.3 Recommended Items" P.11.

*2 When using the 1.5mL Sample Vial Plate, the temperature accuracy of the sample cooler is ±6℃.

■ Column oven

Part Name	Part No.	Explanation
Column Clamp ASSY B5	S228-15617-91	A suite of clamps to add a column with an outside diameter between 6.4 mm and 9.5 mm.
Column Clamp ASSY B8	S228-15617-92	A suite of clamps to add a column with an outside diameter between 9.5 mm and 12.7 mm.

Part Name	Part No.	Explanation
FCV-14AH	S228-45014-57	Automatic column switching valve with 6 positions and 7 ports which is usable at a pressure of 34.3 MPa max. Used for switching between up to 6 columns. FCV-14AH Installation Kit and FCV Piping Kit (ID 0.3 or ID 0.1) are needed to use FCV-14AH. Additionally, the same number of Male Nut Fitting (S228-45717-01) (withstanding pressure: 35 MPa) or UHPLC fitting (S228-56867-41) (withstanding pressure: 130 MPa) as the number of additional columns are required.
FCV-14AH Installation Kit	S228-55765-42	Parts kit to fix FCV-14AH inside the column oven.
FCV Piping Kit (ID 0.3)	S228-58223-41	Tubing parts kit to install up to 2 columns to FCV-14AH.
FCV Piping Kit (ID 0.1)	S228-58223-43	
FCV Additional Piping Kit (ID 0.3)	S228-58223-42	Tubing parts kit to install 3 columns or more to FCV-14AH. The same number as the number of additional columns are required. Columns can be added up to 4, and at most 6 columns can be installed in total. Reference "Attaching multiple columns" P.69
FCV Additional Piping Kit (ID 0.1)	S228-58223-44	
CMD	S228-37281-41	Column Management Device for storing information related to the columns. 1 pc is needed for 1 column. Only 1 CMD can be connected at once to the instrument. CMD Cable is needed to use CMD. The user can check the CMD information on the monitor screen. Reference Operation Guide "2.1.6 Chromatogram Display Tab CMD Screen"
CMD Cable	S228-39991	Cable to connect the CMD to the instrument. 1 pc is needed for 1 instrument.

■ UV detector

Part Name	Part No.	Explanation
Recycle Valve	S228-56808-41	Low-pressure column switching valve to recycle mobile phase.
High-Speed Cell for UV	S228-45621-41	Cell (cell length: 10 mm, cell volume: 8 µL) to support high-speed gradient analysis.
Semi-Micro Cell for UV	S228-45605-46	Cell (cell length: 5 mm, cell volume: 2.5 µL) to support semi-micro analysis.

■ PDA detector

<table>
<tr><th>Part Name</th><th>Part No.</th><th>Explanation</th></tr>
<tr><td>W Lamp for PDA, ASSY</td><td>S228-57110-41</td><td>Tungsten lamp for high-sensitivity analysis in a long wavelength domain and the dedicated socket. Refer to the table below for the relation of wavelength and recommended lamp.
<table>
<tr><th>Wavelength</th><th>Recommended lamp</th></tr>
<tr><td>190 to 800 nm</td><td>Use both of D2 and W Lamp</td></tr>
<tr><td>190 to 500 nm</td><td>D2 Lamp</td></tr>
<tr><td>500 to 800 nm</td><td>W Lamp</td></tr>
</table></td></tr>
<tr><td>High-Speed Cell for PDA</td><td>S228-45618-54</td><td>Cell (cell length: 10 mm, cell volume: 8 µL) to support high-speed gradient analysis.</td></tr>
<tr><td>Semi-Micro Cell for PDA</td><td>S228-45605-47</td><td>Cell (cell length: 5 mm, cell volume: 2.5 µL) to support semi-micro analysis.</td></tr>
</table>

■ Others

Part Name	Part No.	Explanation
Touch Panel Protecting Sheet	S228-59212-41	Protecting sheet for touch panel.
Tool Kit	S228-57647-41	Kit containing the necessary tools for preparation, inspection, and maintenance.
LC-2030 Plus Maintenance Kit (1 Year)	S228-58343-41	Kit containing main consumable parts common to the LC-2030 Plus series.
LC-2030 Plus Maintenance Kit (Full, UV)	S228-58343-42	Kit containing all consumable parts common to the LC-2030 Plus and LC-2030C Plus.
LC-2030 Plus Maintenance Kit (Full, PDA)	S228-58343-43	Kit containing all consumable parts for the LC-2030C 3D Plus.
Anti-Earthquake Kit	S228-56298-41	Parts for strengthening the fixation of the reservoir tray and the instrument.
1 L Mobile Phase Bottle (5 pcs)	S228-38583-42	A set of five 1 L reservoir bottles to put mobile phase in.
Optional Detector Installation Kit*1	S228-56245-41	Kit containing a top plate and reservoir tray to install an additional detector on. Installed after removing standard top plate.
Camera ASSY for Autosampler*1	S228-55517-41	Camera to be installed in the autosampler. Allows monitoring of the needle operation from the PC screen.

Part Name	Part No.	Explanation
Optional A/D Board*1	S228-55519-41	Board for analog-digital conversion to receive analog signals from external devices (such as a third-party detector). Input range can be switched from -1 V to +1 V (noise spec.: 2 µV, ASTM) or -10 V to +10 V (noise spec.: 10 µV, ASTM).
Optional Optical Board*1	S228-55518-41	Expansion board for optical link cable connector. For use when Spectrofluorometric detector (RF-20A/RF-20Axs) or Differential refractive index detector (RID-10A/RID-20A) is installed.
Nexera-i Plus Upgrade Kit UV	S228-66139-41	Kit for upgrade from LC-2030C Plus to LC-2040C Plus. Not usable for LC-2030 Plus and LC-2030 series.
Nexera-i Plus Upgrade Kit PDA	S228-66139-42	Kit for upgrade from LC-2030C 3D Plus to LC-2040C 3D Plus. Not usable for LC-2030 Plus and LC-2030 series.
IM, System Guide (E)	S228-92674	Book form manual.
IM, Integrity Guide (E)	S228-92675	
IM, Maintenance Guide (E)	S228-92676	
IM, Operation Guide (E)	S228-92677	

*1 For installation, contact your Shimadzu representative.

1.2.3 Recommended Items

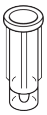
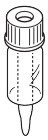
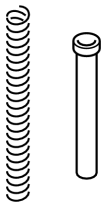
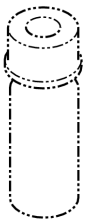
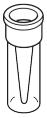
Select recommended items depending on the purpose and content of analysis.

■ Sample vials and septum

Before using, tighten the cap. Otherwise, trouble may occur, such as the septum falling off during injection. If the cap is loose, trouble may occur, such as the septum falling off during injection.

Sample vials

Part Name	Appearance / Volume	Material	Part No.	Purpose	Conforming Plate	Remarks
1 mL Sample Vial	 Volume : 1 mL	Vial: Borosilicate glass Cap: Polyethylene	S228-39699-91	For general purposes	1 mL sample vial plate	With cap, 250 pcs
4 mL Sample Vial	 Volume : 4 mL	Borosilicate glass	S228-21287-91	For general purposes	4 mL sample vial plate	With cap/silicone rubber septum, 100 pcs
4 mL Sample Vial[*1]		Polypropylene	S228-31537-91			With cap/silicone rubber septum, 100 pcs[*3]
1.5 mL Sample Vial	 Volume : 1.5 mL	Borosilicate glass	S228-15652-92	For general purposes	1.5 mL sample vial plate[*2],1.5mL sample vial metal plate[*2]	With cap/silicone rubber septum, 100 pcs
1.1 mL Sample Vial[*1]	 Volume : 1.1 mL		S228-21283-91	For general purposes / small volumes		With cap/silicone rubber septum, 100 pcs

Part Name	Appearance / Volume	Material	Part No.	Purpose	Conforming Plate	Remarks
1 mL Sample Vial*1	 Volume : 1 mL	Vial: Polypropylene Cap: Polyethylene	S228-31600-91	For general purposes / small volumes Disposable	1.5 mL sample vial plate*2,1.5mL sample vial metal plate*2	With cap, 200 pcs*3
0.3 mL Sample Vial*1	 Volume : 300 µL	Borosilicate glass	S228-16847-92	Small capacity vial		With cap/silicone rubber septum, 100 pcs
0.3 mL Sample Vial (Spare) *1			S228-16850-91			100 pcs (glass vials only)
0.3 mL Sample Vial*1		Borosilicate glass	S228-21284-91	Small capacity vial	4 mL sample vial plate	With spring, 100 pcs Used in 4 mL sample vials
0.3 mL Sample Vial (Spare) *1	 Volume : 300 µL		S228-21285-91			100 pcs (glass vials only)
0.2 mL Sample Vial*1	 Volume : 200 µL	Vial: Polypropylene Cap: Polyethylene	S228-35217-91	For small capacity Disposable	1.5 mL sample vial plate*2,1.5mL sample vial metal plate	With cap, 100 pcs*3

*1 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 may differ from the temperature in the sample vial.

*2 Set the needle stroke to 45 mm or less.

*3 Care must be taken when handling the polypropylene sample vials.

Reference "4.4.4 Setting the Plate Type and Needle Stroke from the Top" P.100
"Sample vial material" P.13

Septum

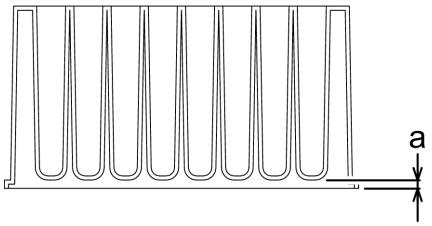
Part Name	Appearance	Material	Part No.	Conforming Sample Vial	Remarks
Silicone Rubber Septum		Silicone rubber w/PTFE cover	S221-26718-93	• 1.5 mL sample vial (S228-15652-92) • 1.1 mL sample vial (S228-21283-91) • 0.3 mL sample vial (S228-16847-92)	100 pcs
PTFE Septum		PTFE	S228-15655-91		100 pcs
Silicone Rubber Septum		Silicone rubber w/PTFE cover	S228-21290-91	4 mL sample vial (S228-21287-91) (S228-31537-91)	100 pcs
PTFE Septum		PTFE	S228-23469-91		100 pcs

Sample vial material

There are glass and plastic (polyethylene) sample vials. If a vial is used incorrectly or the selection is incorrect, a problem may occur during analysis. See the following table for use.

Type	Characteristic	Appropriate Sample Solvent
Glass Sample Vial	Ionic material such as an acid or base may 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, note that alkali or hydrogen fluoride may corrode the glass material.	• 10 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. Note that trifluoroacetic acid will be 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. In this case as well, 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, the additives in the plastic may elute from the surface of the sample vial. Note that an organic solvent may 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.)

■ 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, condensation water may be generated between the cooling plate on the sample rack and the microtiter plate or deep-well plate, thus obtaining incorrect analysis results.

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

Well-fitted sealings and compatible plates

Plate Type	Product	Contact	Remarks
Microtiter Plate	267245 series	Nalge Nunc International (Thermo Fisher Scientific)	Material: Polypropylene Volume: 0.5 mL
Deep-Well Plate	278752		Material: Polypropylene Volume: 2 mL
	AXYGEN P-DW-20-C	Greiner	Material: Polypropylene Volume: 2 mL
Mat	AXYGEN AM-2ML-RD		Material: Silicone
	276011	Nalge Nunc International (Thermo Fisher Scientific)	* Note that too much filled volume in the well might cause the mat to rise to the surface over time.
	276002 series		Material: Thermoplastic elastomer

Heat sealing mats and compatible plates

Plate Type	Product	Contact	Remarks
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

Adhesive sealing mats and compatible plates

Plate Type	Product	Contact	Remarks
Microtiter Plate	267245 series	Nalge Nunc International (Thermo Fisher Scientific)	Material: Polypropylene Volume: 0.5 mL
Deep-Well Plate	278752		Material: Polypropylene 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. * Note that too much filled volume in the well might cause the mat to rise to the surface over time.

NOTE Take enough care when using a mat with the following characteristics because using such with the instrument can cause the flow lines for the needle or the needle seal to clog.

- Mats with adhesive attached to the entire backside (the side in contact with the plate).
  Regardless of the type of solvent, if such a mat is used, there is a tendency that, over time, adhesive will become attached to the outer surface of the needle and the inside of the flow line hole. This will prevent aspiration of the sample, thus clogging the flow line or preventing the correct peak area value from being obtained.
- Mats whose material is polyethylene terephthalate (PET).
  When using an acetonitrile-based / DMSO-based solvent, the sample solvent tends to swell and cause wrinkles in the mat after the mat is sealed, which may prevent airtightness from being maintained.
  When the sample solvent is water-based / methanol-based, there is almost no practical problem.

Temperature control performance

The following are the temperature control performances for when the recommended plates are used.

1 mL Sample Vial Plate 1.5 mL Sample Vial Plate 4 mL Sample Vial Plate	The temperature of the vial bottom is the set temperature ±6 °C.
1.5 mL Sample Vial Metal Plate	The temperature of the vial bottom is the set temperature ±3 °C.
Microtiter Plate Deep-Well Plate	The temperature of the well bottom is the set temperature ±6 °C.

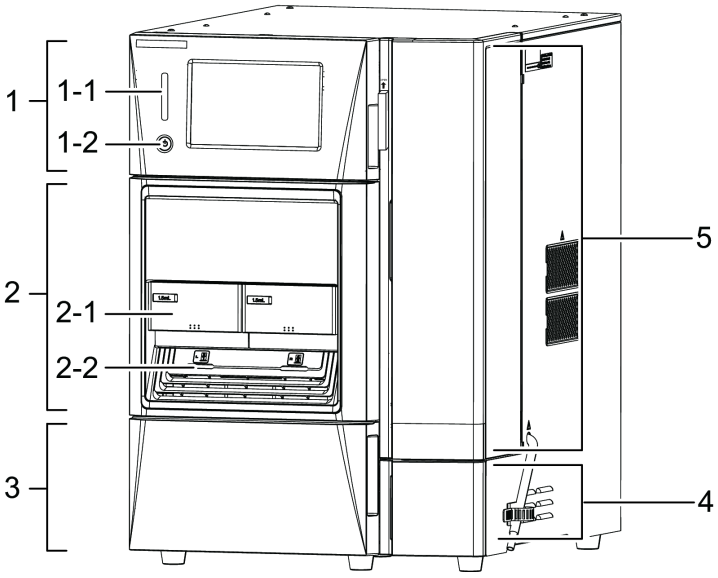
NOTE The temperature control performance varies depending on different conditions such as the ambient environment and the liquid volume in the sample vial. "Temperature control performance" described above indicates standard values under the following conditions.
For sample vials, microtiter plates, and deep-well plates other than those in the following table, the set temperature of the sample cooler may differ significantly from the temperature in the sample vial (temperature in the well) depending on the difference of thermal conductivities due to the shapes or materials.

Plate Type	Room Temperature	Humidity	Liquid Volume	Measurement Target
1 mL Sample Vial Plate	30 °C	70 %	Water: 700 µL	Genuine glass sample vial: Center of vial bottom (S228-39699-91)
1.5 mL Sample Vial Plate, 1.5mL mL Sample Vial Plate	30 °C	70 %	Water: 1 mL	Genuine glass sample vial: Center of vial bottom (S228-15652-92)
4 mL Sample Vial Plate	30 °C	70 %	Water: 3 mL	Genuine glass sample vial: Center of vial bottom (S228-21287-91)
Microtiter Plate	30 °C	70 %	Water: 200 µL	Nalge Nunc round-bottom plate: Center of well bottom
Deep-Well Plate	30 °C	70 %	Water: 1 mL	Nalge Nunc round-bottom plate: Center of well bottom

2 Configuration

2.1 Part Names and Functions

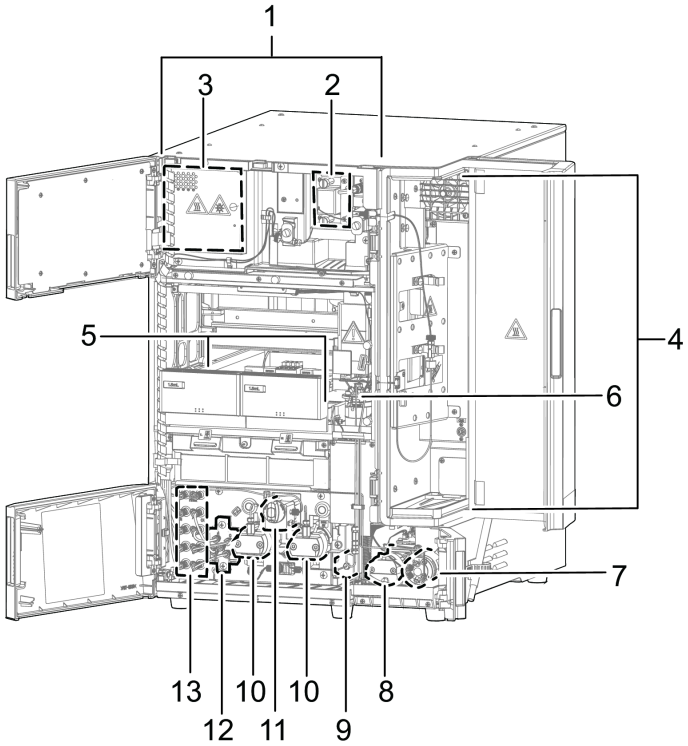
2.1.1 Front Side



No.	Name	Explanation
1	Controller Panel	It has a display panel for operation using a touch panel, and if the panel is opened, it is possible to check the detector devices such as the flow cell and the D2 lamp.
1-1	Status Indicator	Displays the operating status of the system using different colors of the light that it illuminates. • Green: Analyzable • Yellow: Preparing for analysis • Orange: Sleeping • Blue: During analysis • Red: Error
1-2	(Power Button)	Switches the power ON/OFF. When the instrument is powered ON, it is illuminated in white, and when it is OFF, it is illuminated in orange. Even when it is turned OFF, a standby current is flowing to the instrument. For the power supply on the main unit, see "2.1.3 Side" P.20.
2	Front Panel	A semi-transparent panel that enables checking of a set sample. If the front panel is removed, the parts of the autosampler, such as a needle and high-pressure valve, can be maintained.
2-1	Sample Rack	Specific sample vials and microtiter plates are set here.

No.	Name	Explanation
2-2	Rack LED	Illuminated if the sample rack is inserted, and after the autosampler needle starts to move until injection is completed, the rack LED for injection blinks. LEDs on both rack blink during the pretreatment procedure, since the needle may access to the multiple vials in the both trays. **NOTE** Do not remove the rack after the autosampler needle starts to move until injection is completed(the rack LED is blinking) because doing so can damage the needle.
3	Pump	If the door is opened, it is possible to check and maintain the inside of the pump, such as the degassing unit, low-pressure gradient valve, and drain valve.
4	Valve Mount Door	If the door is opened, it is possible to check and maintain the inside of the autosampler, such as the measuring pump and low-pressure valve.
5	Column Oven Door	The door of the column oven. Open this door to set the column.

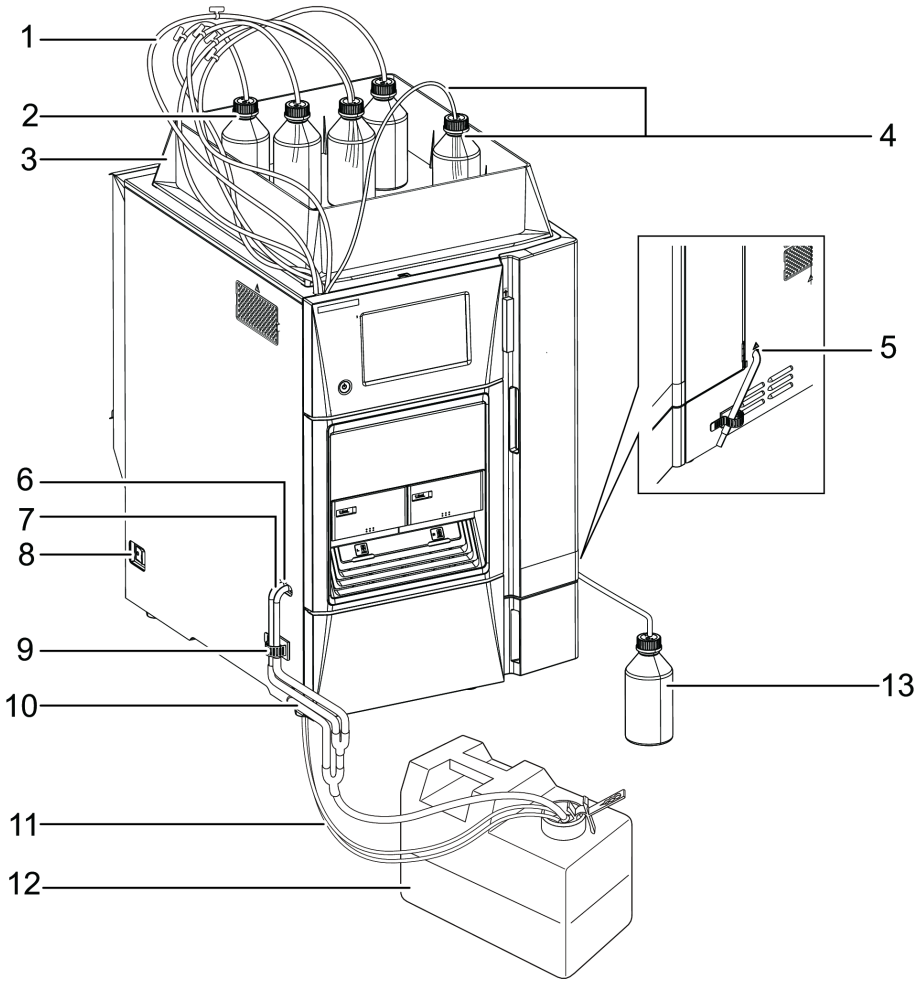
2.1.2 Inside



No.	Name	Explanation
1	UV/PDA Detector	Detects components that have eluted from the column.
2	Flow Cell	Flow cell for the UV detector or the PDA detector. A temperature adjustment function is built in.

No.	Name	Explanation
3	Lamp Cover	Installed at the back of the lamp cover is a D2 lamp (deuterium (D2) lamp) that is used as a detector light. Alternatively, a W lamp (tungsten lamp), an optional part for PDA detector system models, can be installed.
4	Column Oven	Air circulation-style column oven. The temperature of the column is maintained at a given value.
5	Sample Cooler	Direct cooling sample cooler. A temperature control function and dehumidification function are built in.
6	High-Pressure Valve	Switches between high-pressure flow lines.
7	Low-Pressure Valve	Switches between the sample liquid and the rinse solution for measuring with the measuring pump.
8	Measuring Pump	Aspirates or discharges the predetermined volume of sample and rinse solution.
9	Mixer	Stirs the mobile phase to make it uniform and stabilizes the baseline.
10	Pump	Pumps the mobile phase.
11	Drain Valve	Used to open the discharge flow line when purging a mobile phase manually.
12	Low-Pressure Gradient Unit	Mixes a max. of four types of mobile phases.
13	Degassing Unit	Degases the mobile phase and the rinse solution for the autosampler while online.

2.1.3 Side



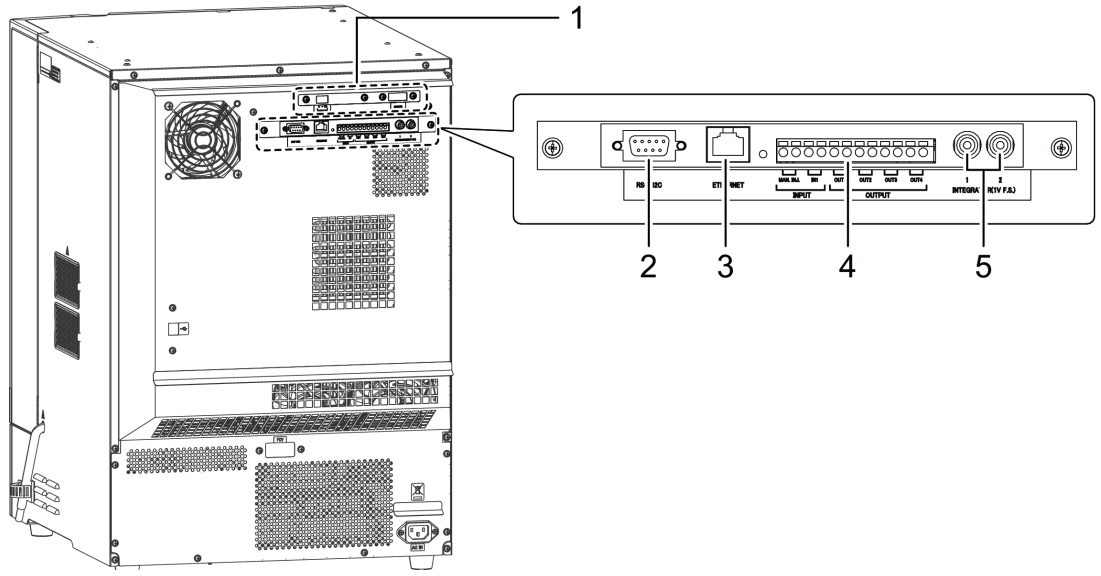
No.	Name	Explanation
1	Suction Tubing	Tube for aspiration of the mobile phase or the rinse solution for the autosampler. A suction filter is attached to the end.
2	Reservoir Bottle	Contains the mobile phase or the rinse solution for the autosampler.
3	Reservoir Tray	Reservoir bottles and seal rinse bottles are set here.
4	Automatic Rinsing Kit	Flushes liquid for rinsing the plunger and plunger seal of the pump.
5	Condensation Water Drain for Oven	Drains the condensation water when the oven is set to a max. of room temperature.
6	Rinse Liquid Drain	Drains the rinse solution of the autosampler.
7	Condensation Water Drain	Drains the condensation water generated when a sample cooler is used. (Only for models with sample cooler.)
8	Main Unit Power Switch	Turn the power supply of the entire instrument ON/OFF. Normally it should always be turned ON. *1
9	Clamp	Holds drain tubing together.
10	Leaked Liquid Drain	Drains the liquid that leaked inside of the instrument.
11	Mobile Phase Drain Tube	Tube for draining the mobile phase waste liquid that passed through the flow cell of the detector part and the mobile phase waste liquid for pump manual purging.
12	Waste Tank	Rinse liquid drain, leaked liquid drain, and condensation water drain (only for models with sample cooler)*2
13	Waste Container	Contains the drainage from the condensation water drain for the oven.*3

*1 Usually, the power of the instrument is turned ON/OFF using ⏻ (power button) of the controller. The power can be turned ON/OFF from the front side of the instrument using ⏻ (power button) of the controller if the main power switch is turned ON. When the instrument will not be used for a long period or when replacing a part, turn OFF the main power switch.

*2 Be sure to set this lower than the drain so that the end of the tube does not contact the liquid surface. In addition, make sure that no part of the tube is higher than the drain. Moreover, be sure to use the drain tube clamp so that the end of the tube will not contact the liquid surface.

*3 Do not put the condensation water tubes for the oven and rinse waste liquid tubes in the same waste container. Otherwise, the air containing the organic solvent volatilized from the waste container will flow back into the oven cavity, resulting in a reaction in the gas sensor inside the oven cavity.

2.1.4 Backside

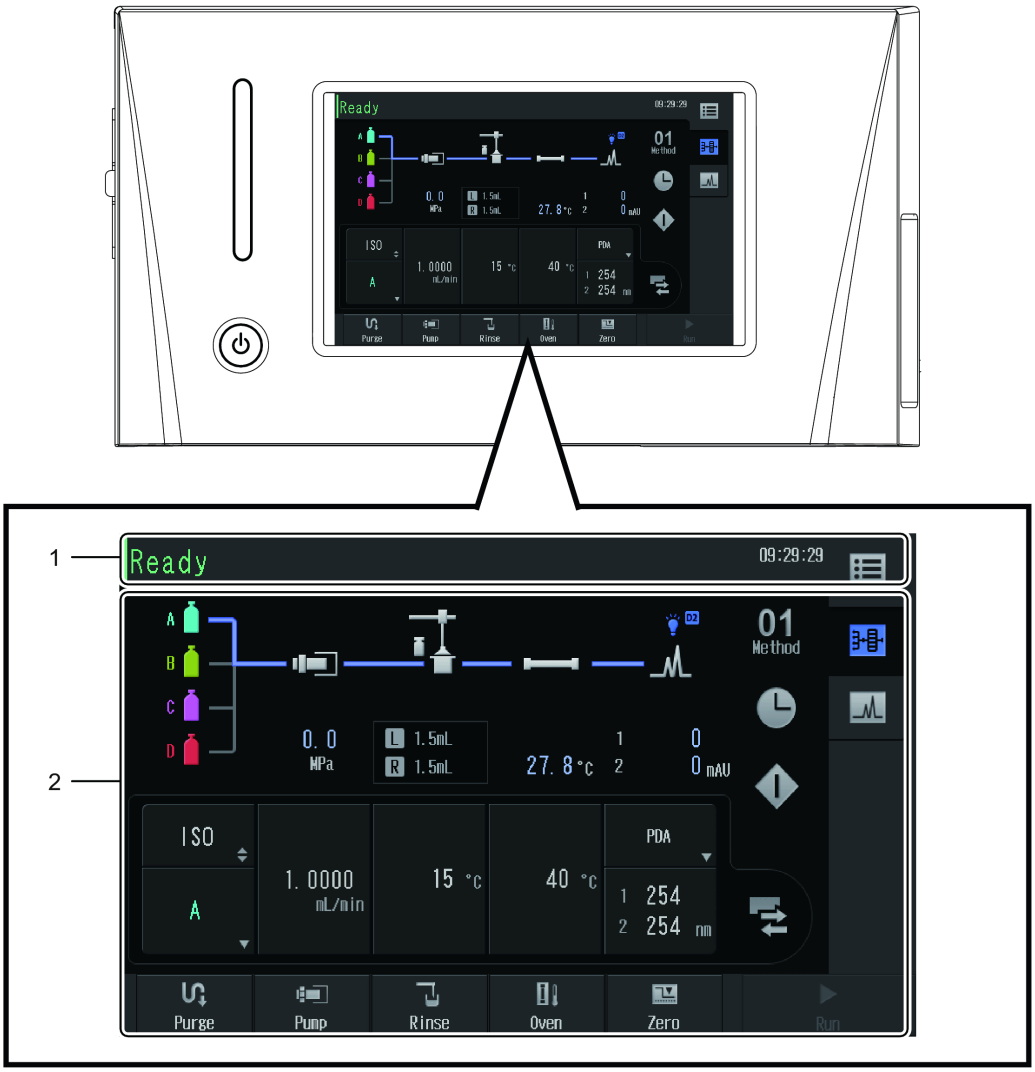


No.	Name	Explanation
1	Optional Board	An optional A/D board or an optional optical board can be installed as an optional part. Reference "Others" P.9
2	RS232C Connector	Unused.
3	ETHERNET Connector	Used to connect external devices such as PCs and data processing devices via a network.
4	External Input/Output Terminal	Used to connect external devices (like a third-party device) and synchronize using a relay contact.
5	Analog Output Terminal (for 2-Channel Output)	Outputs the signals of the detector as analog signals.

2.2 Displays and Operations on the Monitor Screen

In this instrument, touch operations on the monitor screen are used to set values, enter alphabet characters, select items, and start analysis.

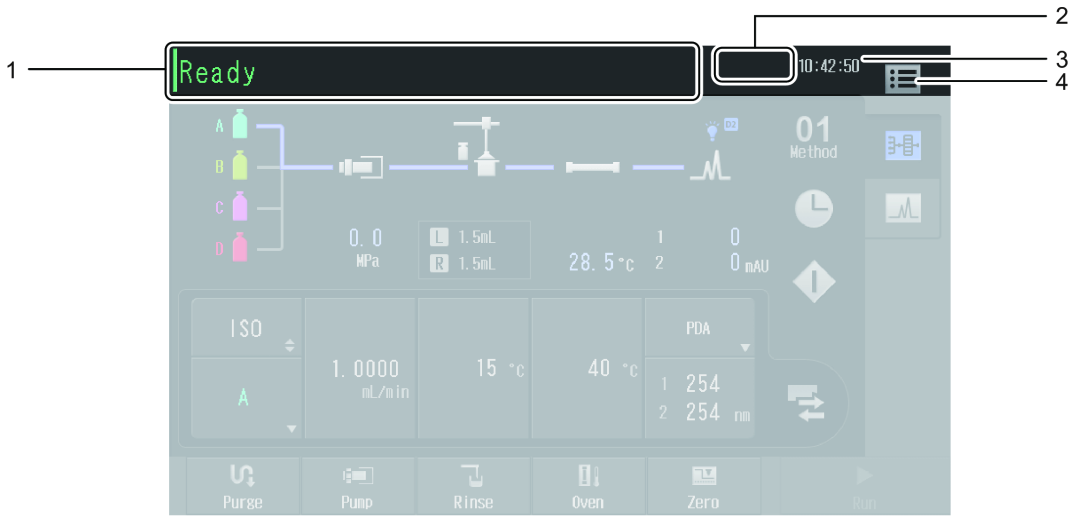
For a detailed description and other screens and operations, refer to the Operation Guide.



No.	Name	Explanation	Ref.
1	Common Display	Displays the status of the instrument and the progress of the analysis.	P.24
2	Main Analysis Screen	Use this screen to process analyses and set or control each part.	P.26

2.2.1 Common Screens

This section explains the common on-screen items.



No.	Name	Explanation	Ref.
1	System Status Information Display Area	Displays the instrument status. During analysis, the analysis start time, analysis end time, and analysis sample no. are displayed.	P.24
2	System Status Display Icons	Displays the instrument status with different icons.	P.25
3	Current Time Display	Displays the current time.	-
4	(Menu)	Displays the [Menu] screen.	-

■ System's status

This section explains the system's status indications and their meanings.

System's Status	Explanation
Ready	Ready for analysis.
Run	During analysis. The elapsed analysis time is shown as well. NOTE When [Gradient Start Adjustment Mode] is [Auto], [Before Injection], or [After Injection], the elapsed analysis time is not displayed.
Pause	Analysis is temporarily stopped.
Pretreat	Pretreatment of the autosampler is in progress.
Cooling Down	Shutdown is in progress.
Wait Oven	The instrument is waiting for the column oven temperature control to become stable.

System's Status	Explanation
Error	An error has occurred. The error code and error details are displayed on the [System monitor] screen.
Stop	Appears if the autosampler operation has been stopped by pressing [Stop] or from the occurrence of an error during analysis.
Rinse	Rinsing of the needle of the autosampler is in progress.
Z Home	The needle of the autosampler is stopped in the home position.
Sampler Purge	Autopurging of the autosampler is in progress.
Manual Prime	The autosampler is in the manual prime flow line status.
A.Purge / B.Purge / C.Purge / D.Purge	Autopurging of the pump is in progress.
Init Conc Flow	Autopurging of the pump has finished and the mobile phase is being replaced at the initial concentration of the method.
Safety Lock	The autosampler has stopped with the safetylock on.
Wait Sampler	Waiting for the autosampler to get ready for operation.
Posttreat	Appears when the autosampler is operating after the completion of analysis.
F Panel Open	The front panel is open.
No Rack L	The left sample rack is not set correctly.
No Rack R	The right sample rack is not set correctly.
Oven Door Open	The oven door is open.
Power Down	Shutdown has been executed.

■ System status display icons

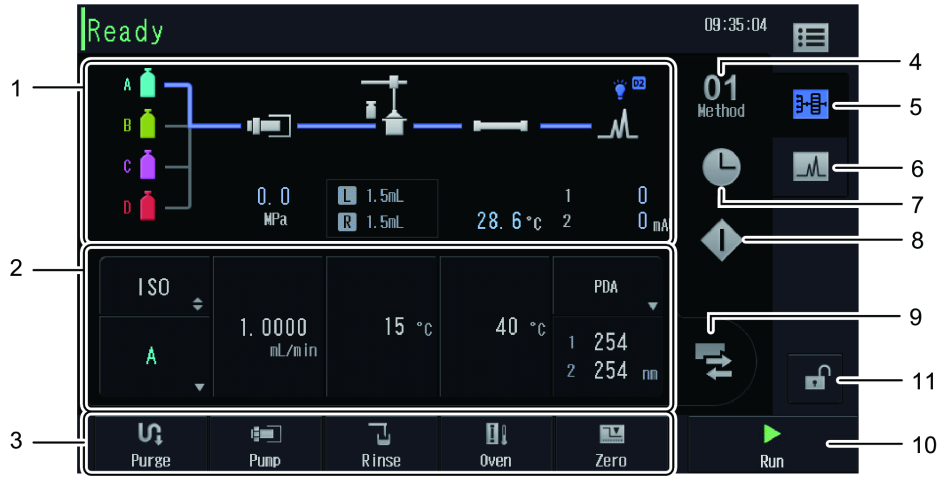
This section explains the system status display icons and their meanings.

Display	Meaning	Ref.
	Appears when there are out-of-date consumable parts.	*1
	Appears when a PC is connected to the instrument over the network.	-
	Appears when the lock by a PC is on.	-

*1 Refer to "2.2 Maintenance Screen" in the Operation Guide.

2.2.2 Main Analysis Screen

This section explains the item names and functions available on the Main Analysis screen. The main analysis screen initially shows the flow display tab.



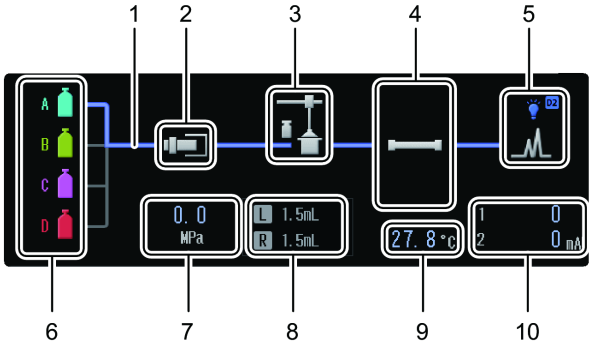
No.	Name		Explanation	Ref.
1	Flow Line Display Area		Displays the flow line and the monitor values. Pressing each unit's icon will display the [Parameter Setting] screen for setting each unit parameter.	P.28
2	User Selection Area		Switches the display between the simple parameters, the chromatograph monitor, and the sequence list.	*1
3	System Control Area		Displays the system control buttons. These can be used to execute operations or display the status.	-
		Purge	Displays the [Auto Purge] screen. Shown in blue during autopurging.	P.64
		Pump	Starts the pumping of the pump. Shown in blue during pumping.	-
		Rinse	Starts rinsing of the autosampler needle.	-
		Oven	Starts temperature control of the column oven. Shown in blue during column oven temperature control.	-
		Zero	Executes the autozero function of the detector selected in the simple parameters. **Hint** The autozero function uses the absorbance of the current detector as "0". It should be executed when chromatogram is stable.	-

No.	Name	Explanation	Ref.
4	 (Method Selection)	Displays the selected method number. The method can be selected on the [Method] screen.	P.51
5	Flow Display Tab	Displays the flow line.	P.28
6	Chromatograph Display Tab	Displays the chromatogram.	*2
7	 (Editing Time Programs)	Displays the [Time Program] screen for editing the time programs.	P.79
8	 (Single Analysis)	Displays the [Single Run] screen for executing single analysis.	P.75
9	 (Switch Displays)	Displays the [Display Switch] screen for switching the user selection area displays.	*1
10	Run	Starts analysis. After the analysis starts, the button display changes depending on the status. • [Pause]: Temporarily stops analysis. • [Stop]: Stops analysis. • [Restart]: Restarts analysis. • [Upload]: Register analysis condition which is set by the instrument on LabSolutions. NOTE [Upload] is displayed when the instrument is connected to LabSolutions. However if Upload is set to be invalid on LabSolutions, [Upload] cannot be used. Refer to the LabSolutions Instruction Manual for detail. If analysis cannot be started because there is no sequence setting or because of the instrument status, [Run] will be disabled.	P.75
11	Lock deactivating button	Change the lock status set on LabSolutions. This button turns blue when the instrument is locked. A part of method parameter can be edited by awaking the lock. NOTE This button is displayed when the instrument is connected to LabSolutions. However if lock deactivating is set to be invalid on LabSolutions, this is not displayed. Refer to the LabSolutions Instruction Manual for detail.	P.123

*1 Refer to "2.1.1 Main Analysis Screen ■ User Selection Area" in the Operation Guide.
*2 Refer to "2.1.6 Chromatograph Display Tab" in the Operation Guide.

■ Flow line display area

The status of in-line instruments and monitor values are displayed.



No.	Name	Explanation	Ref.
1	Flow Line Display	The indication that pumping is in progress is displayed during pump operation. : Inactive : Pumping is in progress. : Not selected	-
2	Pump	When the icon is pressed, the [Pump] tab is displayed on the [Parameter Setting] screen, allowing parameter settings to be configured.	*1
3	Autosampler	When the icon is pressed, the [Autosampler] tab is displayed on the [Parameter Setting] screen, allowing parameter settings to be configured.	*2
4	Column Status	The number of columns displayed differs depending on the connections of the column switching valves (optional). Also, the flow line currently used is displayed as the selected line. When the icon is pressed, the [Oven] tab is displayed on the [Parameter Setting] screen, allowing parameter settings to be configured.  6 columns  Standard	*3

No.	Name	Explanation	Ref.
5	Detector Lamp Status	Displays the detector lamp status. The icon blinks during preparation. When the icon is pressed, the [Detector] tab is displayed on the [Parameter Setting] screen, allowing parameter settings to be configured.  : OFF  : The deuterium (D2) lamp is ON.  : The tungsten lamp (W) is ON (displayed on PDA detector system models only).  : The deuterium (D2) lamp and tungsten lamp (W) are ON (displayed on PDA detector system models only).	-
	Recycling Valve Operational Status	Displays the recycling valve operational status.  : Waste liquid side  : Recycling side	*4
6	Mobile Phase Port Display	When the icon is pressed, the [Pump] tab is displayed on the [Parameter Setting] screen, allowing parameter settings to be configured.	*1
7	Pressure Monitor Value	Displays the current pump pressure value. The pump pressure unit can be changed.	*5
8	Sample Cooler Temperature Monitor Value	Displays the sample cooler temperature monitor value and the rack type. The display can be switched between the sample cooler temperature monitor value and the rack type.  : Sample cooler OFF (Displayed only for models with sample cooler)  : Sample cooler ON (Displayed only for models with sample cooler)  : Rack type	-
9	Oven Temperature Monitor Value	Displays the current oven temperature.	-
10	Detector Data Monitor Value	Displays the monitor value of the current detector data. The displayed value differs depending on the selected detector and the settings.	-

*1 Refer to "5.1.1 Pump" in the Operation Guide.
*2 Refer to "5.1.2 Autosampler" in the Operation Guide.
*3 Refer to "5.1.3 Column Oven" in the Operation Guide.
*4 Refer to "5.1.4 Detectors" in the Operation Guide.
*5 Refer to "5.2.1 Pump" in the Operation Guide.

Parameter Setting screen

Configure the parameter settings of each unit.

Reference Operation details "2.2.3 Common Items and Operations " P.31
Set values Operation Guide "5.1 Method"

No.	Name	Explanation
1	Parameter Settings Button	Displays the set values. Press the buttons to change the settings. The displayed items differ depending on the system's hardware configuration and system settings.
2	Unit Selection Tab	Switches to the [Parameter Setting] screen of each unit. The tab of detector B cannot be selected if no external detector is connected.
3	Page Operation Button	Press the arrows to turn the page. The current page and the total number of pages are shown above the arrows.

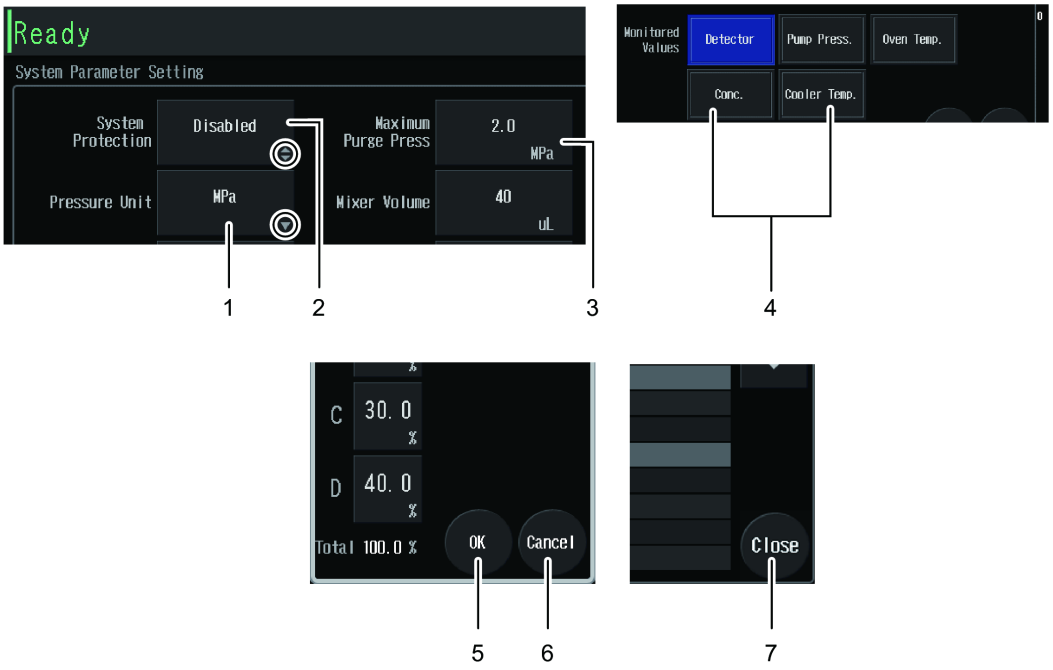
2.2.3 Common Items and Operations

This section explains the common items and operations displayed when operating a screen.

■ Common buttons

This section explains the common on-screen buttons.

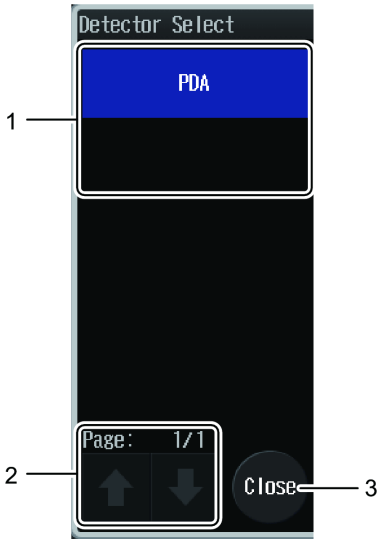
There are three kinds of buttons for items displayed with a set value: "selection", "switch", and "numeric keypad input". The setting procedures for each are not the same. There are also items that indicate their settings and process statuses with different button colors.



No.	Name	Explanation
1	Selection	The Selection screen opens.
2	Switch	Switches between ON and OFF, and enabled and disabled.
3	Numeric Keypad Input	The Numeric Keypad screen is displayed.
4	Multiple Selections	Switches between ON and OFF. The blue highlight indicates ON.
5	OK	Confirms the settings and closes the screen.
6	Cancel	Cancels the setting and closes the screen.
7	Close	Closes the screen.

■ Selection screen

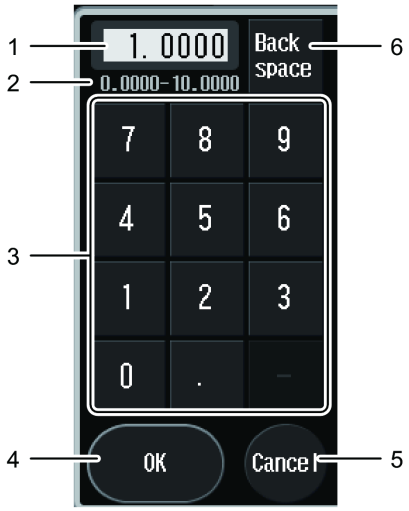
The Selection screen allows items to be selected.



No.	Name	Explanation
1	Selector Buttons	The selected item is highlighted in blue. Pressing the button will confirm the selection and close the screen.
2	Page Operation Buttons	Becomes active when the selection items cannot be shown on a single page. Press the arrows to turn the page. The current page and the total number of pages are shown above the arrows.
3	Close	Closes the Selection screen.

■ Numeric Keypad screen

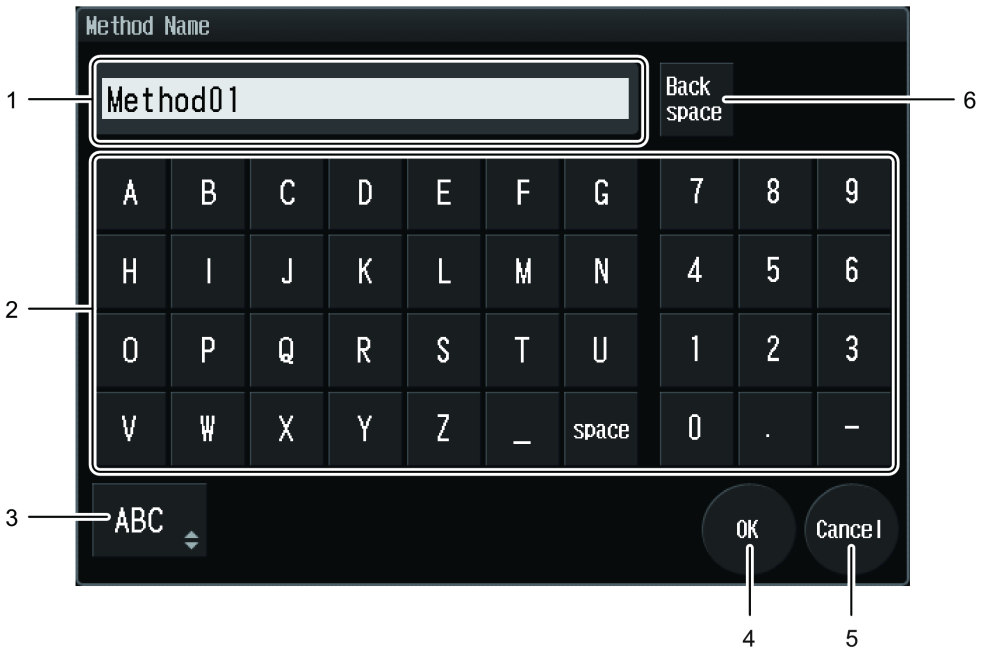
Allows values to be input with the Numeric Keypad screen.



No.	Name	Explanation
1	Display Field	Displays the input numbers and symbols.
2	Allowable Input Range	Displays the range of values allowed to be input.
3	Input	Inputs numbers and symbols.
4	OK	Confirms the input value and closes the screen. NOTE If the input value is not correct, an error window opens. Input again and press [OK].
5	Cancel	Cancels the input value and closes the screen.
6	Back Space	Removes the number immediately before the current position.

■ Numeric Keypad Alphabet screen

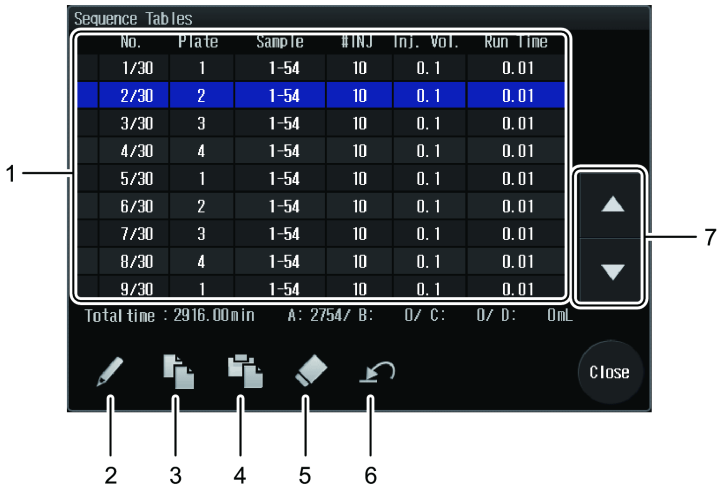
The Numeric Keypad Alphabet screen allows letters, numbers, and symbols to be input.



No.	Name	Explanation
1	Display Field	Displays the input letters, numbers, and symbols.
2	Input	Inputs letters, numbers, and symbols.
3	Switch Between Upper/Lower Case	Switches between uppercase and lowercase.
4	OK	Confirms the input and closes the screen.
5	Cancel	Cancels the input and closes the screen.
6	Back Space	Removes the character immediately before the current position.

■ List screen

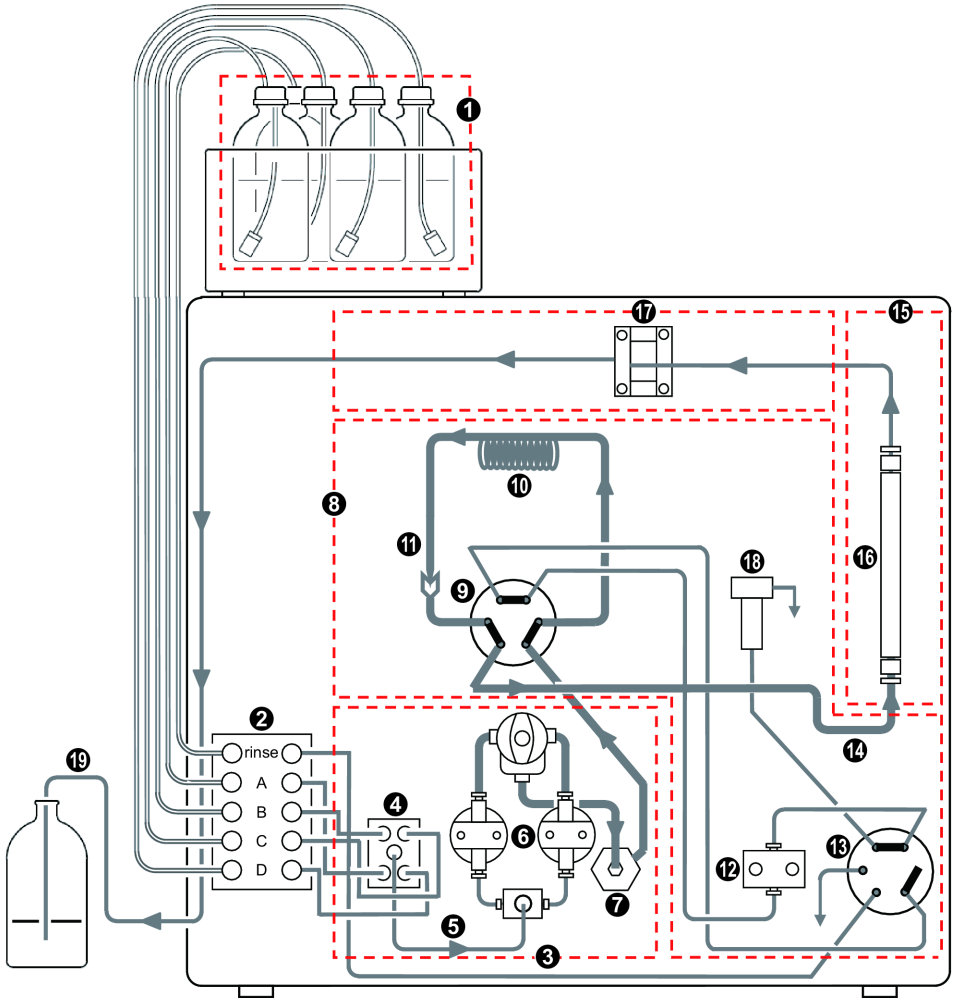
The List screen allows editing, copying, pasting, deletion, or initialization of the list.



No.	Name	Explanation
1	File List	The selected line is highlighted in blue.
2	(Edit)	Displays the Edit screen for the selected line. NOTE To add a new line, select the line below the bottom line and press (Edit).
3	(Copy)	Confirms the copy source of the selected line.
4	(Paste)	The copied line is inserted before the selected line. NOTE • If the copied line is deleted before pasting, the copied information is lost. • The icon becomes active only when the line is copied.
5	(Delete)	Deletes the selected line.
6	(Initialize)	The Confirmation screen is displayed. Press [OK] to proceed to the next process. • [Time Program] screen and [Sequence Tables] screen: All lines will be deleted. • [Method] screen and [Mobile Phase & Rinse Reserve Volume Setting] screen: Values will be initialized.
7	(Selection Shift)	Moves the line selection up/down by one line.

2.3 Flow Line Diagram

2.3.1 Entire Flow Line



—: Low-pressure mobile phase ▬: High-pressure mobile phase ▶: Flow line direction

No.	Name	No.	Name
❶	Mobile Phase	⓫	Needle
❷	Degassing Unit	⓬	Measuring Pump
❸	Pump	⓭	Low-Pressure Valve
❹	Low-Pressure Gradient Unit	⓮	Autosampler Outlet Tubing
❺	LPGE-OUT Tube	⓯	Column Oven
❻	Pump Head	⓰	Column
❼	Mixer	⓱	Detector
❽	Autosampler	⓲	Rinsing Port
❾	High-Pressure Valve	⓳	Drain (Mobile Phase Waste Liquid)
❿	Sample Loop	-	-

■ Inner volume of each flow line

The following table describes the inner volume of each flow line for the main unit and the optional flow line parts.

Reference Flow line location "2.3.1 Entire Flow Line" P.36

Flow Line Location	Flow Line Part Name	Volume (µL)		
		Standard Configuration	Optional Delay Volume-Compatible System Kit*1 (S228-57796-43)	Optional Low Delay Volume System Kit*2 (S228-57796-42)
❸	Pump (Excluding ❺ LPGE-OUT Tube)	275	275	275
❺	LPGE-OUT Tube*3	40	230	40
❼	Mixer*4, *5	40	300	40
❽	Autosampler (Excluding ❿ Sample Loop and ⓮ Autosampler Outlet Tubing)	30	30	30
❿	Sample Loop*6	230	230	70
⓮	Autosampler Outlet Tubing	35	35	5
Total System Delay Volume		650	1100	460

*1 This configuration includes a kit installed to align the LC-2010 with the system delay volume.

*2 This configuration includes a kit installed to reduce the system delay volume for high-speed gradient analysis.

*3 When using a buffer solution for the mobile phase, LPGE-OUT tube should be changed to LPGE-OUT tube long (228-58590-41). Derive the system delay volume by replacing 40 µL, the LPGE-OUT tube volume in the above table, with 315 µL.
(Example) When changing the standard configuration: 275 + 315 + 40 + 30 + 230 + 35 = 925 µL

*4 When using trifluoroacetic acid (TFA) for the mobile phase, the mixer should be changed to Mixer MR300 µL (provided with the Delay Volume-Compatible System Kit). Derive the system delay volume by replacing 40 µL, the mixer volume in the above table, with 300 µL.
(Example) When changing the standard configuration: 275 + 40 + 300 + 30 + 230 + 35 = 910 µL

*5 When a mixing performance higher than that of Mixer MR300 µL is required, change the mixer for one with 780 µL (S228-57313-41) or one with 2 mL (S228-57313-42).
When using 780 µL Mixer, replace 40 µL, the mixer volume in the above table, with 780 µL, and when using 2 mL Mixer, replace the same with 2 mL, then derive the system delay volume.
(Example) When a mixer with 780 µL is installed in the standard configuration: 275+ 40 + 780 + 30 + 230 + 35 = 1390 µL

*6 When the injection volume of the sample needs to be increased, add Optional Loop (500 µL) (S228-45405-41) or Optional Loop (2 mL) (S228-45405-42) to the sample loop.
When using Optional Loop (500 µL), add 885 µL to 230 µL, the sample loop volume in the above table, and when using Optional Loop (2 mL), add 3230 µL to the same, then derive the system delay volume.
(Example) When Optional Loop (500 µL) is installed in the standard configuration: 275 + 40 + 40 + 30 + 230 + 885 + 35 = 1535 µL

■ Setting values when using the start timing adjustment function for concentration gradient

This function enables adjusting the start timing of the gradient program.

Reference "4.7 Using the start timing adjustment function for concentration gradient" P.126

The following table shows the recommended compensation values to use the start timing adjustment function for concentration gradient. The figures are the volume between the pump and the autosampler's high-pressure valve.

Reference Flow line location "2.3.1 Entire Flow Line" P.36

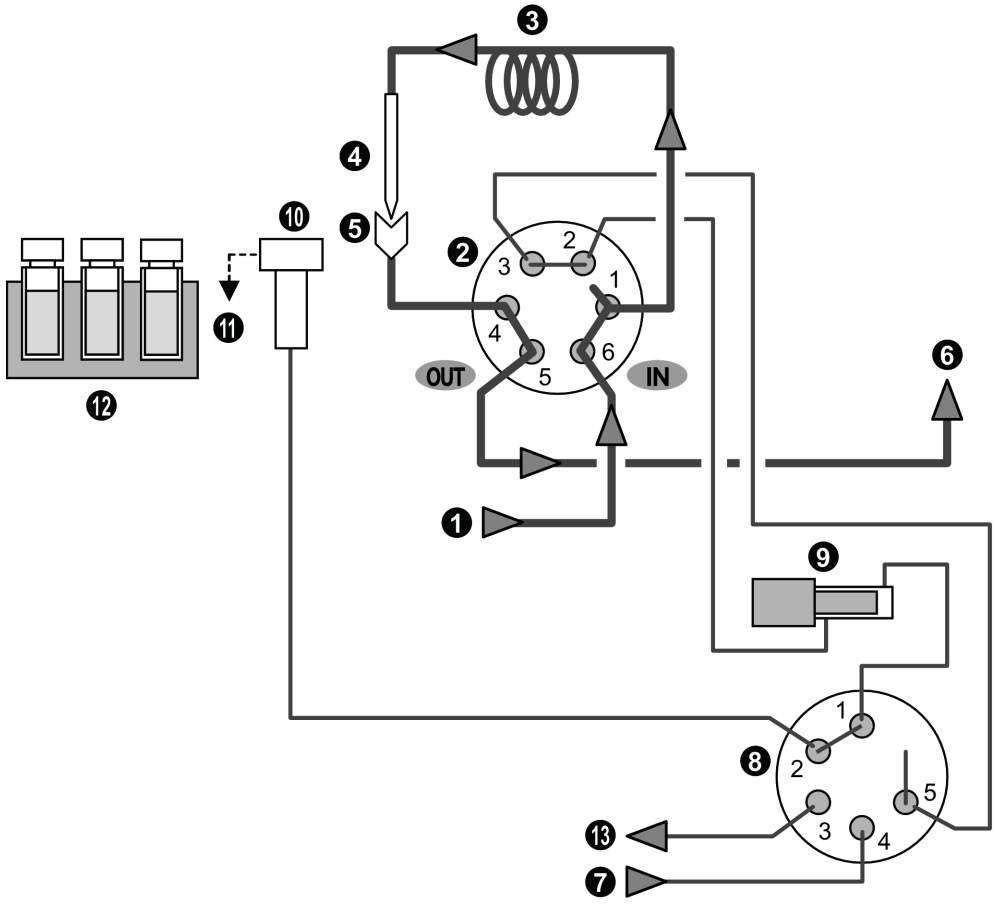
Flow Line Location	Flow Line Part Name	Volume (µL)		
		Standard Configuration	Optional Delay Volume-Compatible System Kit (S228-57796-43)	Optional Low Delay Volume System Kit (S228-57796-42)
❸	Pump (Excluding ❺ LPGE-OUT Tube)	275	275	275
❺	LPGE-OUT Tube	40	230	40
❼	Mixer	40	300	40
❽	Autosampler (Excluding ❿ Sample Loop and ⓮ Autosampler Outlet Tubing)	30	30	30
Delay Compensation Volume		385	835	385

2.3.2 Flow Line During Sample Injection Operations

Perform the sample injection operations in the following order.

■ Ready

The mobile phase sent from the pump goes through the high-pressure valve, sample loop, needle, injection port, then back to the high-pressure valve before reaching the column.

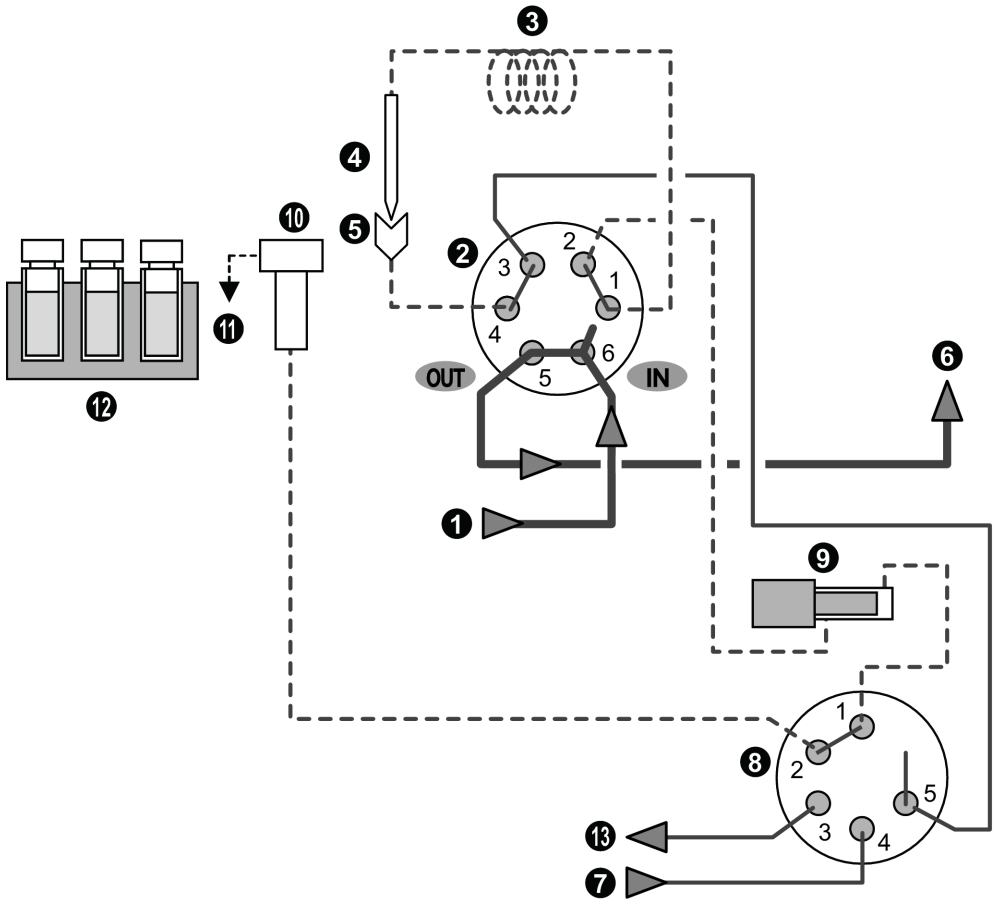


: Mobile phase : Flow line direction

No.	Name	No.	Name
❶	Pump	❽	Low-Pressure Valve
❷	High-Pressure Valve	❾	Measuring Pump
❸	Sample Loop	❿	Rinsing Port
❹	Needle	⓫	Drain (Waste Rinse Liquid)
❺	Injection Port	⓬	Sample
❻	Column	⓭	Manual Prime Port
❼	Rinse Solution	-	-

■ Release of pressure from the flow line

The high-pressure valve will shift to the load position and release the pressure in the sample loop.

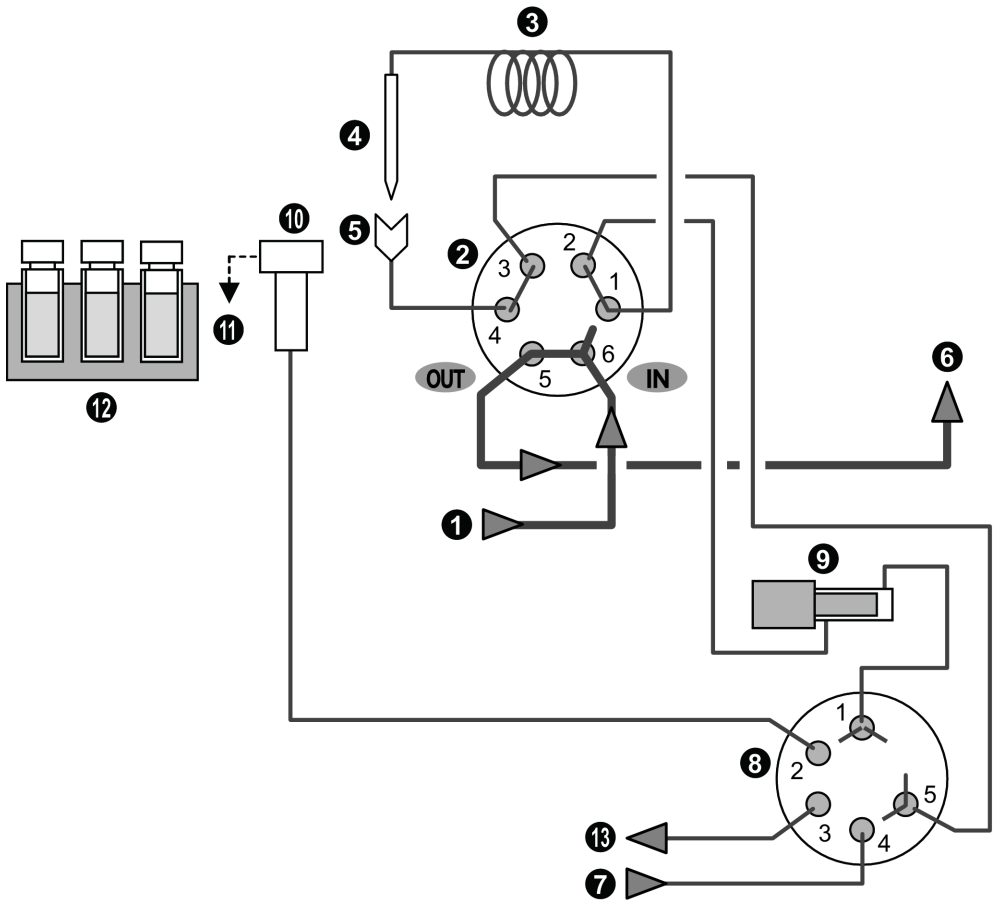


: Mobile phase : Release of pressure : Flow line direction

No.	Name	No.	Name
❶	Pump	❽	Low-Pressure Valve
❷	High-Pressure Valve	❾	Measuring Pump
❸	Sample Loop	❿	Rinsing Port
❹	Needle	⓫	Drain (Waste Rinse Liquid)
❺	Injection Port	⓬	Sample
❻	Column	⓭	Manual Prime Port
❼	Rinse Solution	-	-

■ Needle movement

After the low-pressure valve has operated, the needle will move upward.

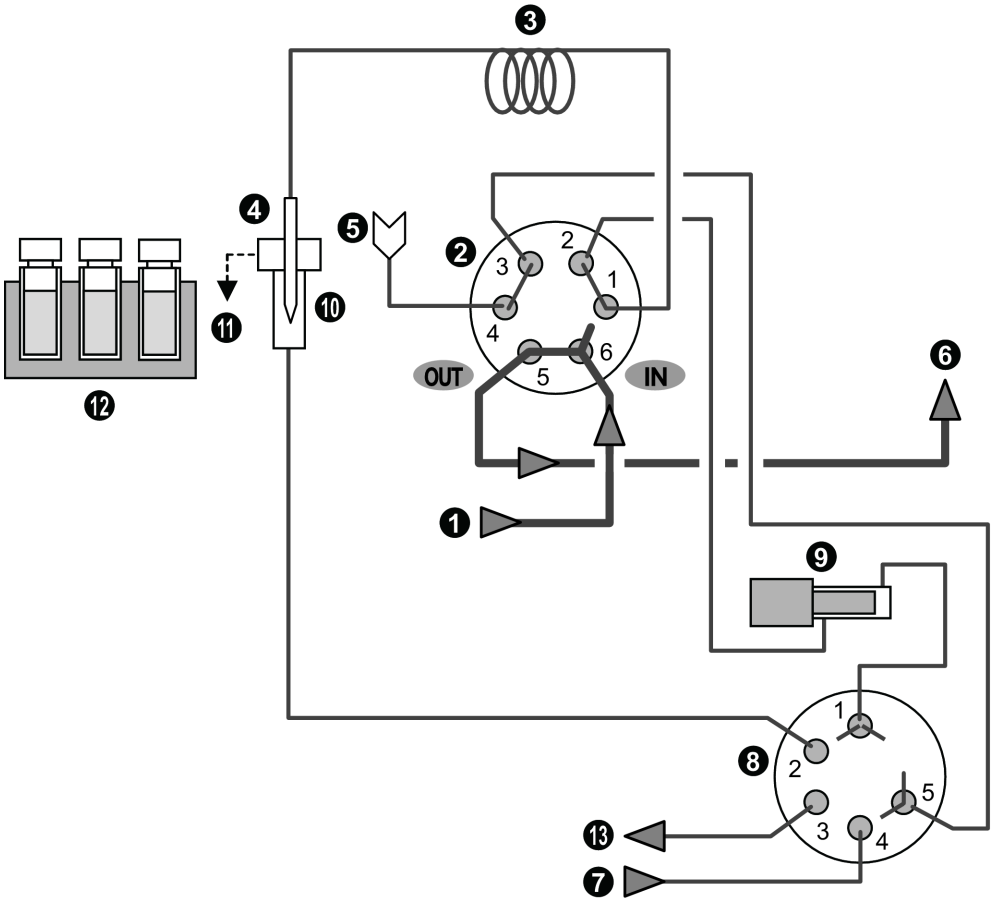


: Mobile phase : Flow line direction

No.	Name	No.	Name
❶	Pump	❽	Low-Pressure Valve
❷	High-Pressure Valve	❾	Measuring Pump
❸	Sample Loop	❿	Rinsing Port
❹	Needle	⓫	Drain (Waste Rinse Liquid)
❺	Injection Port	⓬	Sample
❻	Column	⓭	Manual Prime Port
❼	Rinse Solution	-	-

■ Rinsing of the needle before sample aspiration

The needle is inserted into the rinse port, and the outside of the needle is rinsed with rinse solution in the rinsing port.
This rinsing of the needle before sample aspiration can be set so as not to be performed.

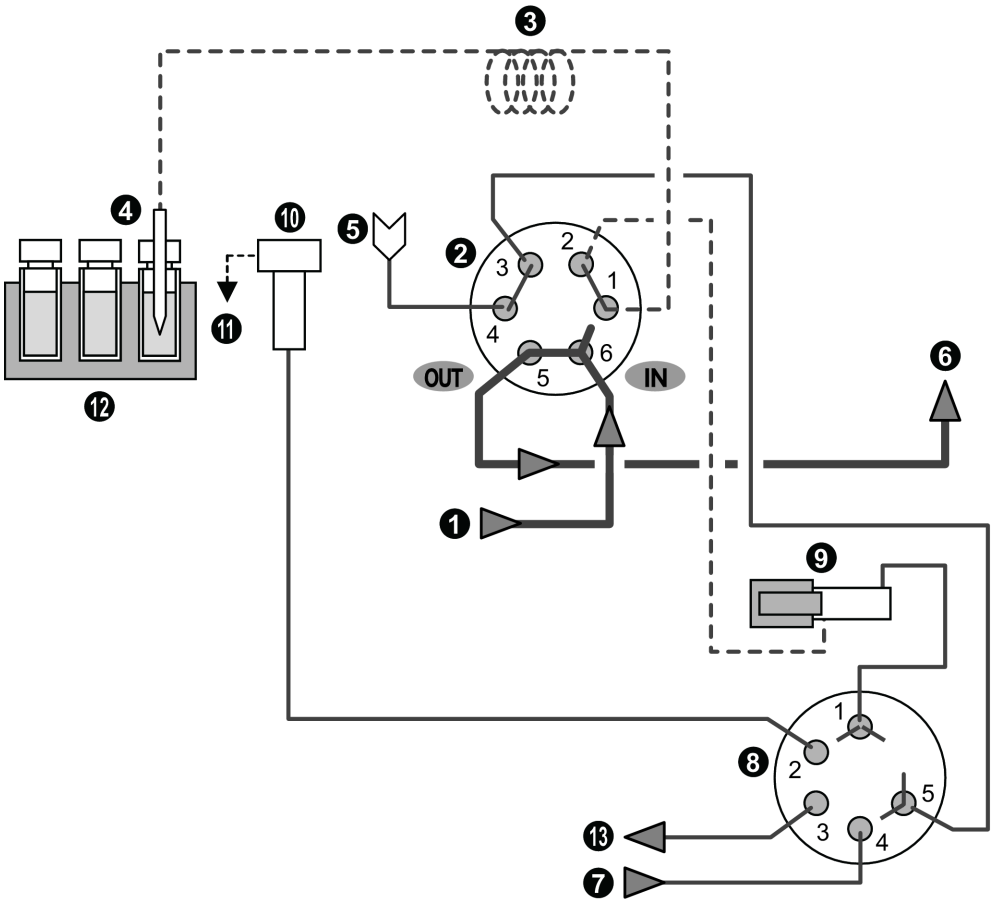


: Mobile phase : Flow line direction

No.	Name	No.	Name
❶	Pump	❽	Low-Pressure Valve
❷	High-Pressure Valve	❾	Measuring Pump
❸	Sample Loop	❿	Rinsing Port
❹	Needle	⓫	Drain (Waste Rinse Liquid)
❺	Injection Port	⓬	Sample
❻	Column	⓭	Manual Prime Port
❼	Rinse Solution	-	-

■ Aspiration of the sample

When the needle is inserted into the sample vial, the measuring pump will be activated and the sample will be aspirated into the needle and the sample loop.

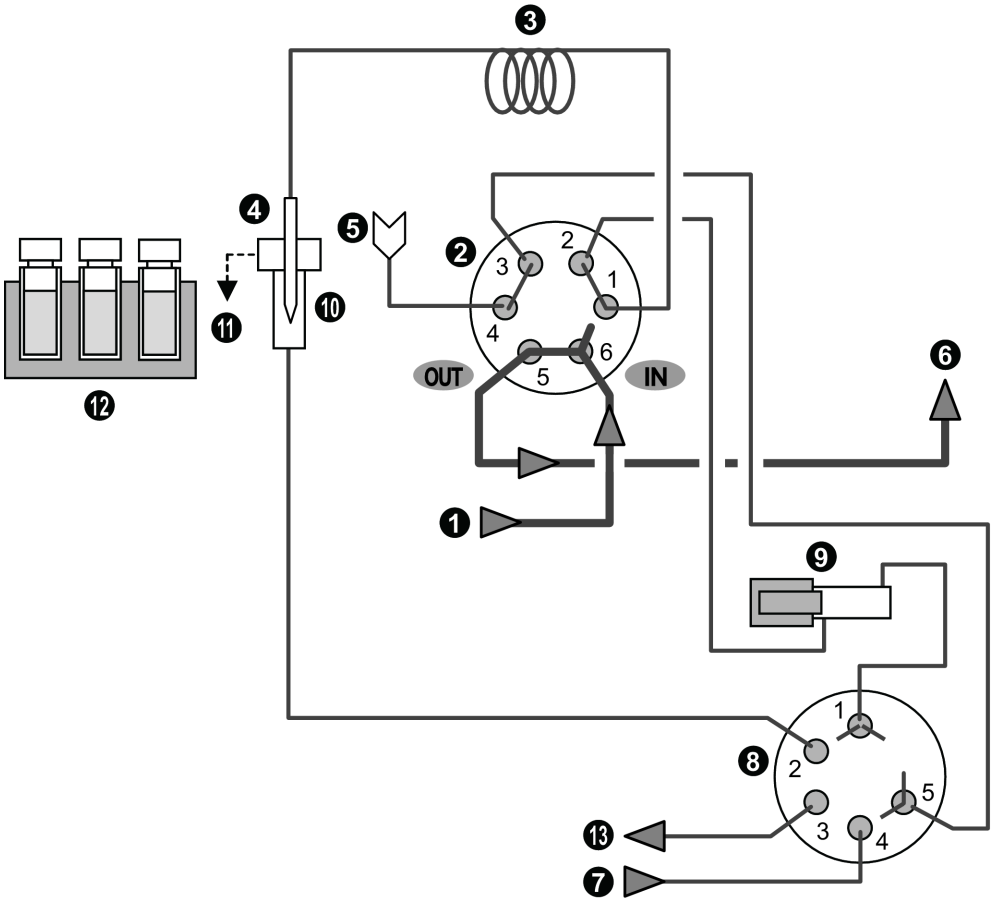


: Mobile phase : Aspiration : Flow line direction

No.	Name	No.	Name
❶	Pump	❽	Low-Pressure Valve
❷	High-Pressure Valve	❾	Measuring Pump
❸	Sample Loop	❿	Rinsing Port
❹	Needle	⓫	Drain (Waste Rinse Liquid)
❺	Injection Port	⓬	Sample
❻	Column	⓭	Manual Prime Port
❼	Rinse Solution	-	-

■ Rinsing of the needle after sample aspiration

The needle is inserted into the rinsing port, and the outside of the needle is rinsed with rinse solution in the rinse port.
This rinsing of the needle after sample aspiration can be set so as not to be performed.

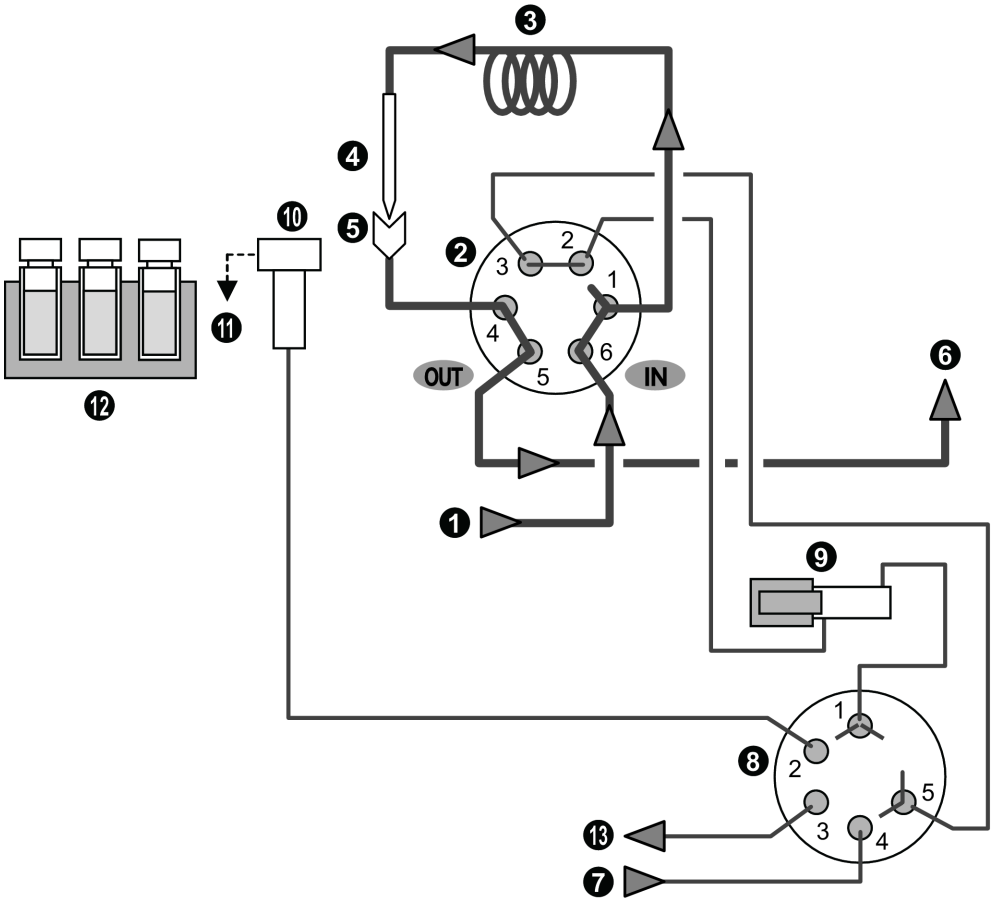


: Mobile phase : Flow line direction

No.	Name	No.	Name
❶	Pump	❽	Low-Pressure Valve
❷	High-Pressure Valve	❾	Measuring Pump
❸	Sample Loop	❿	Rinsing Port
❹	Needle	⓫	Drain (Waste Rinse Liquid)
❺	Injection Port	⓬	Sample
❻	Column	⓭	Manual Prime Port
❼	Rinse Solution	-	-

■ Sample injection (analysis start)

When the needle is inserted in the injection port, the high-pressure valve shifts to the injecting position and analysis starts. Along with the mobile phase solution, the sample goes through the high-pressure valve to the column.

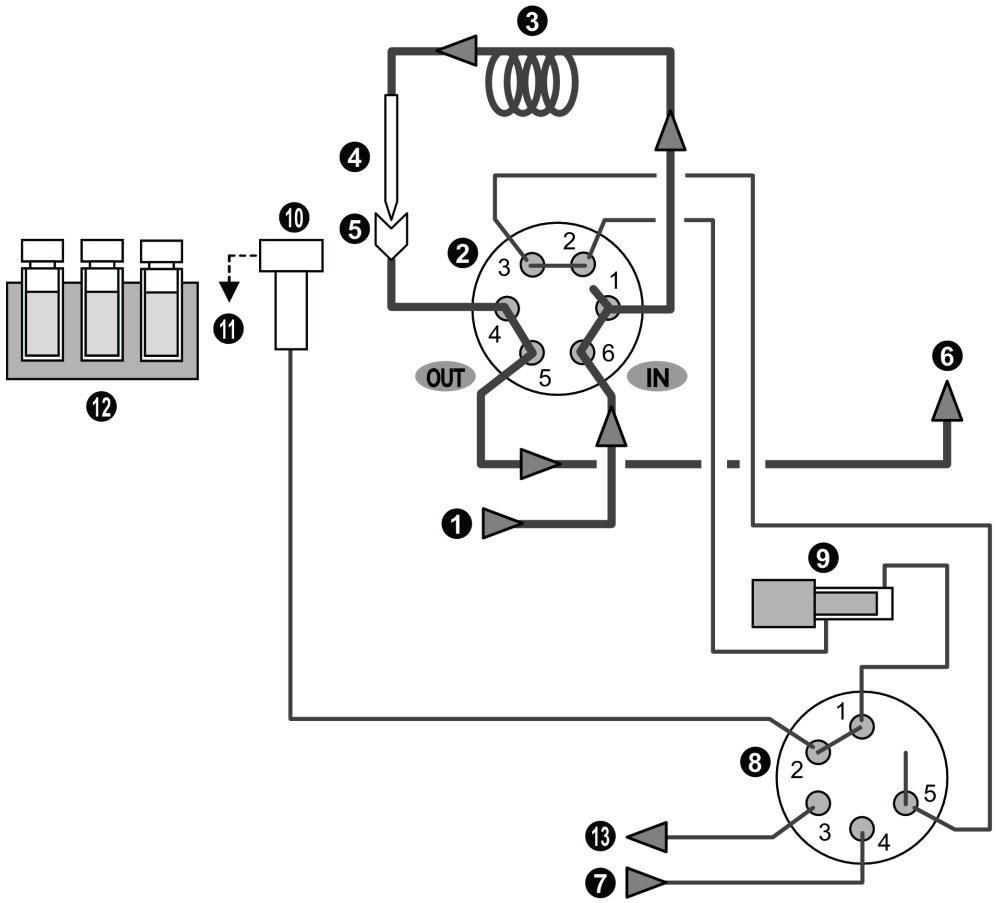


: Mobile phase : Flow line direction

No.	Name	No.	Name
❶	Pump	❽	Low-Pressure Valve
❷	High-Pressure Valve	❾	Measuring Pump
❸	Sample Loop	❿	Rinsing Port
❹	Needle	⓫	Drain (Waste Rinse Liquid)
❺	Injection Port	⓬	Sample
❻	Column	⓭	Manual Prime Port
❼	Rinse Solution	-	-

■ Initializing the measuring pump

After the low-pressure valve has operated, the measuring pump returns to the initial position.

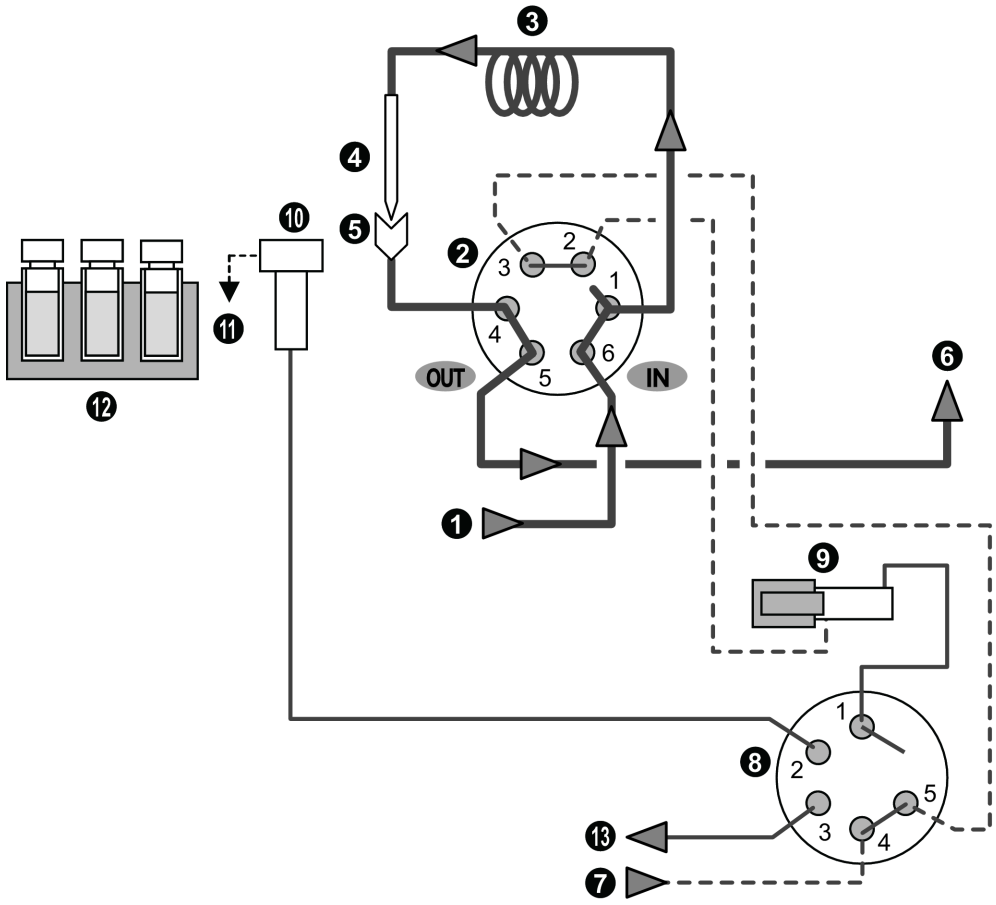


: Mobile phase : Flow line direction

No.	Name	No.	Name
❶	Pump	❽	Low-Pressure Valve
❷	High-Pressure Valve	❾	Measuring Pump
❸	Sample Loop	❿	Rinsing Port
❹	Needle	⓫	Drain (Waste Rinse Liquid)
❺	Injection Port	⓬	Sample
❻	Column Oven	⓭	Manual Prime Port
❼	Rinse Solution	-	-

■ Aspiration of the rinse solution

After the low-pressure valve has operated, the measuring pump aspirates the rinse solution.

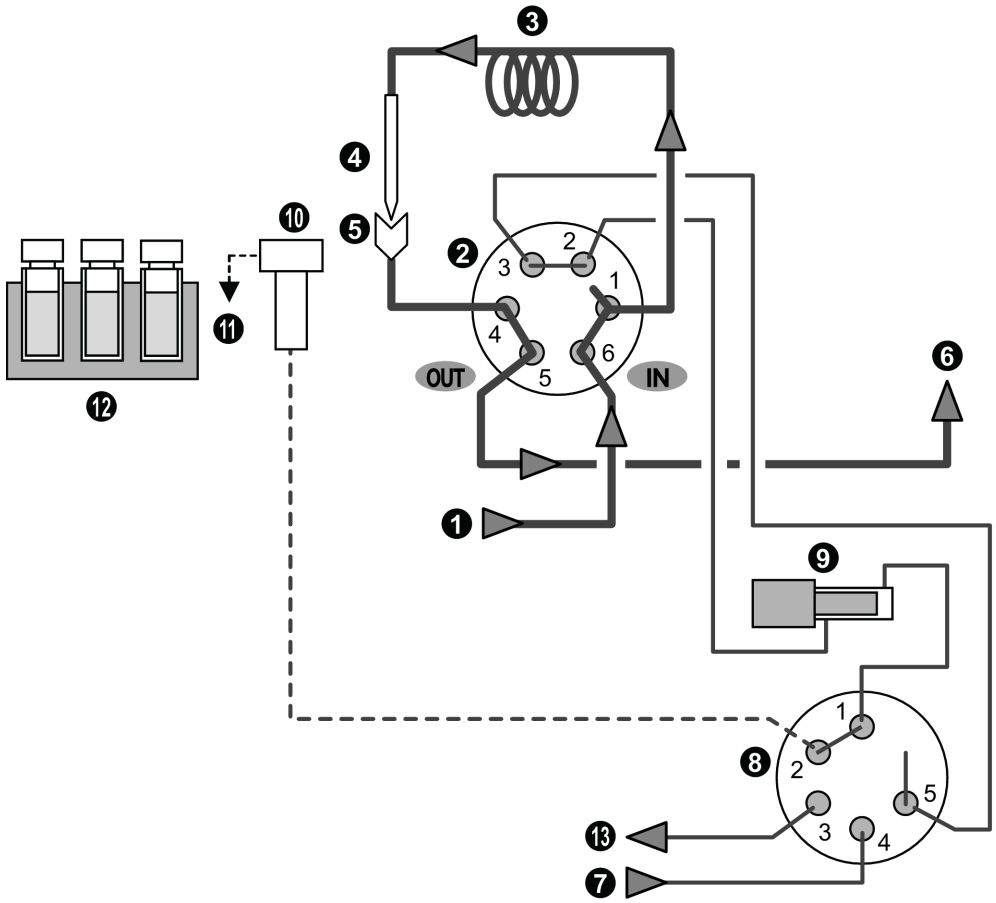


: Mobile phase : Aspiration : Flow line direction

No.	Name	No.	Name
❶	Pump	❽	Low-Pressure Valve
❷	High-Pressure Valve	❾	Measuring Pump
❸	Sample Loop	❿	Rinsing Port
❹	Needle	⓫	Drain (Waste Rinse Liquid)
❺	Injection Port	⓬	Sample
❻	Column	⓭	Manual Prime Port
❼	Rinse Solution	-	-

■ Discharging the rinse solution into the rinsing port

After the low-pressure valve has operated, the measuring pump discharges the rinse solution into the rinsing port.



: Mobile phase : Discharge : Flow line direction

No.	Name	No.	Name
❶	Pump	❽	Low-Pressure Valve
❷	High-Pressure Valve	❾	Measuring Pump
❸	Sample Loop	❿	Rinsing Port
❹	Needle	⓫	Drain (Waste Rinse Liquid)
❺	Injection Port	⓬	Sample
❻	Column	⓭	Manual Prime Port
❼	Rinse Solution	-	-

3 Analysis

3.1 Before Analysis

This instrument is a compact integrated model high performance liquid chromatograph designed for easy gradient analysis. Each unit parameter is saved as a "method" in the instrument, and the saved methods can be selected at the time of analysis.
This instruction manual explains a series of analysis procedures using a simple method as an example. For details on how to operate the controller, such as changing various parameters and details on editing methods, refer to the Operation Guide.

3.2 Analysis Procedure

The following explains the series of analysis procedures using the instrument. Note that the methods for changing rack plate types and connecting to LabSolutions, the dedicated software, are explained in "4 Various Operations" P.85.

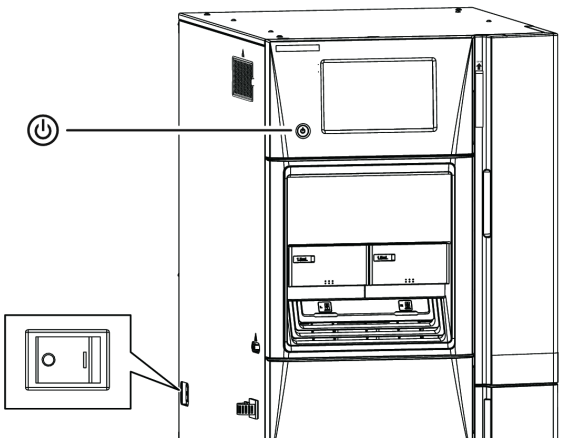
Procedure		Operation	Ref.
1	Turning On the Power and Logging In	Turning On the Power	P.50
		Logging In	P.50
2	Setting Analysis Condition	Selecting the Method	P.51
		Editing the Method	P.53
3	Setting the Mobile Phase and the Rinse Solution for the Autosampler	Setting the Mobile Phase and the Rinse Solution on the Reservoir Tray	P.62
		Performing an Autopurge	P.64
4	Setting the Column	Attaching the Column to the Column Oven	P.66
		Equilibrating the Column	P.70
5	Setting the Sample	Setting the Sample in a Sample Vial	P.70
		Setting the Sample in the Autosampler	P.72
6	Executing Analysis	Executing Single Analysis	P.75
		When Using a Time Program	P.79
		Executing Sequential Analysis	P.80
7	Finishing Analysis and Turning Off the Power	Replacing the Mobile Phase	P.83
		Turning Off the Power	P.84

3.3 Turning On the Power and Logging In

3.3.1 Turning On the Power

1 **Check that the main power switch is set to ON (|) and then press ⏻ (Power button).**

After the instrument starts up, the Startup screen is displayed followed by the [Login] screen.



NOTE

- If the main power switch is switched from OFF (○) to ON (|), the instrument starts up even if ⏻ (Power button) is not pressed.
- Turning ⏻ (Power button) ON will start up the instrument and execute self-checking. If an error is displayed during the self-check, pump the mobile phase* for a while, turn ⏻ (Power button) OFF, and then turn it ON.

* A mobile phase with no absorbance at 230 nm min. (water, acetonitrile, methanol, etc., HPLC grade or higher)

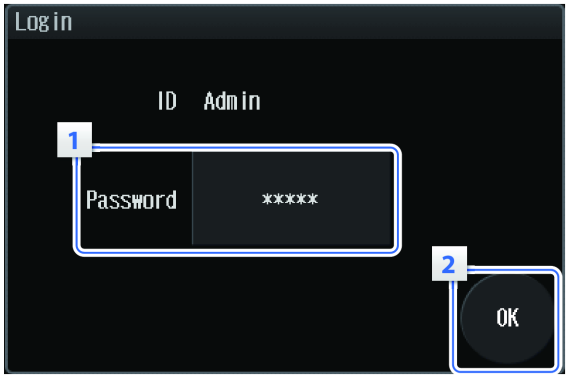
3.3.2 Logging In

1 **Input the login pass ID Number.**

The initial login pass ID Number is set to "00000".

NOTE The [Login] screen is not displayed when [Password request to deactivate lock] is set to be invalid.

Hint It is possible to change the login pass ID Number For details, refer to "1.3.1 Turning Power ON" in the Operation Guide.



Reference "Numeric Keypad screen" P.33

2 **Press [OK].**

The Initial screen is displayed.

> **NOTE** The initial screen can be changed by changing the settings. The default is the Main Analysis screen.

Reference Operation Guide "2.1.1 Main Analysis Screen", "5.2.5 Other"

3.4 Setting Analysis Condition

Save each unit's parameters and the "time programs" for unit control as the analysis condition in the "method". Select the method at the time of analysis.

For one analysis, execute "single analysis".

For multiple analyses in series, create a "sequence" before executing the analyses.

3.4.1 Selecting the Method

Select the desired method to decide the analysis condition. Edit the edit method parameters if necessary.

> **NOTE**
> - Up to 20 methods can be created.
> - The rack-related parameters of the autosampler are shared by all of the methods. Changes made in one method will be applied to all the other methods.

Reference Operation Guide "5.1 Method"

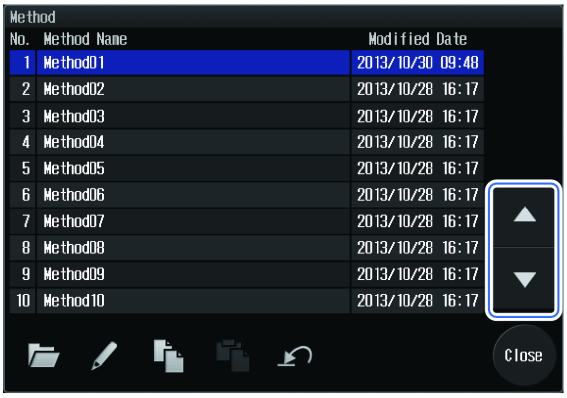
1 **Press 01 Method (Method selection) on the Main Analysis screen.**

The [Method] screen is displayed.

> **NOTE** The method currently selected can be edited on the Main Analysis screen. A method not selected can be edited on the [Method] screen.

Reference "2.2.2 Main Analysis Screen" P.26

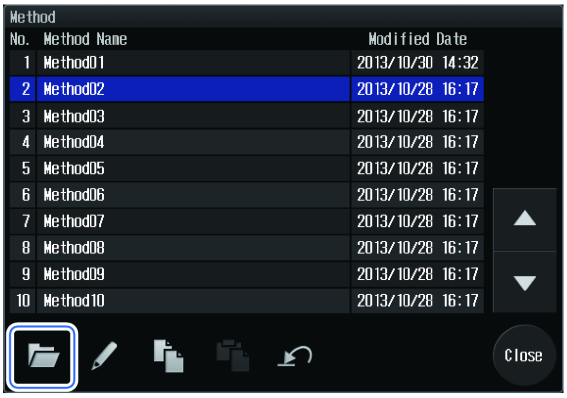
2 Press ▲ ▼ (Selection shift) to select the method.



3 Press (Apply).

The selected method number and contents are displayed on the Main Analysis screen.

NOTE When editing the method, see "3.4.2 Editing the Method" P.53.



3.4.2 Editing the Method

Edit the selected method on the Main Analysis screen.

> **NOTE** A method contains parameters and time programs of each instrument. The following assumes that certain parameters will be edited. To edit advanced parameters and time programs, refer to the Operation Guide.

Reference Operation Guide "5.1 Method"

■ Editing parameters on the [Edit Method Parameter] screen

1 **Press 01 Method (Method selection) on the Main Analysis screen.**

The [Method] screen is displayed.

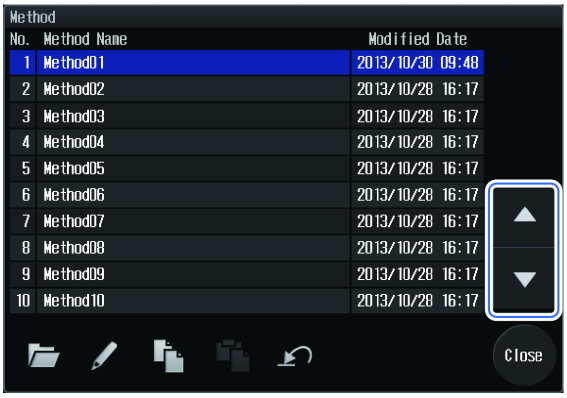
> **NOTE** The method currently selected can also be edited on the Main Analysis screen. A method not selected can be edited on the [Method] screen.

Reference "2.2.2 Main Analysis Screen" P.26

2 **Press ▲ ▼ (Selection shift) to select the method.**

3 **To check/edit the method content, press (Edit).**

The [Edit Method Parameter] screen is displayed.

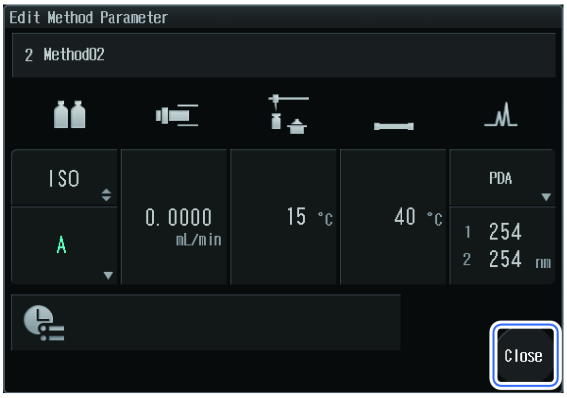


Edit Method Parameter screen

No.	Name	Explanation
1	Method Name	Displays the method name. The method name can be edited.
2	Unit	Press the unit icon to display the [Parameter Setting] screen. The screen has different tabs according to the unit. ▶▶ Reference Operation details "2.2.3 Common Items and Operations " P.31 Set values Operation Guide "5.1 Method"  : [Pump] tab  : [Pump] tab  : [Autosampler] tab  : [Oven] tab  : [Detector] tab
3	Simple Parameter Display	Displays the simple parameters. ▶▶ Reference "Simple parameters" P.56
4	Time Program	Displays the time program information. The [Time Program] screen is displayed. ▶▶ Reference Operation Guide "2.1.4 Time Program Screen"

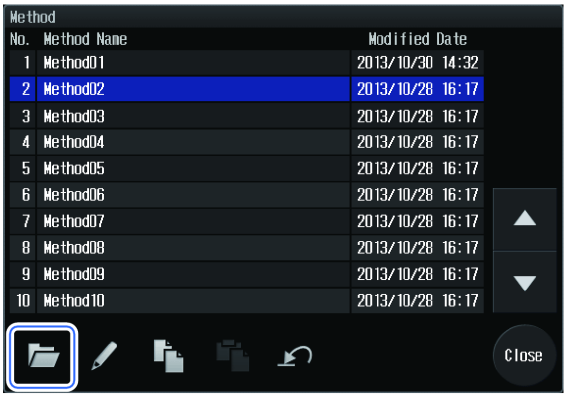
4 **After checking/editing the [Method] content, press [Close].**

The [Edit Method Parameter] screen is closed.



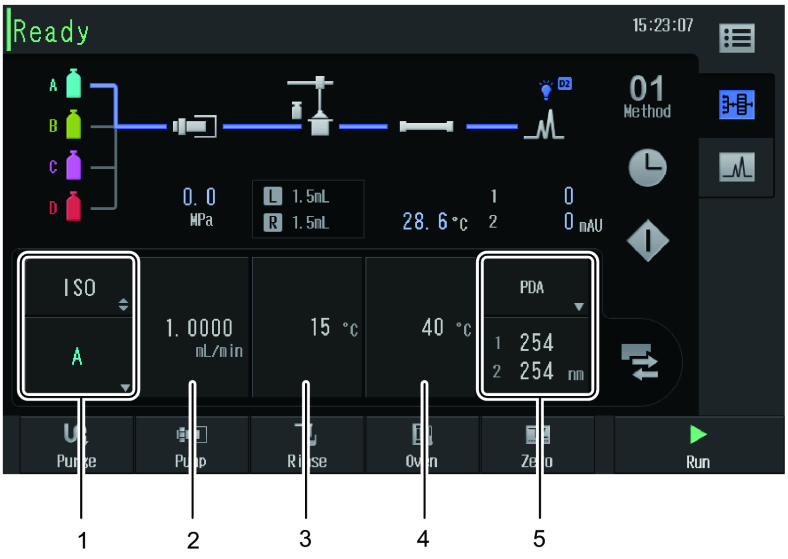
5 **Press (Apply).**

The [Method] screen is closed and the selected method number and contents are displayed on the Main Analysis screen.



■ Editing parameters on the Main Analysis screen

The parameters for the method currently selected are displayed on the Main Analysis screen. Press the buttons to change the settings.



Simple parameters

No.	Name		Explanation
1	Pumping Mode		The pumping mode is switched each time the above button is pressed. • [GRAD.]: Pumping in gradient mode • [ISO]: Pumping in isocratic mode
		Concentration Settings	Appears at the bottom when the pumping mode is set to [GRAD.]. Displays the concentration. The [Concentration] screen is displayed allowing configuration of the port concentration settings. ▶▶ Reference Operation Guide "2.1.2 Main Analysis Screen ■ User selection area"
		Mobile Phase Port Selection	Appears at the bottom when the pumping mode is set to [ISO]. Displays the mobile phase ports. The Selection screen is displayed allowing selection of the mobile phase port.
2	Flow Rate Settings Button		Displays the set flow rate. The Numeric Keypad screen is displayed allowing setting of the flow rate.
3	Sample Cooler Temperature Setting Button		Displays the set cooler temperature (models with sample cooler only). The Numeric Keypad screen opens, allowing the cooler temperature to be set.
4	Column Oven Temperature Setting Button		Displays the set oven temperature. The Numeric Keypad screen opens, allowing the oven temperature to be set.
5	Detector Area		The name of the currently selected detector is shown on the upper button. Pressing the upper button displays the [Detector Select] screen. The [Detector Select] screen displays buttons corresponding to the connected detectors. The detector wavelength is shown on the lower button. Pressing the lower button opens the screen for setting the wavelength.

3.5 Setting the Mobile Phase and the Rinse Solution for the Autosampler

3.5.1 Precautions About Reservoir Bottles and Waste Containers

Note the following before using a reservoir bottle for mobile phase or autosampler rinse solution or using a waste container.

⚠ WARNING

Do NOT use a cracked or scratched bottle.
The bottle may be broken.

⚠ CAUTION

Be sure to place the waste container below the instrument (on the floor, etc.).
If placed in a position higher than the instrument, waste liquid will not be drained and will leak from connection parts, etc.

Correctly attach the drain tubing.
Correctly install the tubing so that waste liquid is properly drained.

Do NOT allow the end of the drain tubing to be submerged in the waste liquid at the mouth of the waste container.
If the end of the drain tubing is submerged in the waste liquid, the liquid may flow back inside of the instrument and damage the instrument.

3.5.2 Precautions When Replacing the Mobile Phase

Note the following precautions when replacing the mobile phase or the rinse solution.

■ Precautions when replacing a liquid with a non-miscible solvent

Replace the old mobile phase with solvent miscible with both the old and new mobile phases, and then replace it with the new mobile phase.

Hint For example, to replace water with hexane, replace with 2-propanol first and then with hexane.

NOTE When using a solvent that is not miscible with water, do not use the automatic rinsing kit for the pump.

■ Precautions when using a buffer solution as the mobile phase

After using a buffer solution as the mobile phase, to replace the mobile phase, replace it with distilled water or purified water, pump at least 20 mL of water, and replace with new mobile phase.

NOTE After analysis using a buffer solution, if left as is, crystals formed due to dehydration may cause clogging in the flow line. After analysis, replace with distilled water or purified water, and pump at least 20 mL of water to rinse the entire flow line.

3.5.3 Precautions When Selecting a Rinse Solution for the Autosampler

> **NOTE** Air bubbles in the rinse solution pipe will decrease accuracy during sample injection. Be sure to turn ON the setting of the degassing unit.

Select the rinse solution for the autosampler according to the mobile phase.

Reversed phases, ion exchanges, and aqueous normal phases

- Use a methanol-water solution at a ratio of methanol / water = 50% / 50% (V / V). However, if the solution precipitates salt when coming into contact with the sample, 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, such as an acidic, basic, or ionic material, use the following rinse solutions:
  - Organic solvents including methanol or 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.
- If the component to be analyzed tends to cause the sample to remain on the outside of the needle, such as an acidic, basic, or ionic material, use 0.1% trifluoroacetic acid (TFA) aqueous solution or organic solvent solution, or mixture of the two.

■ Using a highly volatile acid as the rinse solution

If the rinse solution contains formic acid or acetic acid at a concentration exceeding 1%, or trifluoroacetic acid (TFA) at a concentration exceeding 0.1%, volatile components generated during lengthy serial analyses may cause rust on metal parts inside the instrument, resulting in malfunctions. Heed the following precautions.

⚠ CAUTION

Instruction

As much as possible, 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%

Instruction

After analysis finishes, replace the rinse solution with liquid that does not contain acid, such as water or methanol, and remove the sample racks to ventilate the inside of the instrument.

Instruction

After 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. Because when the needle is inserted into the injection port the Z mount is in the closest position to the rinsing port, the motor of the Z mount may rust. In this case, on the [System Parameter Setting] screen, set [Z Home Mode] in the [Autosampler] tab to [Enabled]. This function will keep the Z mount waiting in a position away from the rinsing port when the device shuts down, where the mount is least affected. However, if a buffer solution is used as the mobile phase, be sure to set to [Disabled]. Salt may be precipitated at the tip of the needle and the upper side of the needle seal, which can cause clogging.

Reference Operation Guide "5.2.2 Autosampler"

■ Using a buffer solution as the mobile phase

When using a buffer solution as the mobile phase, observe the following. Tubes may become clogged depending on the buffer solution used.

⚠ CAUTION

Instruction

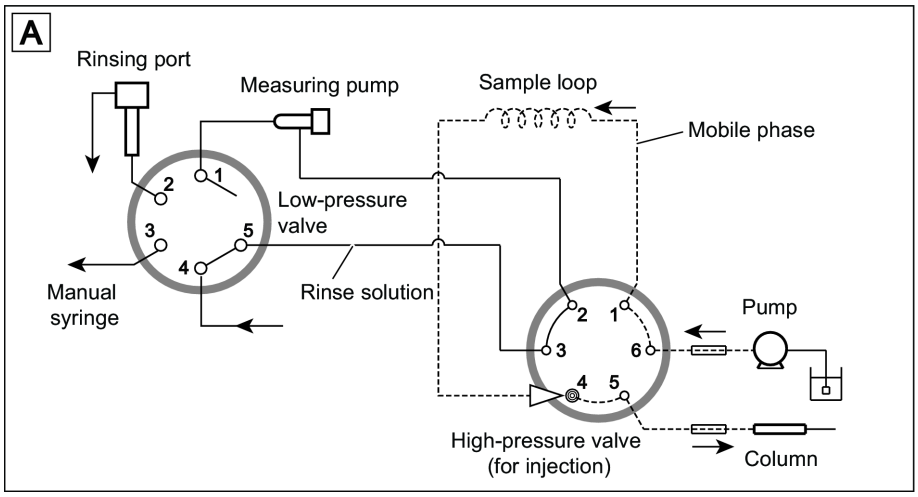
During autosampler injection, the rinse solution and the mobile phase are mixed in the tubing between the high-pressure valve and the low-pressure valve. Check that no salt is precipitated when the rinse solution and the mobile phase are mixed.

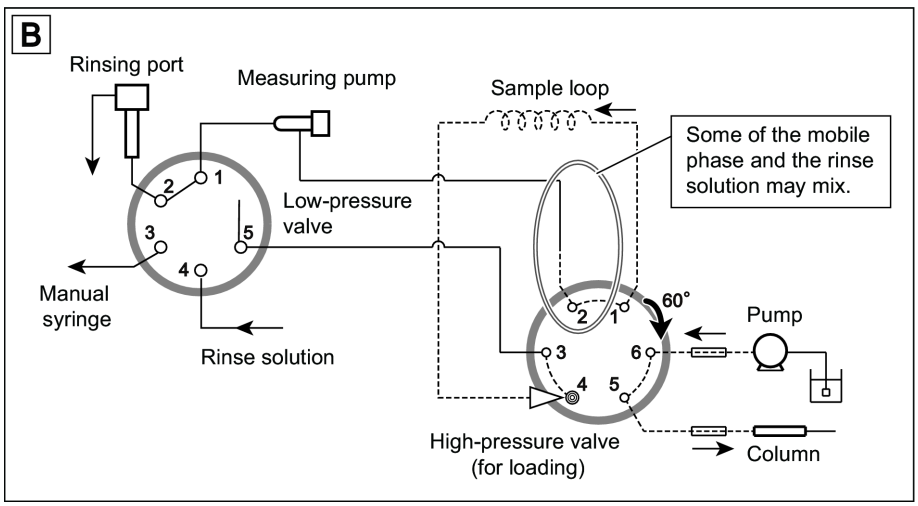
⚠ CAUTION

Instruction

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 A below are filled with rinse solution. Also, flow lines indicated by dotted lines are filled with mobile phase. Before sampling, the high-pressure valve turns and a portion of mobile phase compressed by high pressure is pushed through high-pressure valve ports 1 and 2 as shown in figure B below. The rinse solution and the mobile phase may be mixed in the part circled by B shown in figure ⓪ below, and depending on the pumping pressure, salt may be precipitated.





⚠ CAUTION

For low-pressure gradient analysis using a highly concentrated buffer solution and an organic solvent, replace the tubing from the outlet of the low-pressure gradient unit to the inlet of the pump with the accessory LPGE-OUT tube long.

Salt precipitated at the interface between the highly concentrated buffer solution and the organic solvent may cause the check valve on the pump inlet side to malfunction and reduce retention time reproducibility.
(Example) Guideline for relevant buffer solutions

- Potassium phosphate buffer solution at a concentration of 10 mmol/L min.
- Sodium phosphate buffer solution at a concentration of 50 mmol/L min.

(Generally, potassium salt is more easily precipitated than sodium salt. However, because the precipitation condition of salt depends on the type and concentration of the organic solvent the above buffer solution concentrations are only a guideline.)

NOTE Replacing the LPGE-OUT tube increases the system delay volume. Change the setting for the delay compensation volume.

Reference "2.3 Flow Line Diagram" P.36

3.5.4 Setting the Mobile Phase and the Rinse Solution on the Reservoir Tray

Prepare the mobile phase and set the reservoir bottle on the reservoir tray.

Preparation of the mobile phase

Prepare a mobile phase. It is recommended to filter it through a membrane filter with a filter size of 0.45 µm or less.

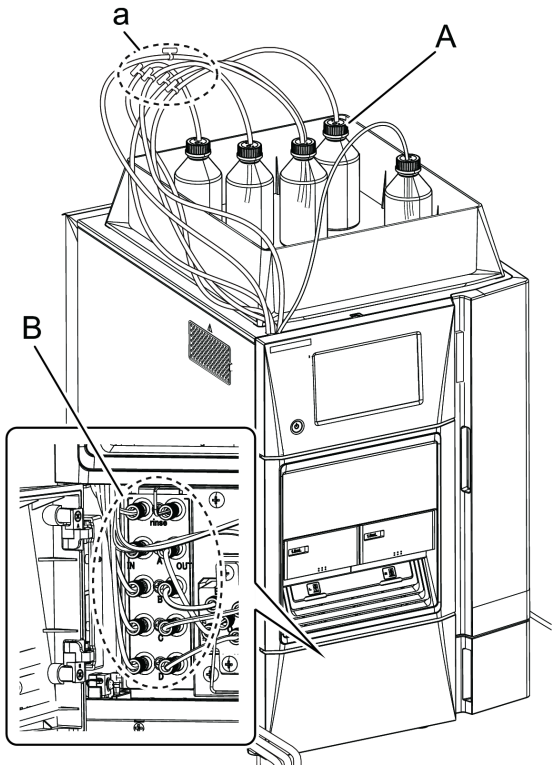
Put it in a dedicated reservoir bottle. It is recommended that ultrasonic vibrations for 2 or 3 minutes be used for degassing.

1 **Prepare the mobile phase and put it into the reservoir bottle (A).**

2 **Put the suction filter and the tube of the mobile phase port to be used into the reservoir bottle (A).**

The tags (a) on the suction tubing correspond to the degassing unit ports (B). Check the tags and set each tube in the reservoir bottle.

Indication on Tag	Port Name
Rinse	Rinse solution for autosampler
SOLVENT: A	Mobile phase A
SOLVENT: B	Mobile phase B
SOLVENT: C	Mobile phase C
SOLVENT: D	Mobile phase D



3 **Set the reservoir bottle on the reservoir tray.**

Combination for mobile phase replacement and mixing

When replacing a residual solvent inside the instrument with a new mobile phase or when mixing them, replacement with another solvent may be required to prevent precipitation and emulsion. See the following examples.

Examples of solvent combinations that should not be replaced or mixed directly

Example of Solvent Combination	Possible Problem	Workaround
Water and Mobile Phase with a Low Dielectric Constant (Hexane, Chloroform, etc.)	Emulsion and separation	Replace the solvent with 2-propanol or acetone.
Buffer Solution and Organic Solvent (Methanol, Acetonitrile, Tetrahydrofuran, etc.)	Precipitation	Replace the solvent with water.
Nitric Acid and Alcohol	Reaction	Replace the solvent with water.

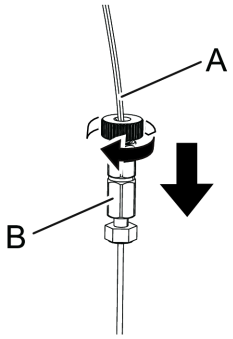
3.5.5 Performing an Autopurge

The mobile phase ports and the rinsing port of the autosampler will be automatically purged.

NOTE

- Replace the entire flow line with mobile phase before setting the column.
- Also, purge mobile phase ports that are not used with a liquid that is equivalent to the mobile phase or that does not affect analysis results. Be careful not to allow air bubbles to remain in the tubes of the mobile phase ports that are not used.
- When the "Rinse solution aspiration rate" in the autosampler settings is 35 µL/sec, the average flow rate of rinse solution pumped by the measuring pump is approximately 1.0 mL/min. To completely replace liquid in the flow line with new rinse solution, perform an autopurge for 25 minutes.
- After using a buffer solution as the mobile phase, when replacing or purging the mobile phase with the buffer solution remaining in the column, do not purge a liquid that easily forms a precipitate in the buffer solution (such as highly concentrated organic solvent) at the last. When normal pumping starts after purging, residue of the mobile phase that was last purged, which can be found between the mixer and the autosampler, may flow into the column and precipitate salt. To replace a mobile phase after using a buffer solution, rinse the column with a liquid that does not form a precipitate in the buffer solution, such as water, and then purge or pump the residual mobile phase.

1 **If a column is connected, remove it and install the provided PEEK tubing (or another replacement tube) (A) and the coupling (B) instead.**

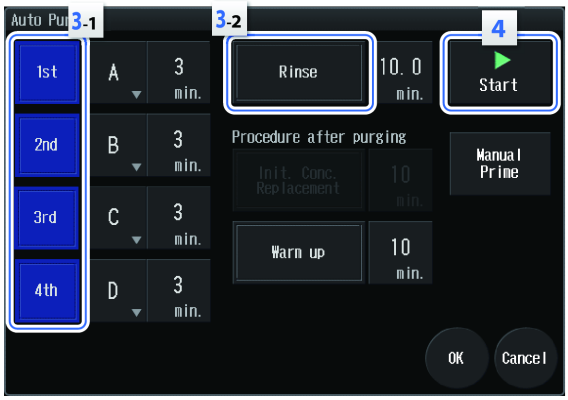


2 **Press [Purge] on the Main Analysis screen.**

Displays the [Auto Purge] screen.

3 Turn ON [1st] to [4th], and [Rinse].

Keep the default purge time.



> **NOTE**
>
> - The default purge time is 3 minutes for mobile phases and 10 minutes for rinse solutions. If air bubbles are found in the flow line, set the time 2 to 5 minutes longer than the initial value.
> - If air bubbles remain in the flow line despite a longer purge time, open the drain valve of the pump. The flow line from the suction filter to the pump head will be purged. After the autopurge finishes, close the drain valve.

4 Press [Start].

Autopurging starts and the [Running] screen opens.

> **NOTE**
>
> - Press [Stop] to cancel the autopurge. Press [Skip] to cancel purging of the mobile phase that is currently being purged and start purging of the next mobile phase.
> - For another operation, press [Close]. The [Running] screen closes but the purge continues. To display the [Running] screen, press [Purge] on the Main Analysis screen.

5 After the purge finishes, press [Close].

The display returns to the Main Analysis screen.

6 Set the flow rate to 1 mL/min and press [Pump] to start pumping.

The mobile phase in the flow lines of the column oven and the detector, which is not replaced through autopurging, will be replaced.

7 **After 10 minutes, press [Pump] to stop pumping.**

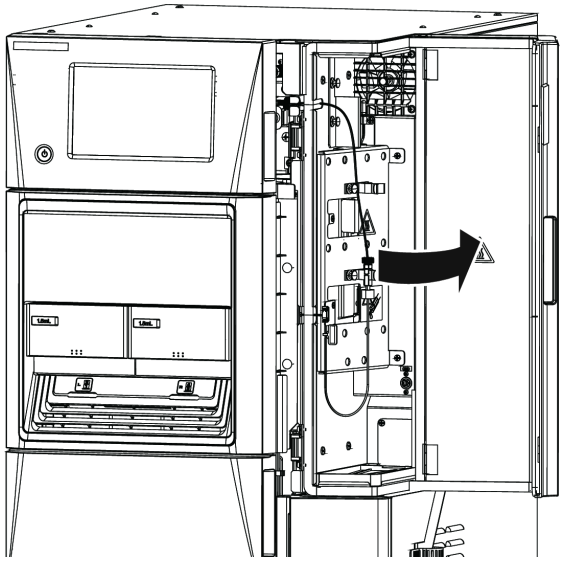
NOTE

- Init. Conc. Replacement: Performs an autopurge at the initial flow rate with the initial [GRAD.] settings only when the pumping mode is [GRAD.].
- Warm up: Pumps the mobile phase at half the initial flow rate with the initial [GRAD.] settings. After the warming up time finishes, the flow rate returns to the initial setting and pumping continues.

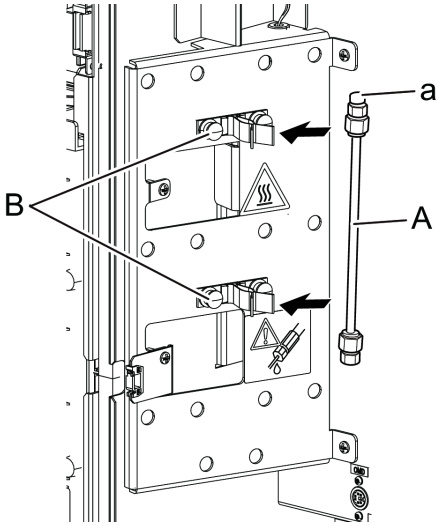
3.6 Setting the Column

3.6.1 Attaching the Column to the Column Oven

1 **Open the column oven door.**



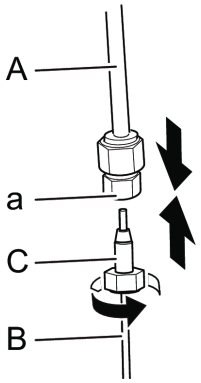
2 Attach the column (A) to the column clamps (B) with the outlet side (a) turned up.



3 Connect the tubing to the column.

1 Connect the SUS tubing (B) to the inlet side (a) of the column (A) from the autosampler.

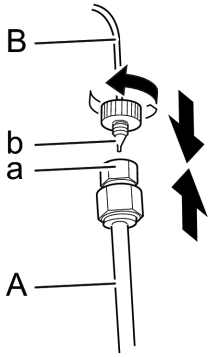
NOTE For the fittings to be used, see the following table.



Part Name	Part No.	Part Type	Remarks
Male Nut Fitting (2 pcs)	S228-45717-01	Standard accessory	Hand-tightened fittings. Usable for analyzing at a pressure of 35 MPa max.
Male Nut, 1.6 MN	S228-16001	Standard accessory	Stainless steel male nut and ferrule.
Ferrule, 1.6F, 316L	S228-16000-10		
UHPLC Fitting (1 pc)	S228-56867-41	Optional part	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.
UHPLC Fitting (10 pcs)	S228-56867-43		

NOTE In such instances as when the column oven temperature is high and when the pump flow rate is excessive (for example, when the column temperature is 70 °C or more and when the pump flow rate is 3 mL/min or more), the detector cell temperature increases to 50 °C or more, and temperature control for the cell portion may become impossible. In this case, turn the temperature control for the cell portion OFF, wait for stabilization (about 60 minutes), and then begin analysis.

2 Connect the blue PEEK tubing (B) on the inlet side (b) of the UV detector or PDA detector to the column (A).



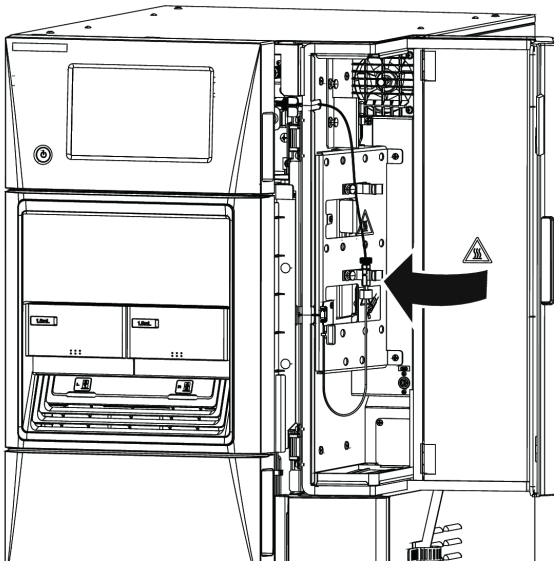
4 Close the column oven door.

CAUTION

Instruction

Secure the column oven door.

Be sure to close the door until it clicks to prevent the door from being opened by mistake during analysis or from being opened while the tubing inside the column oven is in contact with the door.



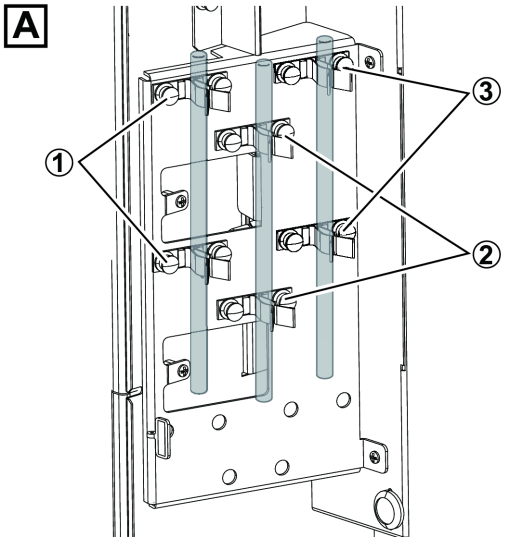
■ Attaching multiple columns

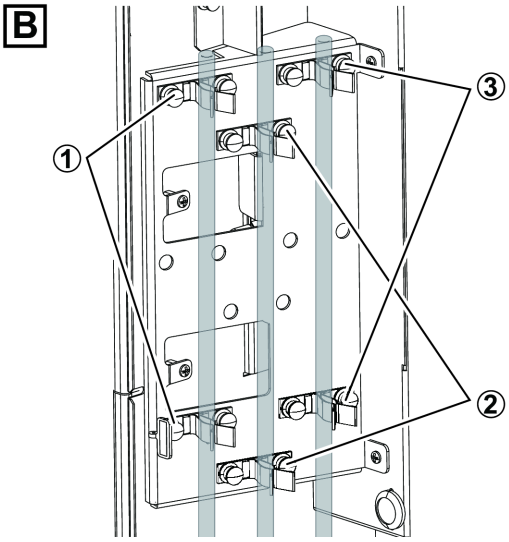
Installing optional column clamps allows multiple columns to be attached. Install column clamps in the positions shown in the following figures according to the length and number of columns, and connect the columns.

Hint Installing the optional FCV-14AH allows automatic switching of multiple columns.

Columns 100 mm to 300 mm in length

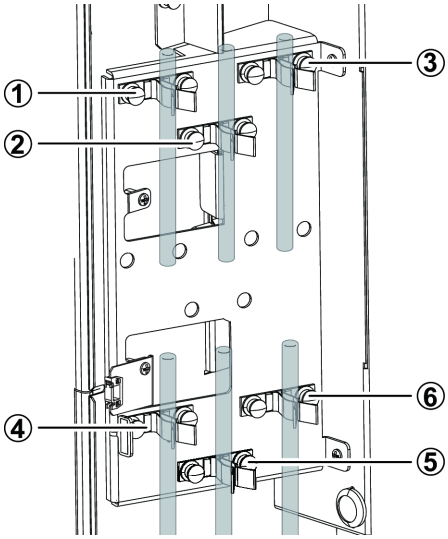
Up to 3 columns can be attached. Install column clamps in pattern A or B depending on the length of the columns.





Columns up to 100 mm in length

Up to 6 columns can be attached.



3.6.2 Equilibrating the Column

Adjust the temperature of the column according to the column oven.

1 **Set the flow rate to one-fifth the set value on the Main Analysis screen.**

> NOTE When the column is at a low temperature, starting pumping may cause an error due to pressure that is too high, or it may damage the column. Pump at a lower flow rate until the oven temperature reaches the set value.

2 **Press [Pump] and [Oven].**

[Pump] and [Oven] are illuminated in blue and the operation starts.

When the oven temperature reaches the set value, the status display area changes from [Wait Oven] to [Ready].

3 **After the oven temperature reaches the set value, return the flow rate to the set value.**

3.7 Setting the Sample

The following explains the procedure of preparing a sample and setting it in the instrument.

3.7.1 Setting in a Sample Vial

⚠ CAUTION

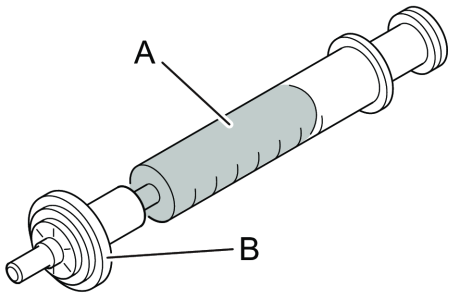
Instruction

Filter the sample in advance using a membrane filter (0.45 µm or less) to remove solid matters and insoluble materials including dust.
Dilute high viscosity samples before use.

- Solid matters 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 instrument's outlet tubing, etc., to clog. Also, it may damage the sliding surfaces of the stator and rotor of the high-pressure valve, resulting in liquid leakage in a short period of time.
- High viscosity samples may 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.

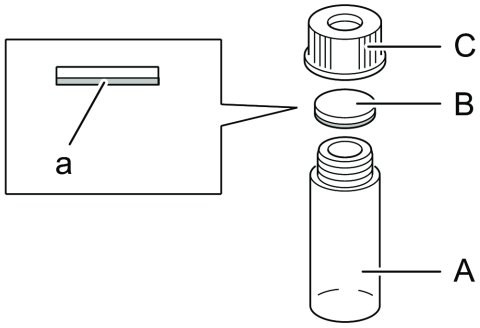
1 **Completely dissolve the sample (A) with a solvent equivalent in composition to the mobile phase.**

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



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.



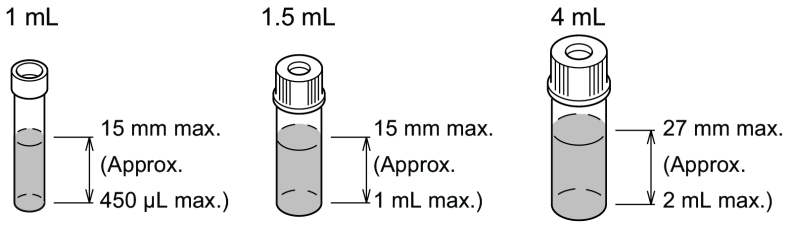
⚠ CAUTION

Instruction

When using a sample vial, attach the cap with the PTFE surface of the silicone septum turned down (turned to the liquid side).
Use a genuine Shimadzu septum.

- If the PTFE surface is turned up, the sample solvent may melt the silicone rubber.
- If the septum is not a genuine part, the flow line may be clogged with septum shavings or the needle may not be able to penetrate the septum.

NOTE When the sample is cooled, the liquid level should be as indicated in the following figure. If it is higher, the sample may not be sufficiently cooled.



3.7.2 Setting the Sample in the Autosampler

Two sample racks can be inserted into the instrument at once, and each sample rack can be loaded with 2 plates of the same type. Plate types include vial plates (1 mL, 1.5 mL, and 4 mL), microtiter plates (MTP), and deep-well plates (DWP).
The top side of each plate has numbers indicating respective installation positions of sample vials and well positions. Specify any of the sample numbers when configuring the required settings.

⚠ CAUTION

Instruction

When cooling a sample, be sure to set both of the sample racks with plates attached in the instrument. Alternatively, turn OFF cooling for the sample rack not used.

Leaving sample racks without being set in the instrument may generate condensation water, which can damage the instrument, and the condensation water may contaminate the samples.

NOTE

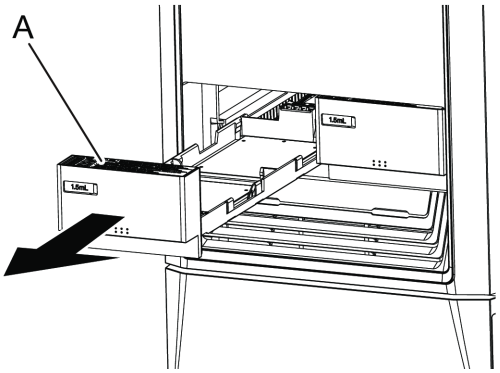
- When pulling out a sample rack from the instrument, pull the rack with one hand horizontally and use the other hand for support.
- The model without a sample cooler is provided with 1.5 mL sample vial plates and the model with a sample cooler is provided with 1.5mL sample vial metal plate by default. When using other plates, be sure to adjust the rack ID settings, needle stroke settings, and rack positions.

Reference "4.4 Changing Sample Racks for the Autosampler" P.93

1 **Remove the sample rack (A).**

NOTE

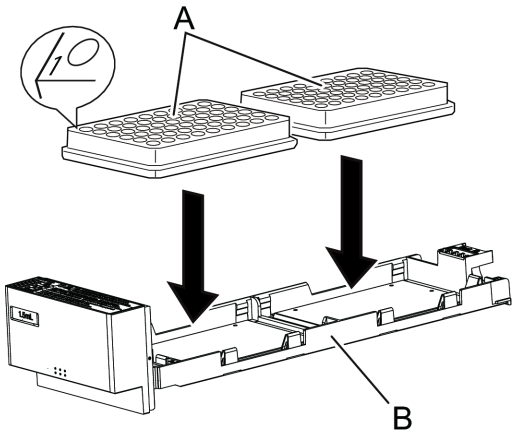
- When pulling out a sample rack from the instrument, pull the rack with one hand horizontally and use the other hand for support.
- Be sure to fully pull out the sample rack before attaching or removing plates.



2 Set the plates (A) filled with sample on the sample rack (B).

- Vial plate:
  Set No. 1 in the front left corner.
- Microtiter plate and deep-well plate:
  Set the A01 well in the front left corner.

Two plates placed on 1 sample rack must be of the same type. Placing different types of plates may cause failure in sample injection.



NOTE

- Two plates placed on 1 sample rack must be of the same type. Placing different types of plates may cause failure in sample injection.
- Cooling a sample rack may cause condensation on the top side of the sample rack. Be sure to set both of the 2 plates.

3 Insert the sample rack all the way horizontally along the guide.

⚠ CAUTION

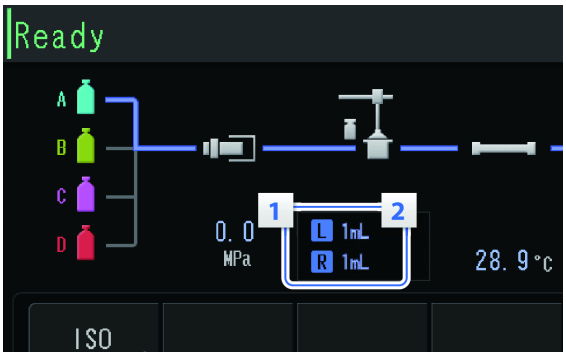
Instruction

Insert the sample rack until it reaches the end.

If it is inadequately inserted, the needle may pierce the wrong position and damage the instrument or become clogged.
In addition, the needle may prick the cap for the sample upon sample aspiration and cause an error.

NOTE Horizontally slide sample racks set with microtiter plates so that the sample does not spill.

When the sample rack is recognized, the positions of the attached racks (right and left) and the plate types are displayed on the Main Analysis screen.



No.	Name	Display
1	Rack Position	L
		R
2	Plate Type	1 mL, 1.5 mL, 4 mL, MTP96, DWP96, MTP384, DWP384

3.8 Executing Analysis

For analysis, "single analysis" is available for setting the condition each time, and "sequence analysis" is available for executing multiple analyses collectively.

NOTE
- Light the detector lamp as early as possible in order to stabilize the baseline. The approximate time for baseline stabilization after the lamp is turned on is 1 hour for UV detector system models and 1.5 hours for PDA detector system models.
- Be sure to close all the doors during measurement.

3.8.1 Executing Single Analysis

The single method will be used to start analysis.

1 **Set the analysis condition.**

Reference "3.4 Setting Analysis Condition" P.51

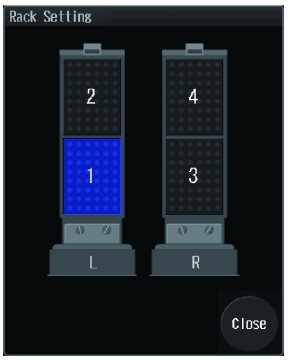
2 **Press (Single analysis) from the Main Analysis screen.**

The [Single Run] screen is displayed.

3 **Configure the single analysis settings.**

Reference "Single Analysis screen" P.76

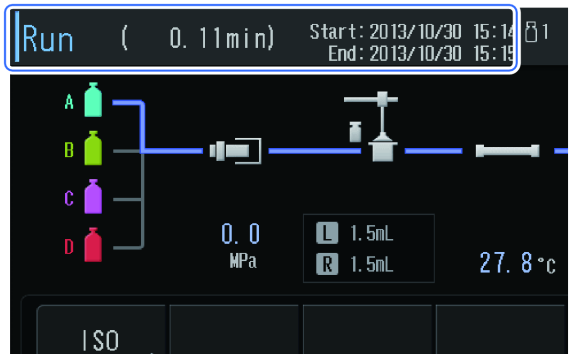
Single Analysis screen

No.	Name		Explanation
1	Plate		Specifies the plate position where the sample is set. On the [Plate] selection screen, select the number to choose the plate. The lower side of the screen is the near side of the sample rack. **NOTE** The plate number can be changed on the [System Parameter Setting] screen. Reference Operation Guide "5.2.2 Autosampler"  [Rack Setting] screen
2	Sample number		Specifies the position number of the sample vial and that of the well filled with the sample.
3	Injection Volume		Sets the injection volume.
4	Run Time		Switches the analysis time source.
		Use Time Program	The method containing a time program used for analysis time is selected. The set values of the selected method are applied to the analysis condition. Reference Operation Guide "5.3 Time Program"
		Input Run Time	Enter the analysis time. The method selected on the Main Analysis screen is used for the analysis condition.
5	Run		Closes the screen and starts analysis. If analysis cannot be started due to the instrument status, [Run] will be disabled.

4 Press [Run].

The display returns to the Main Analysis screen, and analysis starts.

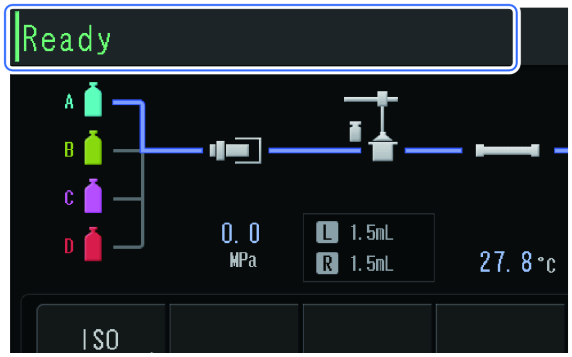
[Run] appears in the upper part of the Main Analysis screen for checking the analysis progress.



NOTE

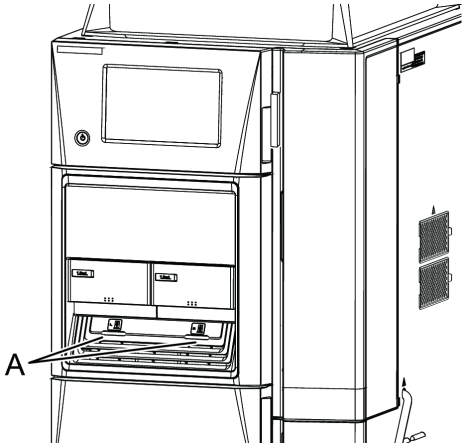
- To urgently stop analysis: Press [Stop].
- If analysis is urgently stopped during injection, the needle moves to the drain port and discharges the sample remaining in the needle in order to clear the sample suctioned into the needle, after which rinsing of the needle starts.

Analysis is completed when [Ready] appears on the Main Analysis screen.



■ Removing a sample rack during analysis

When a rack's LED (A) is not flashing, the sample rack can be removed, even during analysis.



⚠ CAUTION

Prohibition

Do NOT put hands inside the instrument during analysis.

The Z mount and the needle continue operating even if a sample rack has been removed. Putting hands inside the instrument is dangerous.

Prohibition

Do NOT take out a sample rack with a flashing rack LED.

Failure to comply with the above precaution may result in damage to the needle. During injection, the rack LED of the sample rack with the plate injected with the sample will flash.

NOTE

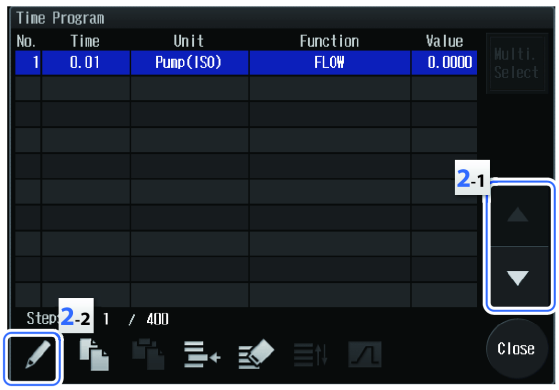
- Attempting to take out a sample rack with a flashing rack LED will pause injection. Putting the sample rack back to the original position will restart injection. If the sample rack to which the sample will be injected is not inserted into the rack plate, injection will not start. Inserting the sample rack will start injection.
- Leaving a sample rack outside for more than 30 minutes with the sample cooler running will result in the sample cooler automatically turning OFF. Putting the sample rack back to the original position will automatically restart operation of the sample cooler.
- Turning OFF the main power switch on the left side of the main unit during injection of a sample (when the rack LED is flashing) may stop the needle while in a lower position. With the needle in a lower position, pulling out the sample rack may cause the needle to become bent.

3.8.2 Setting a Time Program

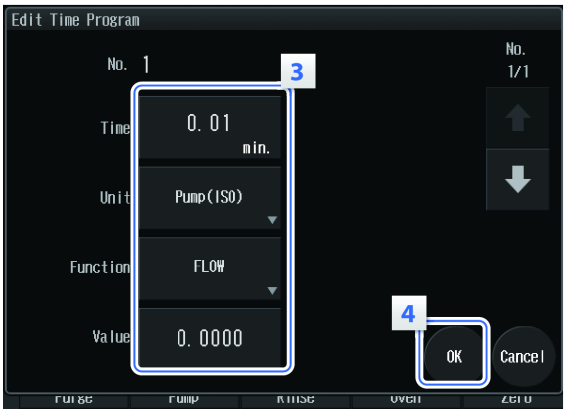
Register a time program in the method parameter to control the operation of each part according to the lapse of time, and execute analysis.
The following uses single analysis as an example to explain the procedure of starting analysis with a time program.
For details on time programs, refer to the Operation Guide.

1 **Press (Editing time programs) on the Main Analysis screen.**
The [Time Program] screen opens.

2 **Press (Selection shift) to select the list to be edited, and press (Edit).**
The [Edit Time Program] screen opens.



3 **Set each item.**
Reference Operation Guide "2.1.4 Time Program Screen ■ Time Program Edit Screen"



4 **Press [OK].**
The display returns to the [Time Program] screen.

5 **Repeat steps 2 to 4 to set the time programs.**

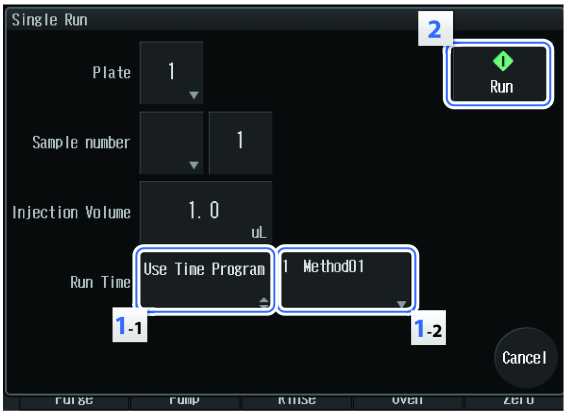
6 **Press [Close] on the [Time Program] screen.**
The display returns to the Main Analysis screen.

■ Starting analysis

1 **Use a time program in [Single Run].**

1 Switch [Input Run Time] to [Use Time Program] in step 3 of "3.8.1 Executing Single Analysis" P.75.

2 Select the method set with the time program to be used.



2 **Press [Run].**

3.8.3 Executing Sequential Analysis

Sequential analysis allows multiple analyses to be executed collectively. Also, it is possible to set a separate method for each analysis.

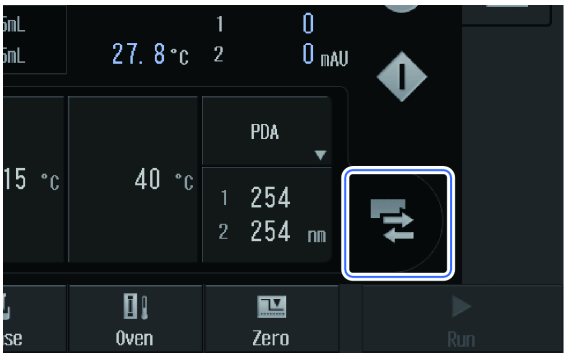
The following explains the procedure of starting an analysis using a sequence.

For details on sequences, refer to the Operation Guide.

■ Editing a sequence

1 **Press**  **(Switch displays) on the Main Analysis screen.**

The [Display Switch] screen is displayed.

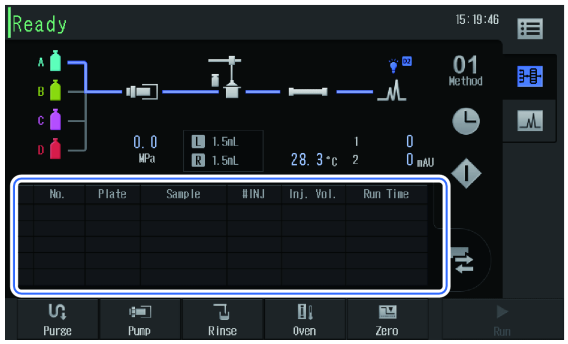


2 **Press [Sequence List].**

The sequence list is displayed.

3 **Press the sequence list display area.**

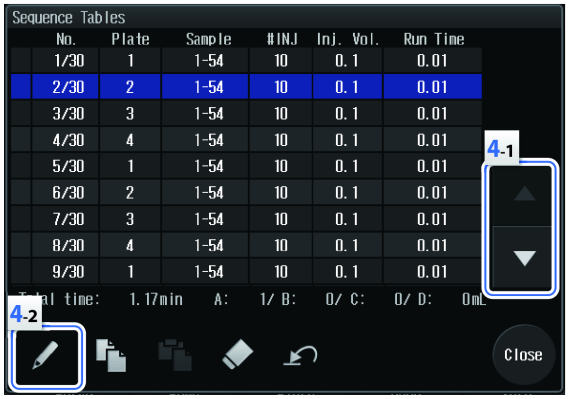
The [Sequence Tables] screen is displayed.



4 **Press ▲ ▼ (Selection shift) to select the list to be edited, and press (Edit).**

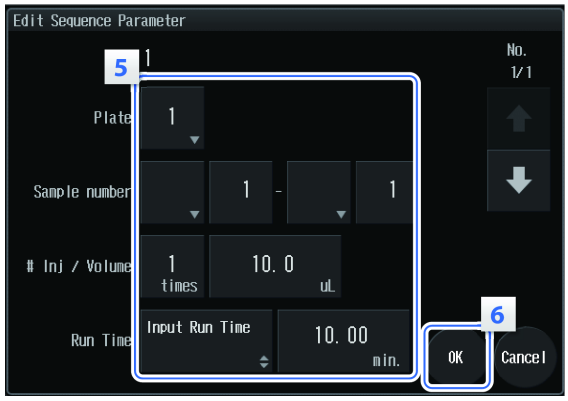
The [Edit Sequence Parameter] screen is displayed.

Reference Operation Guide "2.1.2 Sequence Tables Screen ■ Edit Sequence Parameter Screen"



5 **Set each item.**

Name		Explanation
Plate		Specifies the plate position where the sample is set.
Sample number		Specifies the starting and finishing sample numbers for injection.
# Inj / Volume		Sets the injection frequency and amount.
Run Time		Switches the analysis time source.
	Use Time Program	The method containing a time program used for analysis time is selected.
	Input Run Time	Enter the analysis time.



6 **Press [OK].**

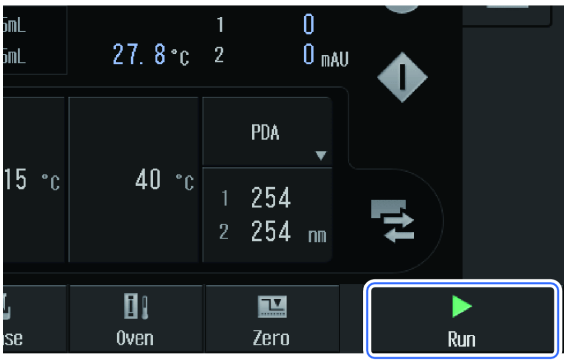
The display returns to the [Sequence Tables] screen.

7 **Repeat steps 4 to 6 to set the time programs.**

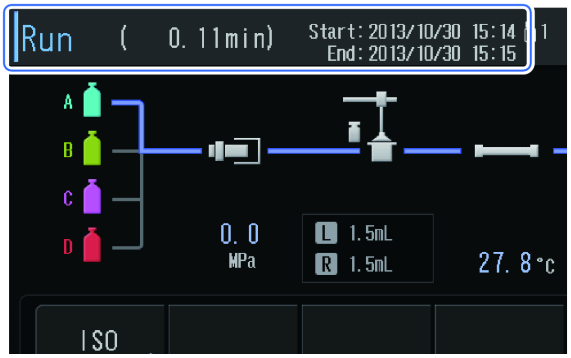
8 **After editing the list, press [Close] on the [Sequence Tables] screen.**
The display returns to the Main Analysis screen.

■ Starting analysis

1 **Press [Run].**
Analysis is executed according to the sequence list.

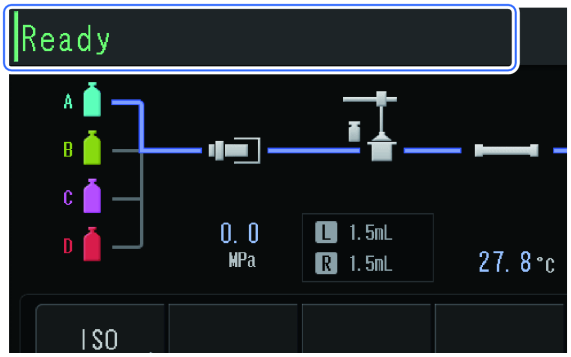


[Run] appears in the upper part of the Main Analysis screen for checking the analysis progress.



> **NOTE**
> - To pause analysis:
> Press [Pause]. Analysis is temporarily stopped when the analysis being processed ends. Press [Restart] to restart.
> - To urgently stop analysis:
> Press [Stop].

Analysis is completed when [Ready] appears on the Main Analysis screen.



3.9 Finishing Analysis and Turning Off the Power

3.9.1 Replacing the Mobile Phase

Leaving a mobile phase used for an analysis in the column for a long period (3 days or more) may result in deterioration of the column. When leaving the column for a long period (3 days or more), replace the liquid in the column with column sealing liquid, remove the column from the instrument, and store it.
Replace the liquid with the column sealing liquid using the following procedure.

NOTE

- It is possible to automatically specify the flow rate and concentration of mobile phase and the oven temperature after analysis finishes. For details, refer to "4.3 Executing Shutdown After Analysis" in the Operation Guide.
- For details on how to store the used column, refer to the instruction manual provided with the column or ask 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 will cause an increase in detector noise. If a buffer solution was used as the mobile phase, rinse the flow cell with water after analysis finishes. Dried buffer solution will form crystals and clog the flow line or cause wear on each part or dirt in the flow cell.

1 **Press [Pump] to stop pumping.**

2 **Put the suction tubing for the mobile phase into a reservoir bottle with column sealing liquid and set it on the reservoir tray.**

3 **Purge the mobile phase port whose tubing is put into the bottle with column sealing liquid.**

Reference "3.5.5 Performing an Autopurge" P.64

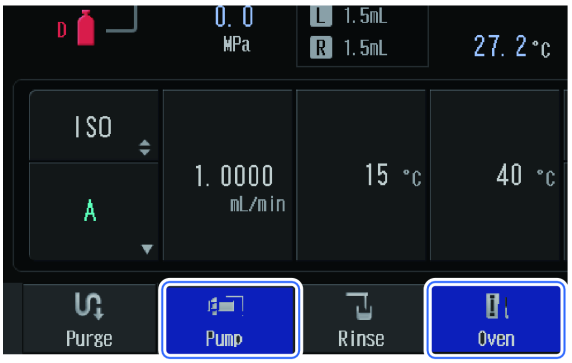
4 **Configure the pump settings as follows.**

Item	Setting
Pumping Mode	ISO
Mobile Phase Port	Mobile phase port whose tubing is connected to the bottle with column sealing liquid
Flow Rate Setting	One-fifth of the analysis flow rate

5 **Press [Pump] to start pumping.**

The liquid in the column will be replaced with column sealing liquid. When replacement finishes, the pressure becomes stable.

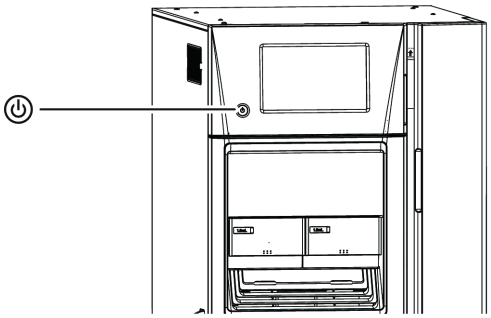
6 **The pump pressure becomes stabilized, and after about 10 minutes of pumping, press [Pump] to stop pumping.**



3.9.2 Turning Off the Power

1 **Press (Power button).**

The power of the instrument will be turned off.



NOTE

- Pressing (Power button) will display the Confirmation screen.
- Pressing and holding (Power button) for 4 seconds or more will forcibly turn the power OFF. However, this process may cause corruption or failure when saving the settings data.

4 Various Operations

This chapter explains the settings and advanced operations specific to each unit.

4.1 Replacing the Rinse Liquid of the Pump Automatic Rinsing Kit

The automatic rinsing kit is a kit that automatically rinses the plunger and plunger seal of the pump. Select a rinse liquid to use for rinsing as follows.

For cases when water is used for the mobile phase, including reversed phases and ion exchanges

Use 10% 2-propanol water.

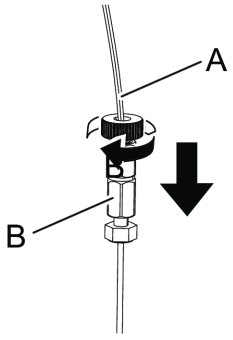
For cases when water is not used for the mobile phase, including non-aqueous normal phases

No rinse liquid is used.

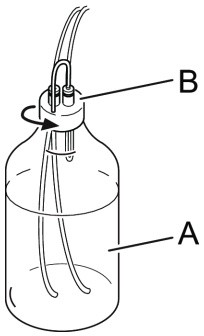
When using the instrument or replacing the rinse liquid for the first time, absorb the rinse liquid in the rinse solution bottle into the flow line through the following procedure. In addition, when the rinse liquid is not pumped, perform the same procedure.

> NOTE If the 10% 2-propanol water in the rinse solution bottle is dirty, replace with new solution. Especially when getting dirty significantly, replace with new solution once a day. Even if it does not appear dirty, replace with new solution once a week.

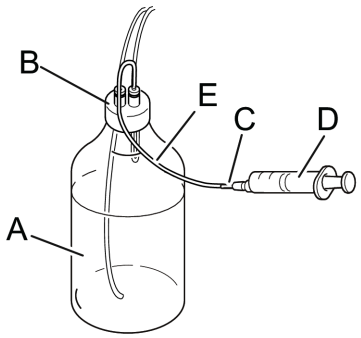
1 **If a column is connected, remove it and install the provided PEEK tubing (or PEEK or SUS tubing equivalent to the provided one) (A) and the coupling (B) instead.**



2 **Remove the cap (B) of the rinse solution bottle (A) in the automatic rinsing kit and add 1 L of 10% 2-propanol water.**



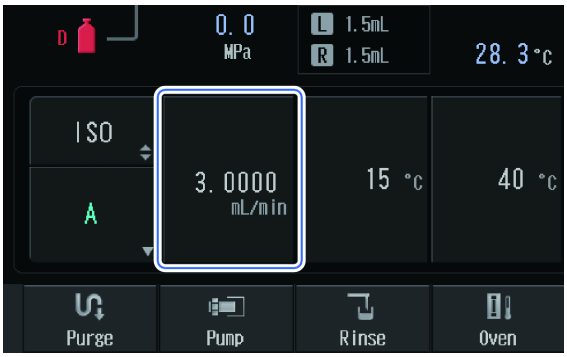
3 **Attach the cap (B) of the automatic rinsing kit to the rinse solution bottle (A), and then remove the outlet FEP tubing (E) (in the upward U-shape) from the rinse solution bottle.**



4 **Attach the syringe needle (C) to the end of the FEP tubing (E) (in the upward U-shape), and use the syringe (D) to suction out the 10% 2-propanol solution from the rinse flow line.**

5 **Remove the syringe needle (C) and the syringe (D) from the FEP tubing (E).**

6 **Press the flow rate settings button and set the flow rate to 3 mL/min.**



7 **Press [Pump].**

[Pump] is illuminated in blue and pumping starts.

8 **Check that the rinse liquid flows from the end of the FEP tube on the outlet side of the automatic rinsing kit.**

9 **If the rinse liquid is flowing, press [Pump].**

[Pump] is turned off and pumping stops.

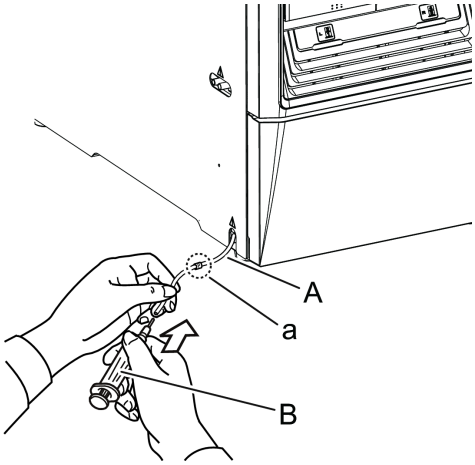
10 **Return the automatic rinsing kit to the original status.**

4.2 Manually Purging the Pump

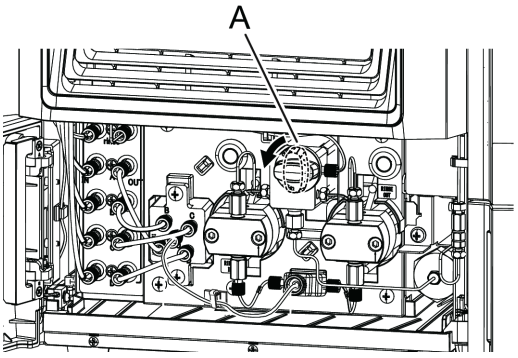
When purging is not sufficient through autopurging or when there is no liquid in the suction tubing as after exchange of plunger seal, perform manual purging using a syringe with the following procedure.

1 **Put the suction tubing to be purged into a reservoir bottle in which a mobile phase has been added, and set the bottle in the reservoir tray.**

2 **Insert the syringe with needle (B) into the mobile phase drain tube (A) marked with "P" (a).**

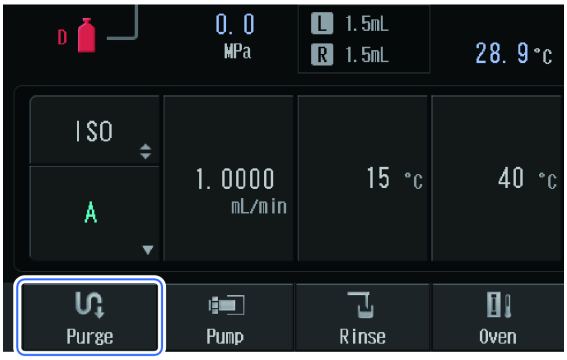


3 **Open the pump door, rotate the drain valve knob (A) 90 degrees counter-clockwise, and open the drain valve.**



4 **Press [Purge] on the Main Analysis screen.**

Displays the [Auto Purge] screen.

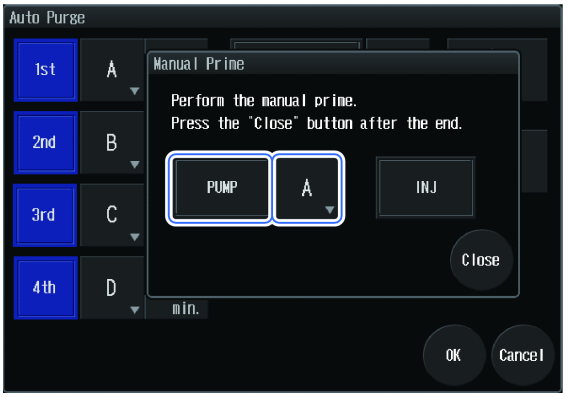


5 **Press [Manual Prime].**

Display the [Manual Priming Standby] screen.

6 **Select the mobile phase port for manual priming and press [PUMP].**

The valve of selected mobile phase port will open.



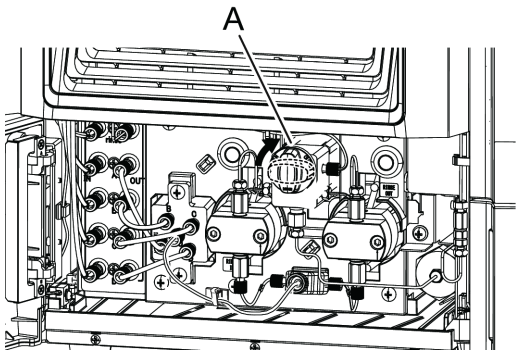
7 **Aspirate the mobile phase with the syringe.**

The criterion value for the aspirated volume is 10 mL.

8 **When purging another mobile phase port as well, change the mobile phase ports and aspirate the mobile phase port with the syringe as well.**

9 **When all the purgings are completed, press [Close] to finish manual priming.**

10 **Close the drain valve by rotating the drain valve knob (A) clockwise until the rotation stops.**



11 **Close the pump door.**

12 **Remove the syringe.**

13 **Perform respective autopurging for 3 minutes or more.**

Conduct autopurging for all mobile phase ports for which manual purging was performed until there are no air bubbles in the flow line.

Reference "3.5.5 Performing an Autopurge" P.64

NOTE In manual purging, the tubes downstream from the pump are not replaced. To replace the tubes downstream from the pump, conduct autopurging for 3 minutes or more for all mobile phase ports for which manual purging was performed until there are no air bubbles in the flow line.

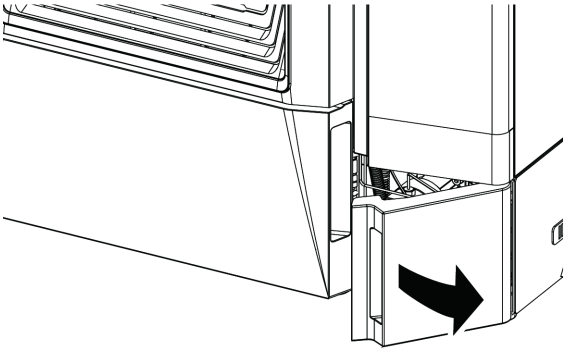
4.3 Manual Priming for Rinse Solution of the Autosampler

When purging is not sufficient through autopurging or when there is no liquid in the suction tubing, perform manual priming using a syringe with the following procedure.

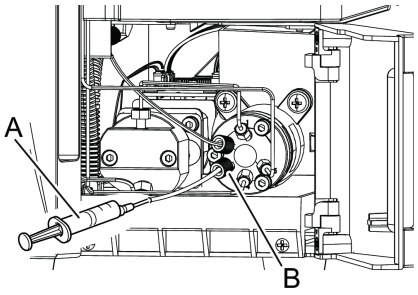
NOTE
- Check that the degassing unit is ON.
- When replacing with a non-miscible solvent, substitute first for a miscible solvent as an intermediate rinse solution, and then replace with the desired solvent.

Reference "Precautions when replacing a liquid with a non-miscible solvent" P.58

1 **Open the valve mount door.**



2 **Insert the syringe with a needle (A) into the tube coming out of low-pressure valve port No. 3 (B).**



3 **Press [Purge] on the Main Analysis screen.**

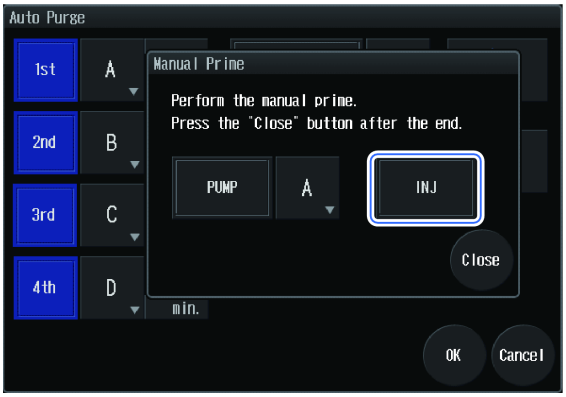
Displays the [Auto Purge] screen.

4 **Press [Manual Prime].**

Display the [Manual Priming Standby] screen.

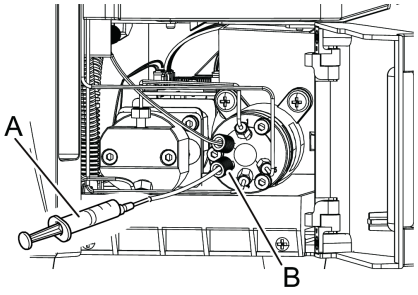
5 **Press [INJ].**

The flow line will be switched for manual priming.



6 **Pull the plunger of the syringe with needle (A) and aspirate the rinse solution.**

The criterion value for the aspiration volume is 5 mL.



7 **Press [Close] to finish manual priming.**

The display returns to the [Auto Purge] screen.

8 **Reset the tube and close the valve mount door.**

9 **Configure the settings for [Rinse] to 10 minutes or more, and perform an autopurge.**

Reference "3.5.5 Performing an Autopurge" P.64

NOTE After manual priming, the pressure of the measurement line may decrease, thus causing air bubbles to be generated. To remove air bubbles, conduct an autopurge for 10 minutes or more after manual priming.

4.4 Changing Sample Racks for the Autosampler

The model without a sample cooler is provided with 1.5 mL sample vial plates and the model with a sample cooler is provided with 1.5mL sample vial metal plate as a standard. The procedure for changing the settings to use other plates is described below.

NOTE Additional plates are optional extras.

Reference "1.2.3 Recommended Items" P.11

■ Procedure

When the plate type has been changed, set the rack ID, plate type, needle stroke, and rack position through the following procedure.

	Procedure	Explanation	Ref.
1	Setting the Rack ID	Move the sliding switch of the sample rack to set the rack ID (A to G).	P.93
2	Selecting a plate type	Select the type of plate being place on the specific sample rack.	P.96
3	Setting the needle stroke from the top	Set the needle stroke (drop amount of the needle) for sample aspiration according to the well depth of the plate being used.	P.100
4	Adjusting the Rack Positions	Adjust the rack position so that the dropping positions of the needle in the 4 wells in the plate will become the center of the well.	P.103

4.4.1 Setting the Rack ID

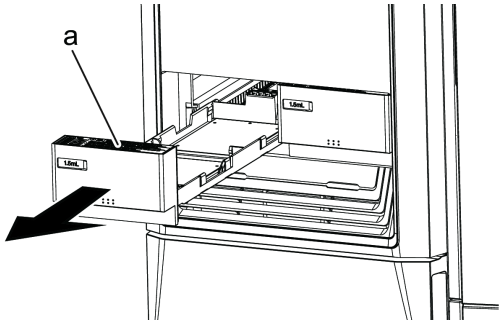
The rack ID is the ID the instrument uses to identify the type of the plate that has been inserted. Set the rack ID by operating the sliding switch at the rear of the sample rack.

The 2 sample racks provided with the instrument have rack IDs set to "A" and "B" by factory default, meaning that the needle strokes and rack positions are adjusted for a "1.5 mL sample vial plate" or "1.5 mL sample vial metal plate".

NOTE
- When the rack ID settings have been changed, it is necessary to configure the plate type, set the needle stroke from the top, and adjust the rack position.
- If the plate type is changed but the same rack ID is used, the needle stroke from the top should be set and the rack position adjusted.

Reference
- "4.4.4 Setting the Plate Type and Needle Stroke from the Top" P.100
- "4.4.5 Adjusting the Rack Positions" P.103

1 **Remove the sample rack (a).**



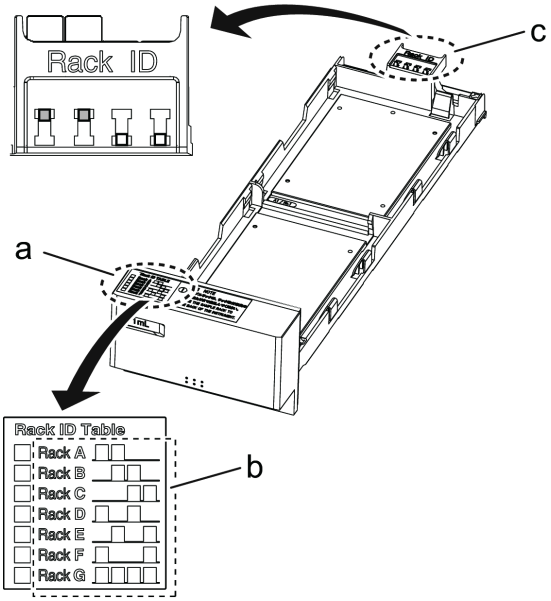
2 **Check the label (a) in front of the sample rack to verify the sliding switch position (b) of the rack ID to be set.**

Reference "Positional relation between the rack ID and the sliding switch" P.95

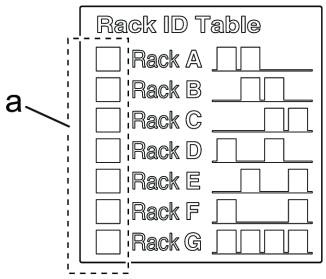
3 **Set the sliding switch position (c) at the back of the sample rack.**

NOTE Move the sliding switch forward or backward after pushing the projection a little.

Set different rack IDs for the left and right sample racks. If the same rack ID is set, an error message saying "Racks that have the same ID are set in the autosampler." is displayed.

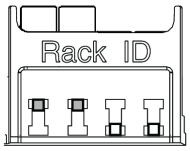
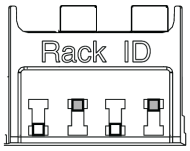
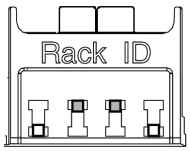
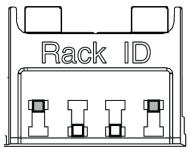
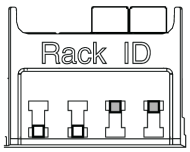
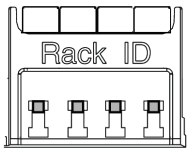
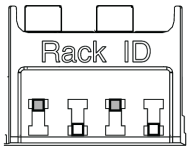


4 **Check the boxes (a) for set rack IDs using a permanent marker.**



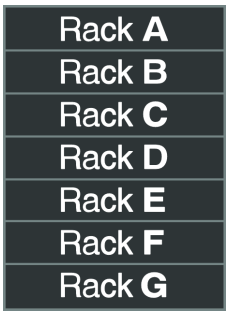
Positional relation between the rack ID and the sliding switch

The rack ID can be selected from seven types (A to G).

Rack ID	Sliding Switch Position	Rack ID	Sliding Switch Position
A		E	
B		F	
C		G	
D		-	-

■ Labels to affix to front of handle

The sample rack is supplied with labels to be put on the handle. When necessary, apply them to a location that can be easily seen, such as the front of the handle.



4.4.2 Setting the Plates on the Sample Rack

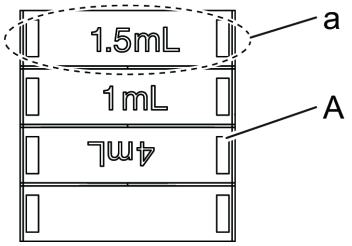
Set the type of plate to place on the sample rack.

NOTE

- The provided sample rack is set with "1.5 mL sample vial plate" or "1.5 mL sample vial metal plate".
- When the plate type selected on the settings screen differs from that of the plate, the needle may come down to a different position from the plate well, thus damaging the needle. If the plate is changed, be sure to change the plate type on the settings screen (P. 91), set the needle stroke (P. 91), and adjust the rack position (P. 93).

1 Insert the provided plate identification panel into the sample rack.

1 Set the plate type (a) indicated by the plate identification panel (A) on the upper side with the letters facing upwards.



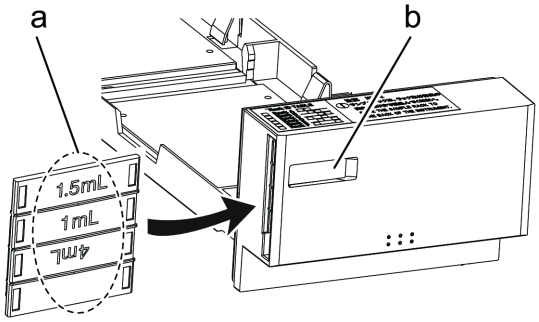
(Example in the figure) 1.5 mL sample vial plate

Indications and positions of plate identification panels

Plate Type	Display	Position
1 mL Sample Vial Plate	1 mL	Front
1.5 mL Sample Vial Plate 1.5mL Sample Vial Metal Plate	1.5 mL	Front
4 mL Sample Vial Plate	4 mL	Front
96-Well Microtiter Plate	MTP96	Back
96-Well Deep-Well Plate	DWP96	Back
384-Well Microtiter Plate	MTP384	Back

Plate Type	Display	Position
384-Well Deep-Well Plate	DWP384	Back

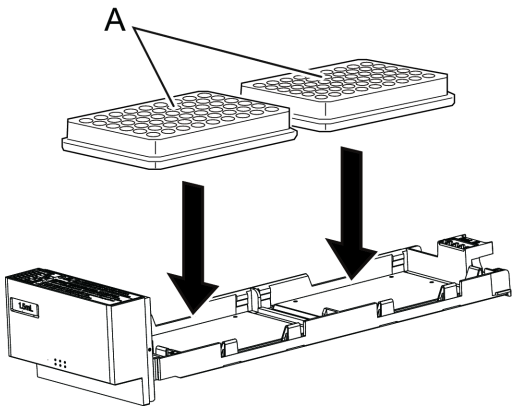
2 Insert the panel with the vertical position aligned so that the plate type display (a) can be seen from the sample rack identification window (b).



Hint Flip the panel over and insert upside down, thus enabling the plate type display to be seen from the identification window.

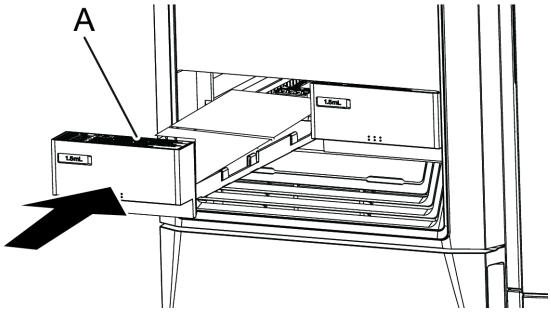
2 Place 2 plates (A) of the same type on the sample rack

NOTE Place 2 plates (A) of the same type on the sample rack.



3 Install the sample rack (A).

NOTE If the same rack ID is set for both the left and right racks, an error message saying "Racks that have the same ID are set in the autosampler." is displayed. Change either the left or right rack ID.



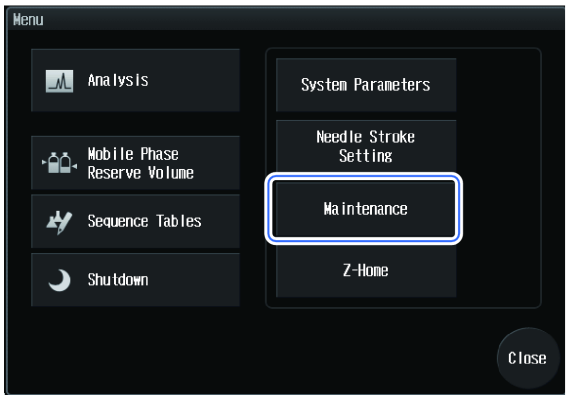
4.4.3 Opening the Rack Settings Screen

1 **Display the [Maintenance] screen.**

1 Press (Menu).

The [Menu] screen is displayed.

2 Press [Maintenance].
The [Maintenance] screen is displayed.



2 Display the [System Adjustment] screen.

1 Press  (Calibration tab).

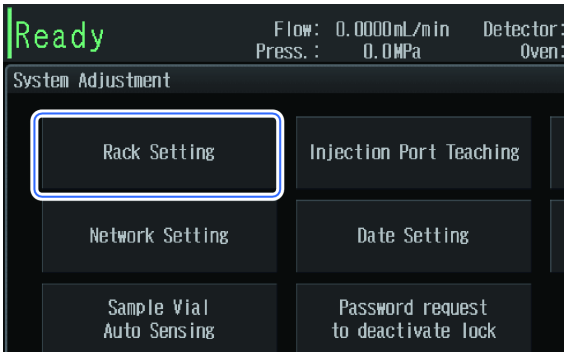
The [Login] screen is displayed.

2 Enter the system pass ID Number and press [OK].
The initial value for the system pass ID Number is set to "00000".
The [Calibration] screen is displayed.

3 Press [System Adjustment].
The [System Adjustment] screen is displayed.

3 Press [Rack Setting].

The [Rack Setting] screen is displayed.



4.4.4 Setting the Plate Type and Needle Stroke from the Top

1 **Display the [Rack Setting] screen in [System Adjustment].**

2 **Select the rack ID**

1 Press  to select a rack ID.

2 Press  .

The [Rack Setting] screen is displayed.

3 **Select a plate type.**

Select a plate type to be used.

Reference Plate type and needle stroke from the top

4 **Set the needle stroke from the top.**

Input a value depending on the plate type to be used.

Reference Plate type and needle stroke from the top

5 **Press [OK].**

Continue with the rack position adjustment.

Reference "4.4.5 Adjusting the Rack Positions" P.103

■ Plate type and needle stroke from the top

Plate Type	Screen Display	Needle Stroke from the Top	
		Setting Range	Initial Value
1 mL Sample Vial Plate	1 mL	10 mm to 52 mm	47 mm
1.5 mL Sample Vial Plate 1.5mL Sample Vial Metal Plate	1.5 mL	10 mm to 52 mm	47 mm
4 mL Sample Vial Plate	4 mL	10 mm to 52 mm	47 mm
96-Well Microtiter Plate	MTP96	10 mm to 52 mm	45 mm
96-Well Deep-Well Plate	DWP96	10 mm to 52 mm	40 mm
384-Well Microtiter Plate	MTP384	10 mm to 52 mm	45 mm
384-Well Deep-Well Plate	DWP384	10 mm to 52 mm	40 mm

⚠ CAUTION

Instruction

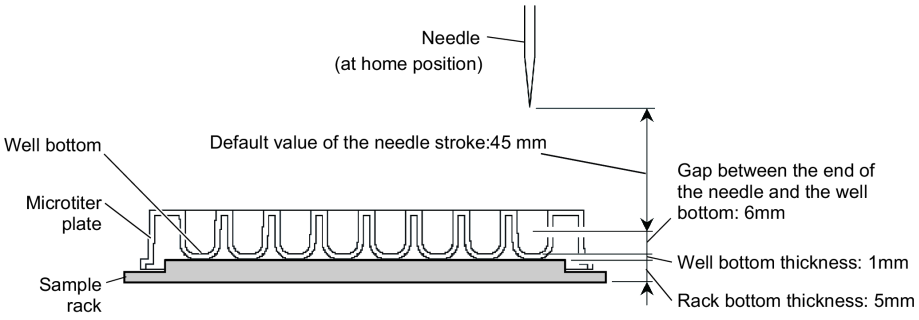
When using a resin sample vial or a small volume type sample vial that has a thin end, set the needle stroke to 45 mm or less.

Part Name	Part No.
1.1 mL Sample Vial	S228-21283-91
1 mL Sample Vial	S228-31600-91
0.3 mL Sample Vial	S228-16847-92
0.2 mL Sample Vial	S228-35217-91

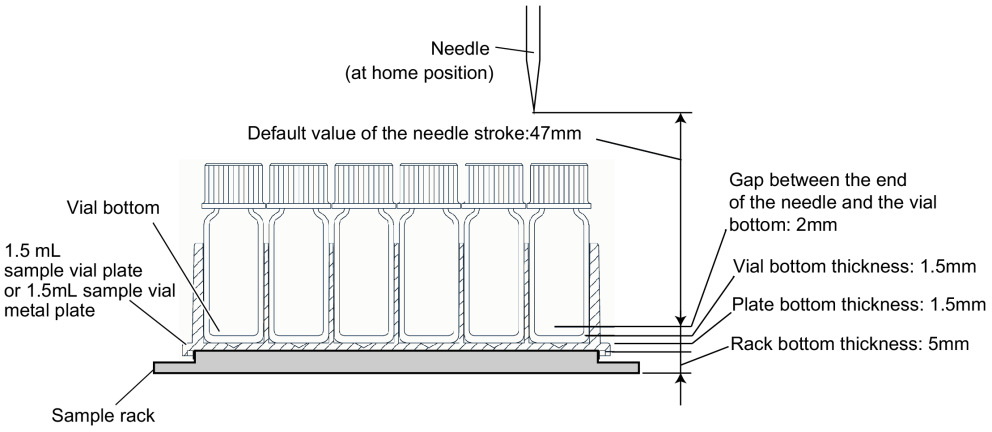
Setting the needle stroke to more than 45 mm may cause the needle to hit the bottom, thus resulting in variation of the aspirated sample amount or damage to the tip of the needle.

NOTE

- Configure the set value for the needle stroke so that the gap between the tip of the needle and the vial bottom or well bottom is 1 mm or more. When there is no gap between the tip of the needle and the vial bottom or well bottom, the tip of the needle will contact the vial bottom or well bottom during sample aspiration, resulting in sample aspiration failure, thereby preventing proper analysis results from being obtained.
- Using a microtiter plate
  If the needle stroke is set to 45 mm, the initial value, the tip of the needle is designed to come down to about 6 mm from the well bottom when the well bottom thickness of the plate is 1 mm.



- Using a 1.5 mL sample vial plate or 1.5mL vial Metal Plate
  If the needle stroke is set to 47 mm, the initial value, the tip of the needle is designed to come down to about 2 mm from the vial bottom when the vial bottom thickness is 1.5 mm.



Residual volume in bottom 2 mm of sample vial and reagent bottle

Part Name	Volume	Part No.	Residual Volume in Bottom 2 mm of Reagent Bottle
4 mL Sample Vial	4 mL	S228-21287-91	Approx. 400 µL
4 mL Sample Vial	4 mL	S228-31537-91	Approx. 400 µL
1.5 mL Sample Vial	1.5 mL	S228-15652-92	Approx. 150 µL
1.1 mL Sample Vial	1.1 mL	S228-21283-91	Approx. 5 µL
1 mL Sample Vial	1 mL	S228-39699-91	Approx. 100 µL
1 mL Sample Vial	1 mL	S228-31600-91	Approx. 25 µL
0.3 mL Sample Vial	300 µL	S228-21284-91	Approx. 20 µL
0.3 mL Sample Vial	300 µL	S228-16847-92	Approx. 5 µL
0.2 mL Sample Vial	200 µL	S228-35217-91	Approx. 5 µL

4.4.5 Adjusting the Rack Positions

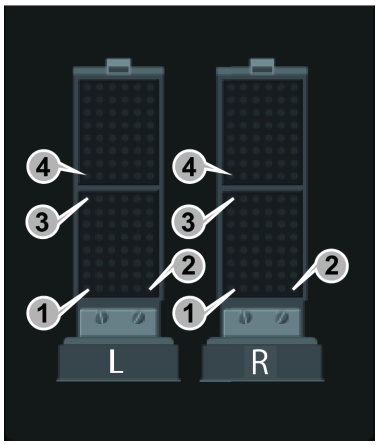
Depending on the plate fitted onto the sample rack, adjust the position to which the needle moves down.

NOTE

- The plate placed on the sample rack must be of the type that has been selected on the settings screen. Placing a different type of plate causes incorrect adjustment.
- Stored rack positions include combinations of the right/left rack plates, rack IDs, and plate types. Adjust the rack position for all plates to be set on the sample rack. If the rack IDs or plate types are changed, adjust the rack positions again.

Reference "4.4.1 Setting the Rack ID" P.93

Position number and adjustment position



Position Number	Adjustment Position	Number Displayed on Plate				
		1 mL Sample Vial	1.5 mL Sample Vial	4 mL Sample Vial	96 Hole MTP/DWP	384 Hole MTP/DWP
1	Front Left Corner of the Front Plate	1	1	1	A01	A01
2	Front Right Corner of the Front Plate	73	46	22	H01	P01
3	Rear Left Corner of the Front Plate	12	9	7	A12	A24
4	Front Left Corner of the Rear Plate	1	1	1	A01	01

NOTE When adjusting the rack position for sample vial plates, insert the sample vials into all the adjustment positions. Plates only would not be enough for adjustment to be performed.

⚠ WARNING

Prohibition

Never put hands inside the instrument while adjusting the rack positions.

Failure to comply with the above precaution may result in injury. While the rack positions are adjusted, the Z mount and the needle operate even if a sample rack is removed.

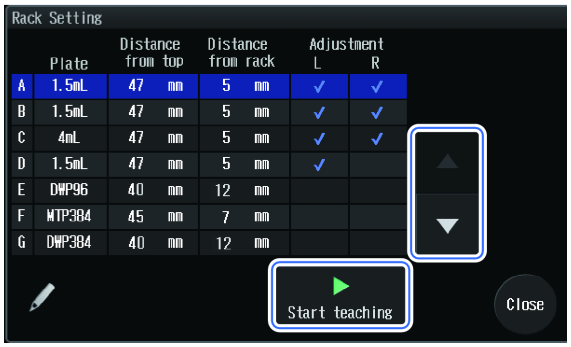
1 Display the [Rack Setting] screen.

Reference "4.4.3 Opening the Rack Settings Screen" P.98

2 Select a plate type.

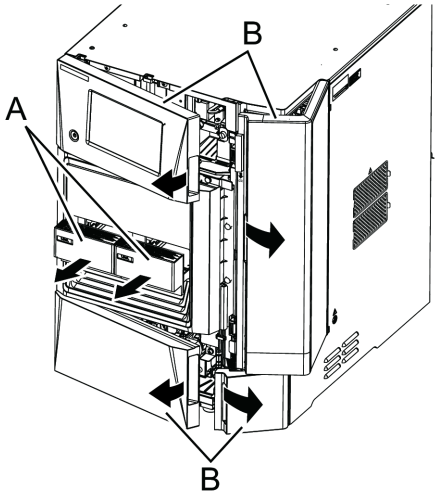
1 Press ▲ ▼ to select a rack ID.

2 Press [Start teaching].
The [Select Position] screen is displayed.

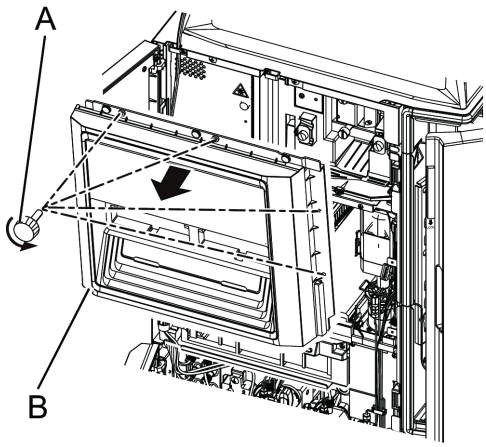


3 Remove the front panel.

1 Remove the inserted sample racks (A) and open the panels and doors (B) as shown in the diagram.

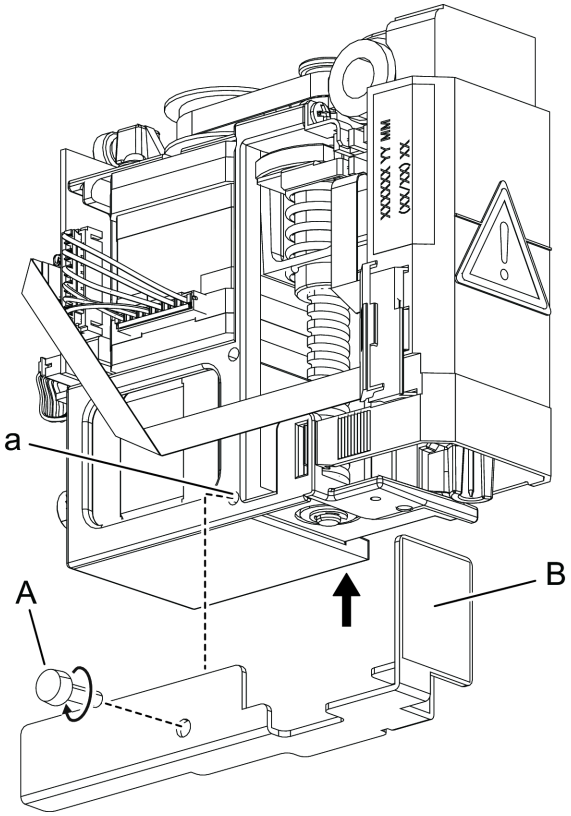


2 Remove the 4 knurled screws (A), pull the front panel (B) forward to the right, disconnect the tube from the left slot of the front panel (B), and detach the front panel (B).

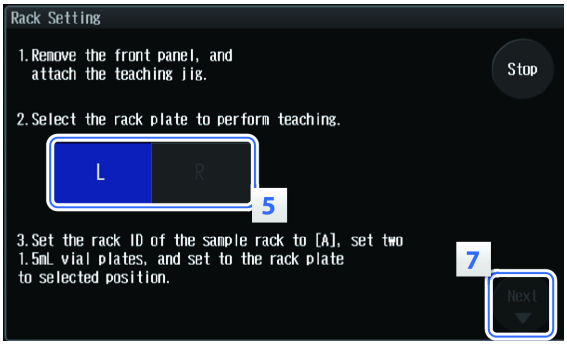


4 Attach the rack teaching jig to the Z mount.

1 Install the rack teaching jig (B) in the threaded screw hole (a) at the bottom of the left side of the Z mount by aligning the jig hole and the screw hole using the cap/knob (A).

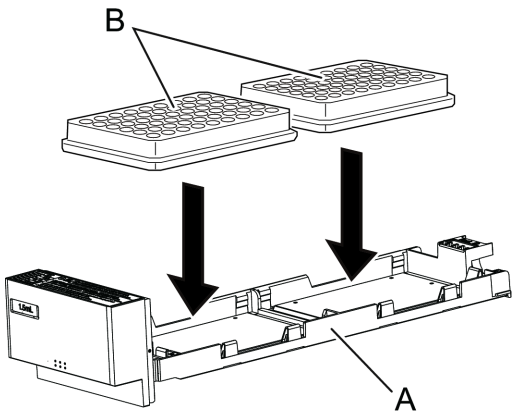


5 Select the rack position (L/R) to be adjusted.



6 Put the plates on the sample rack and insert into the instrument.

1 Put the plates (B) on the sample rack (A) whose position will be set.

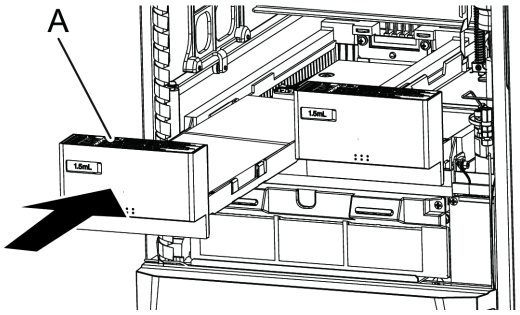


⚠ CAUTION

Prohibition

Do NOT attach the sample vial cap when adjusting the 4 mL vial plate position.
The cap may make contact with the teaching jig, which can cause errors. If an error occurs, restart the instrument and readjust the position.

2 Insert the sample rack (A) on the side for setting the rack position.

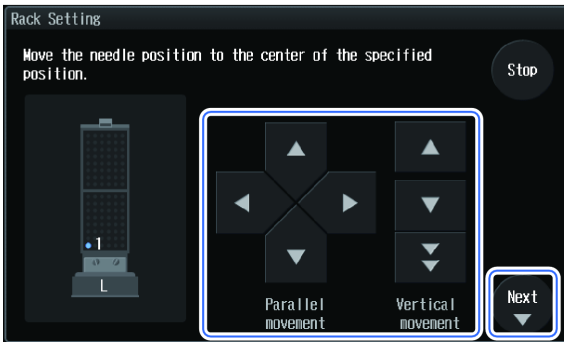


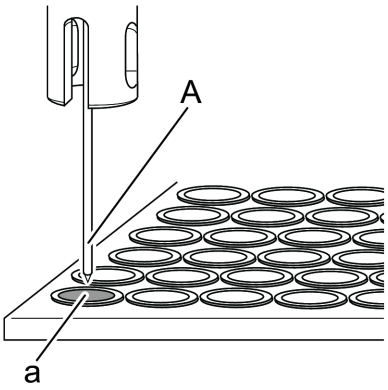
7 Press [Next].

The [Position1] Adjustment screen is displayed, and the needle moves to [Position1].

8 Finely adjust the needle position.

1 Press [Parallel movement] and [Vertical movement] to move the tip of the needle (A) to the center of the positioning hole (a).





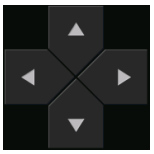
Hint

- Use [Vertical movement] to drop the tip of the needle to a height that makes it easy to check the relative position between the needle tip and the left-right and front-back positions of the hole.
- Use [Parallel movement] to align the tip of the needle with the center of the hole.

2 Press [Next].
The next [Position] Adjustment screen is displayed, and the needle moves near the next position.

Needle distances moved: left-right and front-back, up and down

[Parallel movement] and [Vertical movement] each move the needle as described in the following table.

Direction	Operation
 (Left-Right and Front-Back Directions)	The needle moves in 0.1 mm increments.
 (Up)	The needle moves to the highest point.
 (Down)	First needle drop: 4.0 mm, Second and subsequent drops: 0.2 mm
 (Down (Large))	First needle drop: 4.0 mm, Second and subsequent drops: 1.0 mm

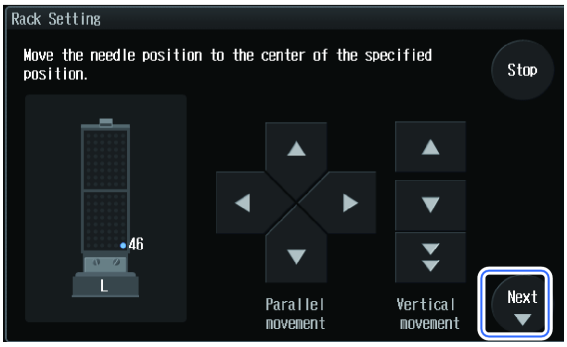
NOTE

- Press [Stop] to cancel the adjustment during the procedure. The adjustment is finished without updating the needle position.
- [Vertical movement] is for checking the relative position with the hole by bringing the tip of the needle closer to a well or a sample vial. This function is not for deciding the needle stroke.

9 Repeat Procedure 8 for fine adjustment of the remaining positions.

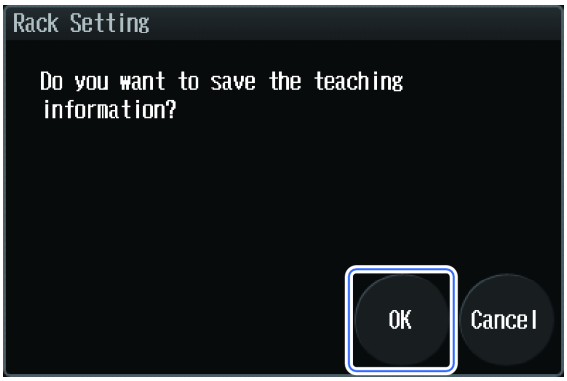
After finishing adjustment on the [Position4] screen and pressing [Next], the message "Do you want to save the teaching information?" is displayed.

Hint Press [Cancel] to close the message without saving the data.



10 Press [OK].

The message "Remove the teaching jig." is displayed.



11 Remove the rack teaching jig from the Z mount.

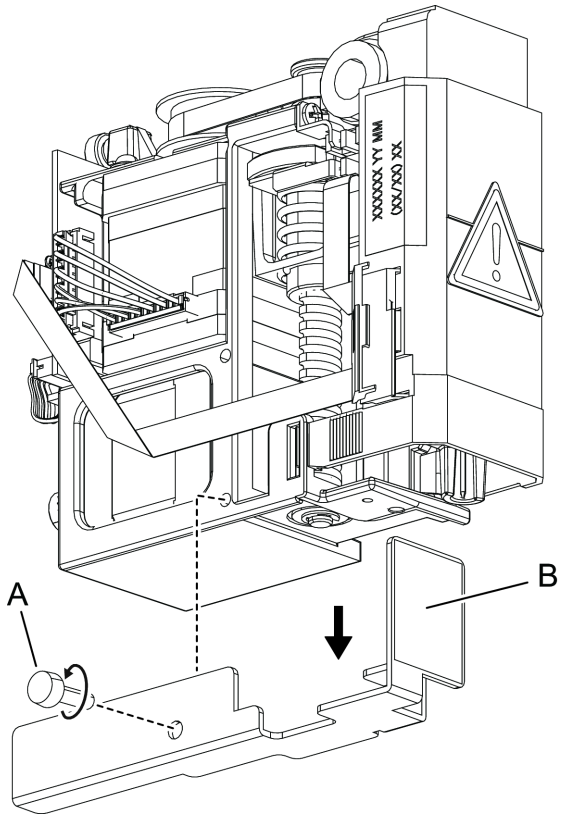
1 Remove the cap/knob (A) and remove the rack teaching jig (B).

⚠ CAUTION

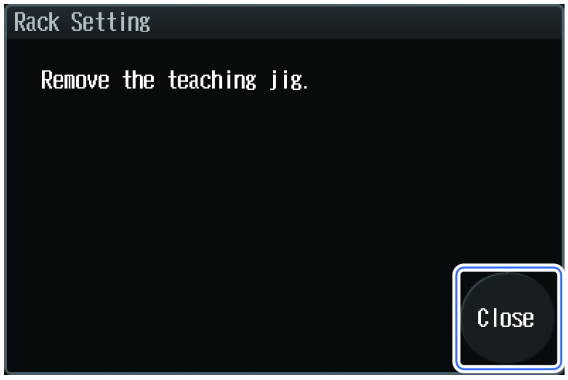
Instruction

After rack position adjustment is finished, remove the rack teaching jig and cap/knob.

Failure to do so will result in interference with the drive section and will prevent normal operation. It may also cause damage to the instrument.



12 Press [Close].



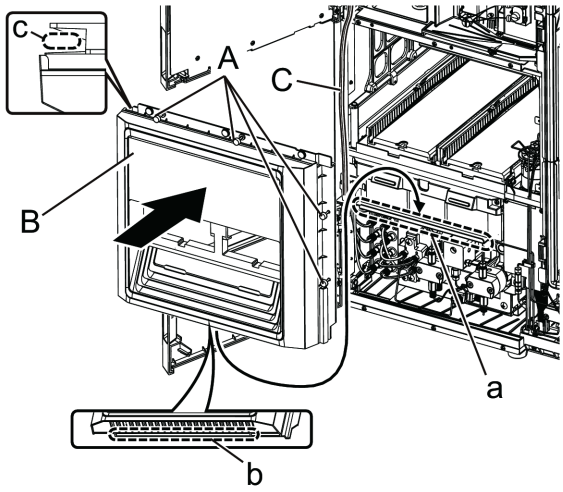
13 Attach the front panel.

1 Remove the sample rack.

2 Align the groove (b) on the bottom of the front panel with the protrusion on the main body frame (a) to insert the front panel.

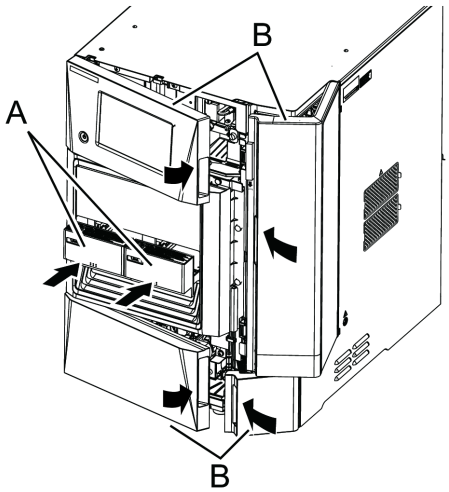
3 Insert the bundle of tubes (C) into the opening (c) on the left side of the front panel.

4 Attach the 4 knurled screws (A).



NOTE If the front panel (B) is not attached correctly, condensation may settle on the rack plate.

5 Attach the removed sample racks (A) and close the panels and doors (B) as shown in the diagram.



4.5 Pretreatment function

4.5.1 About pretreatment function

The pretreatment function enables you to perform a variety of sample injection operations that are different from the standard injection operation. Routines for sample dilution, reagent addition, and co-injection can be easily configured through the Pretreatment screen.

NOTE The pretreatment program can only be set from the workstation, LabSolutions LC/GC (version 5.92 or later) or LabSolutions DB (version 6.82 or later)

NOTE • Expected performance for pretreatment functions

Item	Expected Performance	Remark
Dilution accuracy	± 10 % max.	
Area reproducibility between vials	RSD ≤ 1% (5 µL injection)	When the dilution ratio is smaller than 1/10 and total volume of liquid makes to is greater than 100 µL.

NOTE • To improve the mixing performance, round bottom vials provide greater efficiency.
The vial given below is recommended.

Part name	Capacity	Material	Part No.	Application	Remark
1 mL sample vial	1 mL	Polypropylene Cap: polyethylene	S228-31600-91	For general purpose/ Small volume	200 vials (with cap)
				Disposable	

- Adjust the needle stroke depending on the height of the vial bottom for each type of sample vial will be used. A 1.5 to 2.0 mm gap between the needle tip and vial bottom is needed. If the gap is too small or too big, mixing performance and accuracy will suffer.
- During mixing operations, dilution solvent may enter the measuring pump lines. To fully replace the rinse solution in those lines, set the Rinse Volume to 2000 µL for each injection.

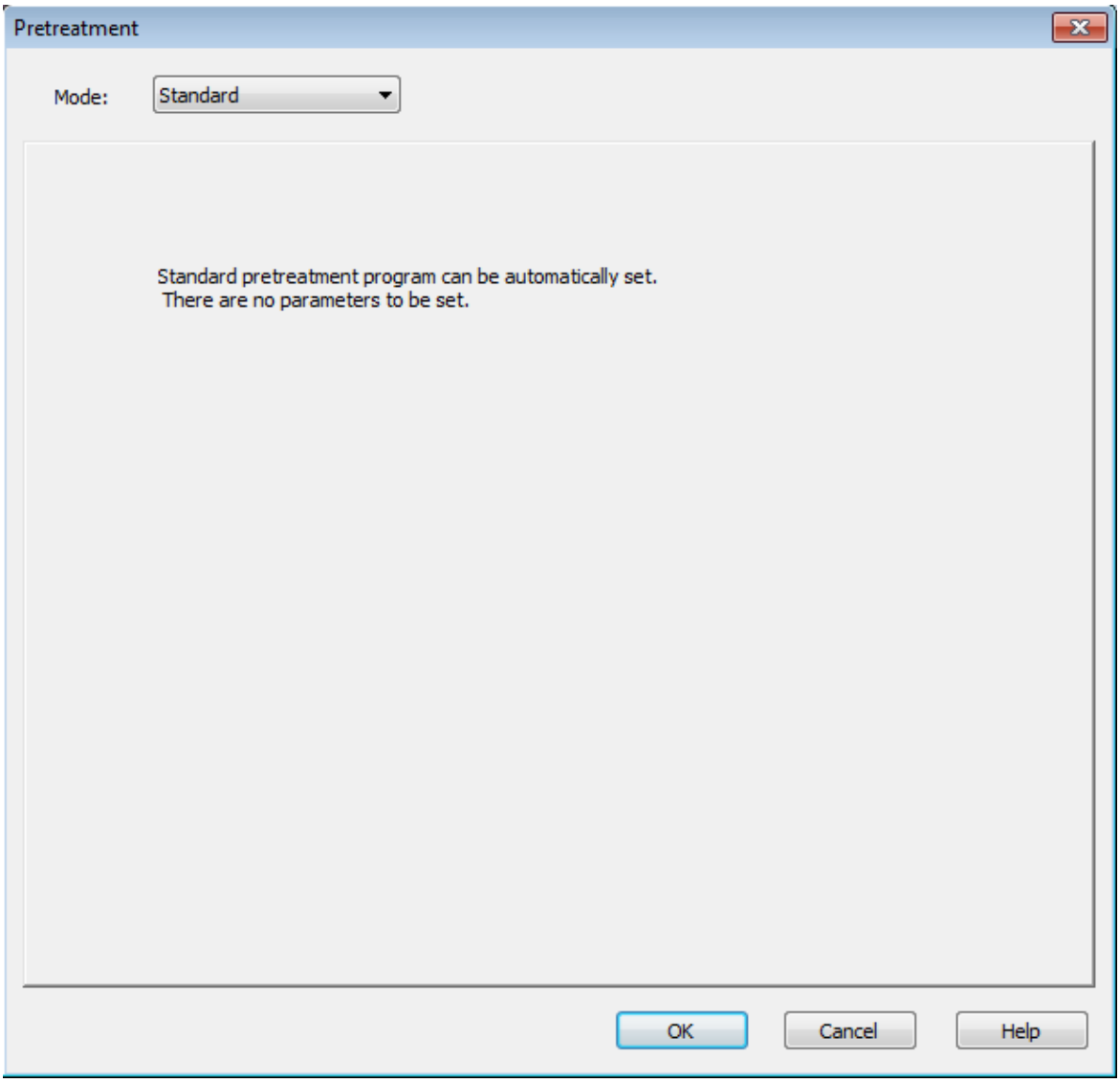
4.5.2 Pretreatment function operation setting mode

The [Pretreatment] screen provides four modes: Standard, Dilution, Reagent, and Co-injection.

■ Standard mode

In standard mode, the standard pretreatment program is automatically set and no further settings are required.

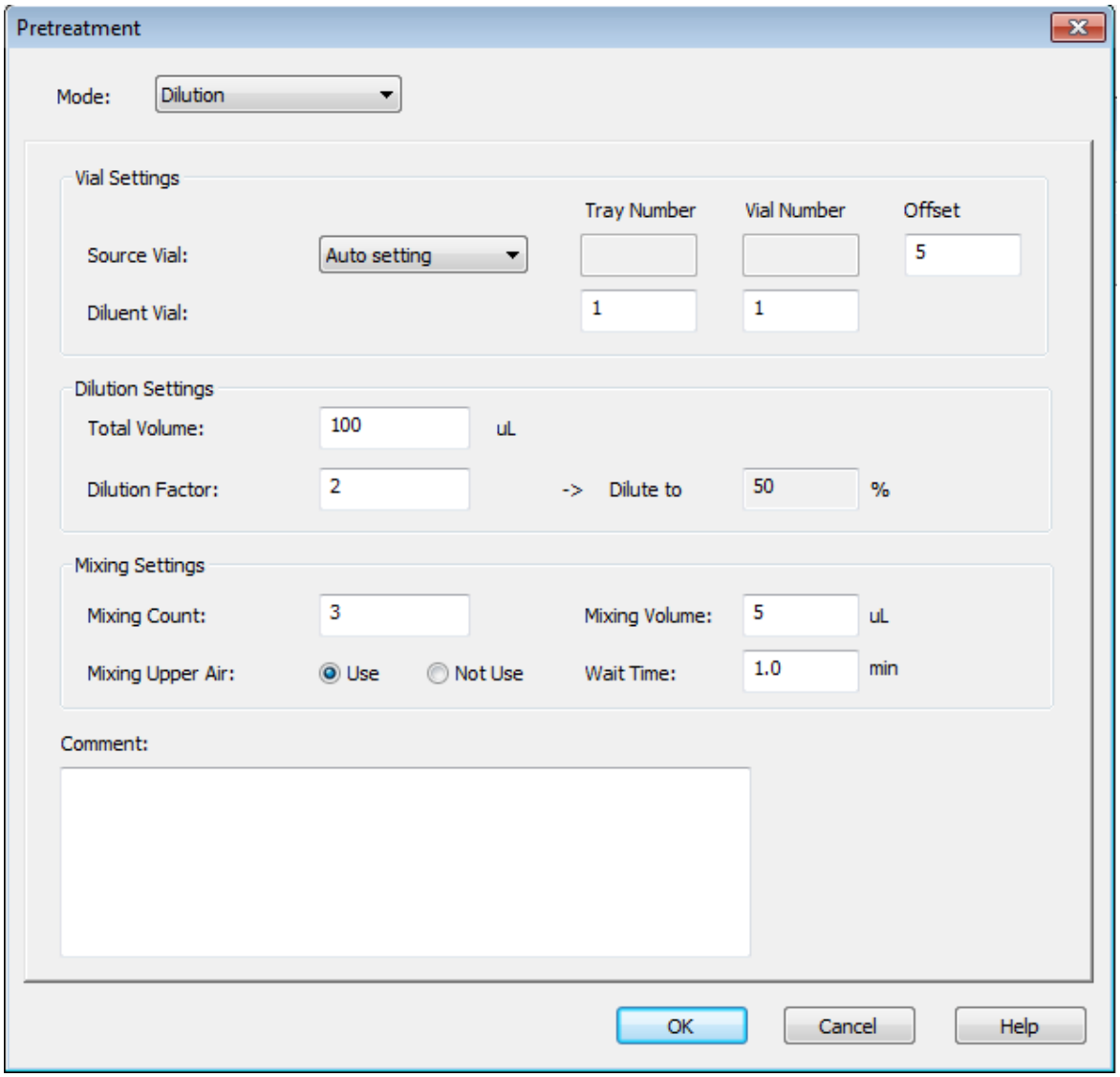
Standard mode screen



■ Dilution mode

Sample dilution included in the pretreatment function can be programmed simply with the parameter settings on the screen shown below.

Dilution mode screen



• Vial settings

Set the sample vial that contains a stock solution to be diluted at [Source Vial]. Set the sample vial number that contains a diluent or the rinse solution to be used for dilution at [Diluent Vial].

Item	Description		Set Range	Default Value
Source Vial	Select the method for specifying the sample vial that contains a stock solution to be diluted.		Auto setting Vial number setting	Auto setting
Source Vial	Tray Number (Vial setting)	Specify the tray number of the sample vial that contains a stock solution to be diluted.	1 to 4	1
	Vial Number (Vial setting)	Specify the number of the sample vial that contains a stock solution to be diluted.	Set the value within the range below depending on the plate type. An error will occur at the time of injection if the set value is out of the range. [1.5 mL plate] 1 to 54 [1 mL plate] 1 to 84 [4 mL plate] 1 to 28 [MTP 96] 1 to 96 [MTP 384] 1 to 384 [DWP 96] 1 to 96 [DWP 384] 1 to 384	1
	Offset (Auto setting)	When auto setting is selected at [Source Vial], set the distance between the injection vial and the source vial. For example, if the injection vial is 1 and offset 5, then the stock solution vial is set to 6.	The value of injection vial + [Offset] must be less than or equal to the last vial position on the rack, or an error will occur at the time of injection.	5

Item	Description		Set Range	Default Value
Diluent Vial	Tray Number	Specify the tray number of the sample vial that contains a diluent.	1 to 4	1
	Vial Number	Specify the number of the sample vial that contains a diluent.	Set the value within the range below depending on the plate type. An error will occur at the time of injection if the set value is out of the range. [1.5 mL plate] 1 to 54 [1 mL plate] 1 to 84 [4 mL plate] 1 to 28 [MTP 96] 1 to 96 [MTP 384] 1 to 384 [DWP 96] 1 to 96 [DWP 384] 1 to 384	1

• Dilution Settings

Item	Description	Set Range(units)	Default Value
Total Volume	Set the volume of the mixed solution after dilution.	100 to 1000 (μL)	100
Dilution Factor	Sets (mixed solution volume) / (stock solution volume).	2 to 100	2

NOTE If the total volume after dilution is not divisible by the dilution factor, the dilution factor takes priority so that the total volume will be less than the specified volume.
Example: When "3" is set at [Dilution Factor] and 100 μL is set at [Total Volume]: Stock solution 33 μL and diluent 66 μL are mixed and the total volume after dilution becomes 99 μL.

• Mixing Setting

Item	Description	Set Range(Unit)	Default Value
Mixing Count	The instrument performs mixing while aspirating and dispensing the mixed solution through the needle. Set the number of mixing cycles here.	1 to 10	3
Mixing Volume	Set the volume to be aspirated and dispensed for each mixing cycle.	1 to 25 (μL)	5
Mixing Upper air	Select whether or not to perform bubbling by discharging air through the needle during dilution.	Use	Use
		Not Use	
Wait Time	Set the wait time before sample injection after completion of pretreatment.	0.1 to 999.0 (min)	1.0

• Comment

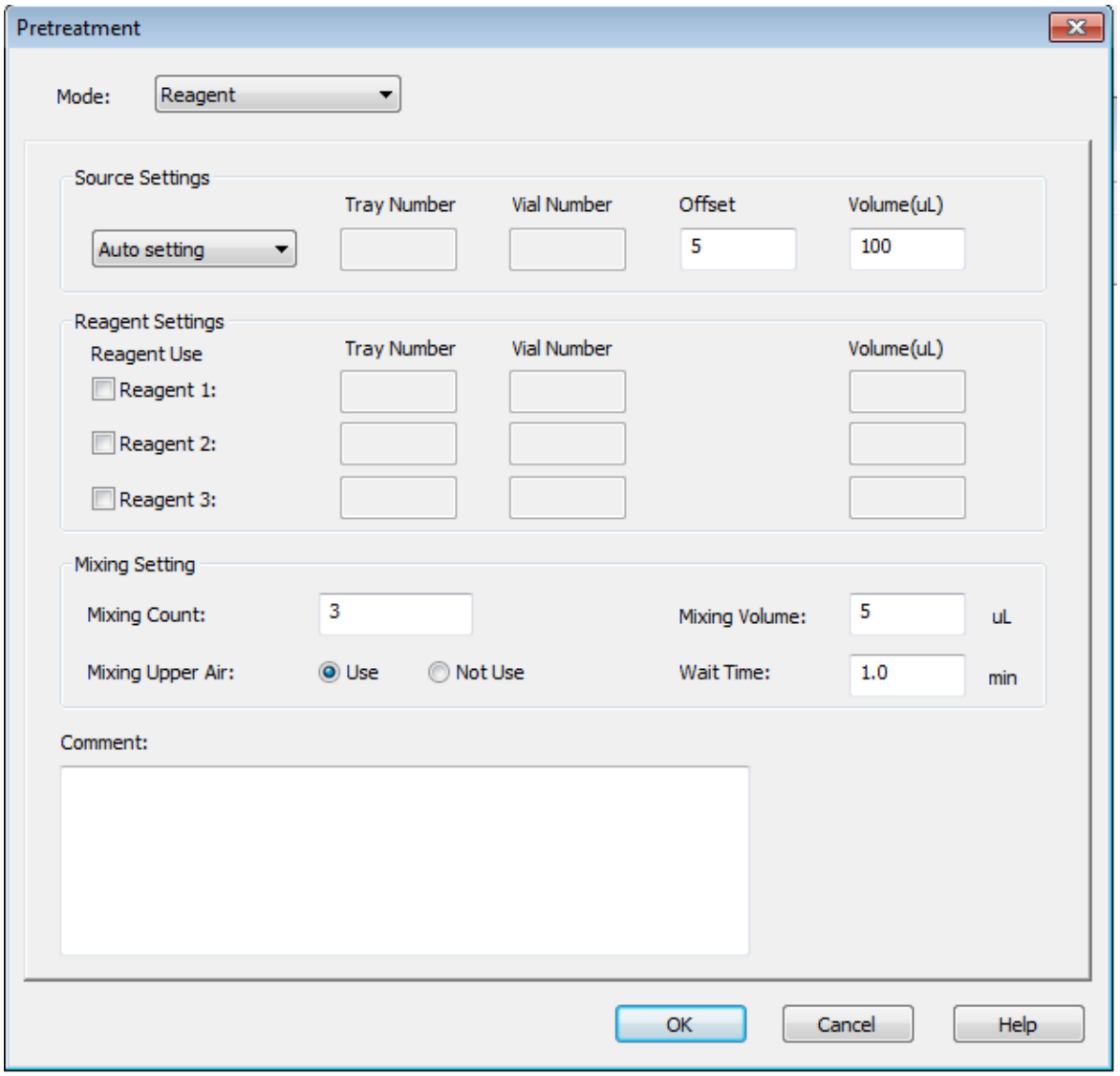
Any comments can be written in a box.

NOTE The comments can be described within 7 lines, 1024 one-byte characters per line.

■ Reagent Mode

Reagent addition included in the pretreatment function can be programmed simply with parameter settings on the screen shown below.

Reagent mode screen



• Source settings

Item	Description	Set Range	Default Value
Source Vial	Select the method for specifying the sample vial that contains a stock solution to which a reagent is to be added.	Auto setting Vial number setting	Auto setting
Tray Number (For vial number setting)	Specify the tray number of the sample vial that contains a stock solution to which a reagent is to be added.	1 to 4	1
Vial Number (For vial number setting)	Specify the number of the sample vial that contains a stock solution to which a reagent is to be added.	Set the value within the range below depending on the plate type. An error will occur at the time of injection if the set value is out of the range. [1.5 mL plate] 1 to 54 [1 mL plate] 1 to 84 [4 mL plate] 1 to 28 [MTP 96] 1 to 96 [MTP 384] 1 to 384 [DWP 96] 1 to 96 [DWP 384] 1 to 384	1
Offset (Auto setting)	When auto setting is selected at [Source Vial], set the distance between the injection vial and the source vial. For example, if the injection vial is 1 and offset 5, then the stock solution vial is set to 6.	The value of injection vial + [Offset] must be less than or equal to the last vial position on the rack, or an error will occur at the time of injection.	5
Volume	Set the volume of stock solution to which a reagent is added.	1 to 1000 (μL)	100

• Reagent Settings

Item	Description	Set Range	Default Value
Reagent Use Reagents 1 to 3	Select whether or not to use reagent 1 to 3.	ON, OFF	OFF
Tray Number	Specify the tray number of the sample vial that contains reagent 1 - 3 to be added.	1 to 4	1
Vial Number	Specify the number of the sample vial that contains reagent 1 - 3 to be added.	Set the value within the range below depending on the plate type. An error will occur at the time of injection if the set value is out of the range. [1.5 mL plate] 1 to 54 [1 mL plate] 1 to 84 [4 mL plate] 1 to 28 [MTP 96] 1 to 96 [MTP 384] 1 to 384 [DWP 96] 1 to 96 [DWP 384] 1 to 384	1
Volume	Set the volume of reagent 1 to 3 to be added.	1 to 1000 (μL)	100

• Mixing settings

Item	Description	Set Range (Units)	Default Value
Mixing Count	The instrument performs mixing while aspirating and dispensing the mixed solution through the needle during reagent addition. Set the number of mixing cycles here.	1 to 10	3
Mixing volume	Set the volume to be aspirated and dispensed for each mixing cycle.	1 to 25 (μL)	5
Mixing Upper Air	Select whether or not to perform bubbling by discharging air through the needle during reagent addition.	Use	Use
		Not Use	
Wait Time	Set the wait time before sample injection after completion of pretreatment.	0.1 to 999.0 (min)	1.0

• Comment

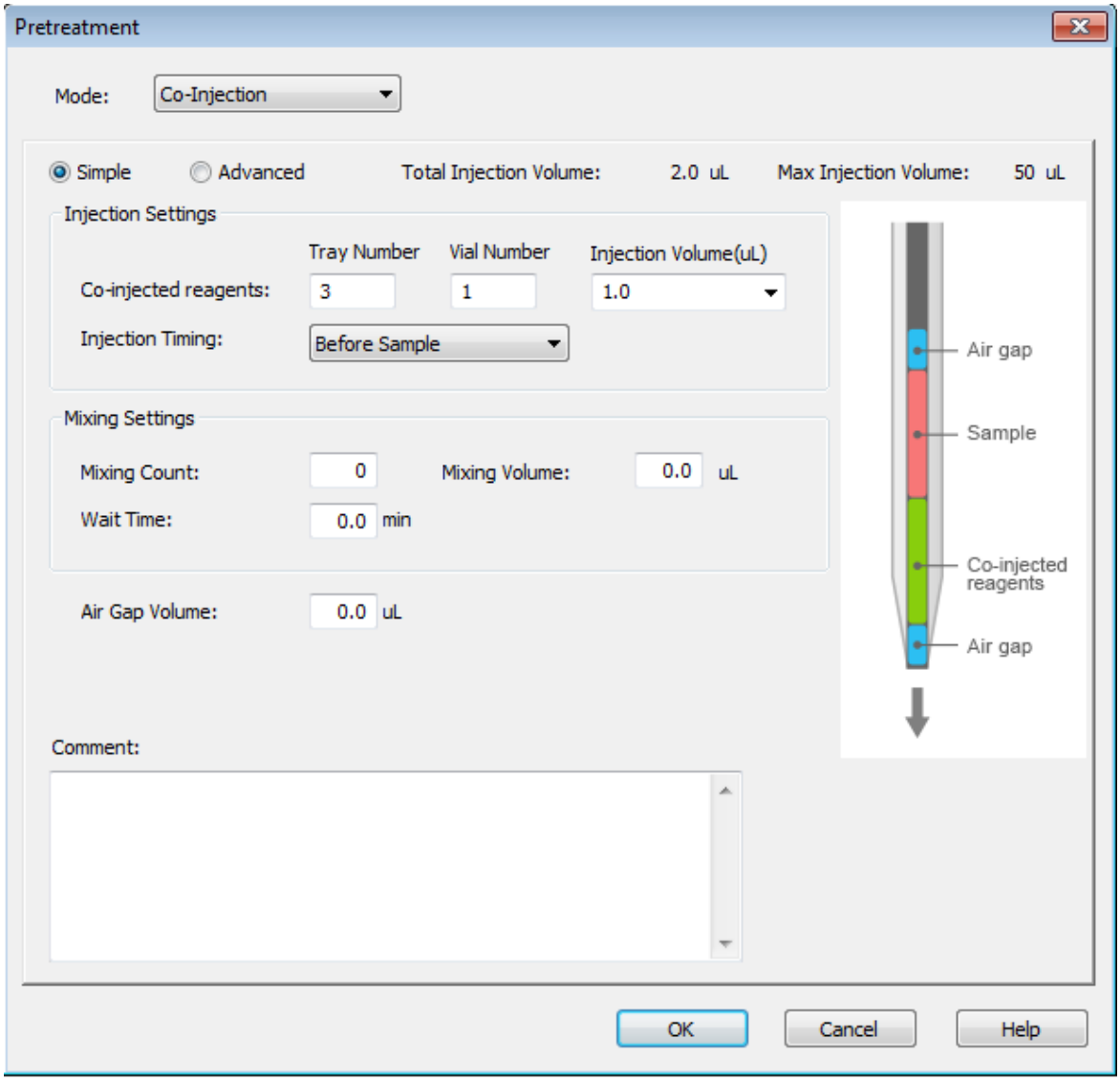
Any comments can be written in a box.

NOTE The comments can be described within 7 lines, 1024 one-byte characters per line.

■ Co-injection mode

In the co-injection mode, the sample solution and co-injection reagent are aspirated in the user specified order and injected together. This function provides two operation modes, [Simple] mode and [Advanced] mode. [Simple] mode allows creation of a co-injection method by setting just a few simple parameter, as described here. Please refer to documentation of LabSolutions for greater detail regarding [Advanced] mode operation.

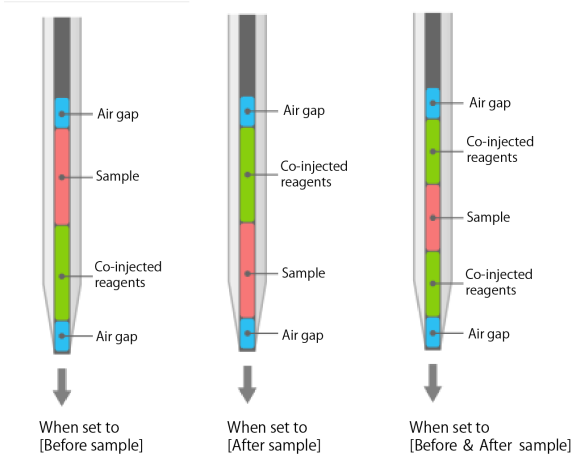
Co-injection mode "simple" set screen



• Injection setting

item	Explain	set range(unit)	Default value
Tray Number	Specify the tray number of the co-injection reagent vial is set.	1 to 4	3
Vial Number	Specify the vial number of the co-injection reagent vial.	Set the value within the range below depending on the plate type. An error will occur at the time of injection if the set value is out of the range. [1.5 mL plate] 1 to 54 [1 mL plate] 1 to 84 [4 mL plate] 1 to 28 [MTP96] 1 to 96 [MTP384] 1 to 384 [DWP96] 1 to 96 [DWP384] 1 to 384	1
Injection volume	Set the volume of co-injection reagent.	" Same as the sample", or set the value from 0.0 to {maximum injection volume – 5} (μL)	1.0
Injection timing	Specify how the co-injection reagent is aspirated into the needle.	Before sample After sample Before & After sample	Before sample

NOTE An example of "injection timing"
For example, "Before sample" setting makes the needle aspirate sample solution and co-injection eluent in serial. It results in injecting the co-injection reagent first into the column, followed by the sample solution.



• Mixing setting

item	explain	set range(unit)	Default value
Times of mixing	Set the number of times to aspirate and discharge for mixing the solvents in a needle. This operation contributes to improving the mixing performance.	0 to 10	0
Mixing volume	Set the volume to aspirate and discharge for mixing the solvents in a needle.	0.0 to {maximum injection volume - 5}(μL)	0.0
Wait time	Set the length of time to wait for the injection after completing mixing procedure.	0.0 to 999.0 (min)	0.0

• Air-gap volume

item	explain	set range(unit)	Default value
Air-gap volume	Set the volume of air-gap(s) in the needle.	0.0 to 5.0 (μL)	0.0

NOTE When using Co-injection mode, the air-gap value set in the [Autosampler] tab is ignored, the setting in the Pretreatment Co-injection screen is adopted.

• Comment

Any comments can be written in a box.

NOTE Up to 200 half-pitch characters can be entered.

4.6 Connecting the Instrument to LabSolutions

LabSolutions software provides ease-of-use and advanced functions. It supports automating and streamlining a series of analysis tasks.
Specifically, it can be used to perform the following:

• Controlling the instrument and collecting data

• Analyzing and browsing data

• Highly customizable reporting and printing

• Data management

This section explains the connection and settings operated through LabSolutions for the instrument. For details including installation, refer to the LabSolutions Instruction Manual.

4.6.1 Connecting a PC

Use a straight LAN cable to connect to a PC.

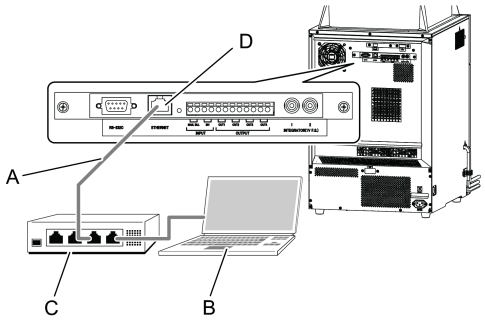
■ Using a straight LAN cable

Necessary parts

Part Name	Explanation
Straight LAN Cable	Min. Category 5 UTP straight cable
Switching Hub	100 Base-TX compatible
Cable Holder	Required when wiring a LAN cable on the floor or wall

1 **Connect the straight LAN cable (A) to the Ethernet connector (D) on the back of the instrument.**

2 **Attach the straight LAN cable (A) connected to the instrument to the switching hub (C) connected to the PC (B).**



4.6.2 Setting a Network

To operate the instrument from LabSolutions, set up the network environment on the instrument side.

NOTE For the settings configuration, refer to "4.1.3 Configuring Network Settings" in the Operation Guide or consult the network management division or the person responsible for the department or office involved.

4.6.3 Setting the Basic Parameters

A PC is needed to set the basic parameters related to the instrument. For details, refer to the LabSolutions Instruction Manual.

4.6.4 Starting Analysis by the Instrument while connecting to LabSolutions

It is possible to set a part of analysis conditions and start analysis even when the instrument is connected to LabSolutions. Refer to the help of LabSolutions to use this function.

■ Register the analysis

1 Set analysis condition.

The following parameter can be edited by awaking the lock when the instrument is connected to LabSolutions. Refer to operation guide "5.1 Method" for the detail of each parameter.

Unit	Parameter
Pump	Flow, P.Max, P.Min, Port, Solvent B/C/D Conc., Solenoid Valve 1/2/3
Autosampler	Cooler Temperature
Column Oven	Ovent Temperature, Temperature Limit (Maximum), Valve Position
Detector	Wavelength Ch1/2 (Only for UV Detector) Excitation Wavelength, Excitation Wavelength2, Emission Wavelength, Emission Wavelength2

NOTE Method 01 is selected when PC is connected to LabSolutions. The method number can not be changed.

Reference "3.4 Setting Analysis Condition" P.51
"3.8.2 Setting a Time Program" P.79

2 Press [Upload].

The [Upload] screen is displayed.

3 Input each item.

Name	Explanation
Plate	Specifies the plate position where the sample is set.
Sample Number	Specifies the starting and finishing sample numbers for injection.
# Inj / Volume	Sets the injection frequency and amount.
Run Time	Display analysis time set in time program.*1

Name	Explanation
Run	Start analysis.*2

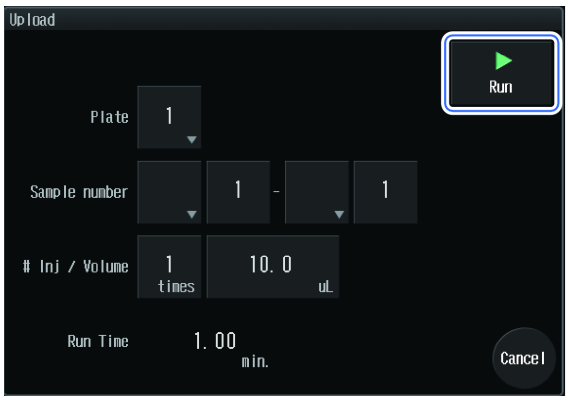
*1 If [Stop] time program is not set in Controller, "-" is displayed.

*2 If analysis cannot be started due to the instrument status, [Run] will be disabled.

4 Press [Run].

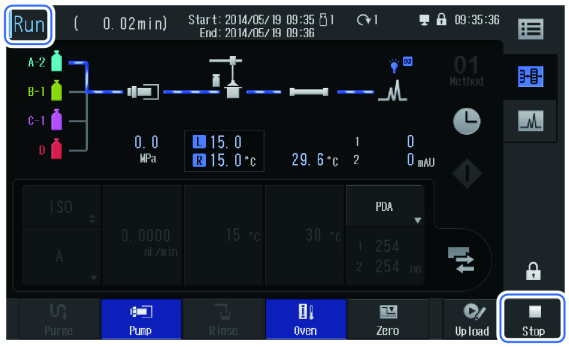
1 Analysis starts on the set analysis condition.

NOTE Analysis starts after about 10 seconds.



2 [Run] is displayed on the upper section of the Main Analysis screen and the process of analysis can be checked.

NOTE Analysis can be stopped with an emergency by pressing [Stop].



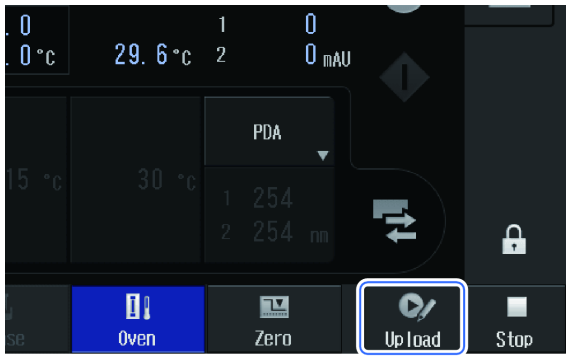
3 When the analysis is completed, [Ready] is displayed on the Main Analysis screen.

■ Register additional analysis while analysis is running.

1 Press [Upload].

The [Upload] screen is displayed.

NOTE The method and time program cannot be edited while analysis is running.



2 **Set each item and press [Queue].**

The additional analysis is registered.

4.7 Using the start timing adjustment function for concentration gradient

It takes time before the column end reaches the specified concentration value in normal analysis, because the concentration program at the low-pressure gradient unit starts at the moment of injection. Injection can be performed when the concentration gradient program at the column end starts, by adjusting the start timing of the concentration gradient program earlier using the start timing adjustment function for concentration gradient.

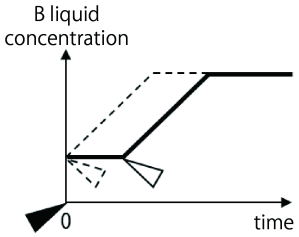
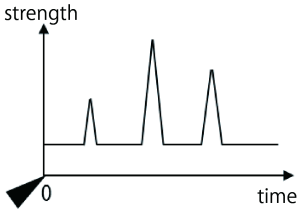
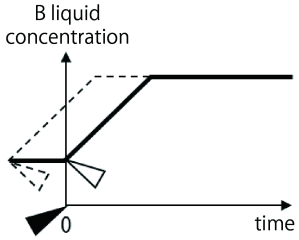
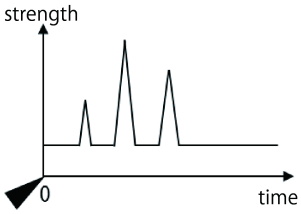
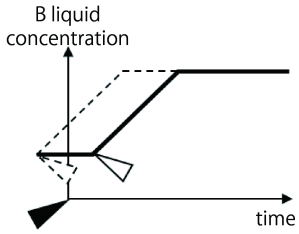
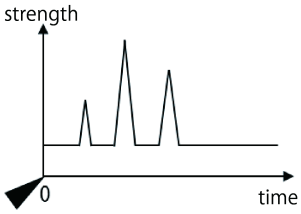
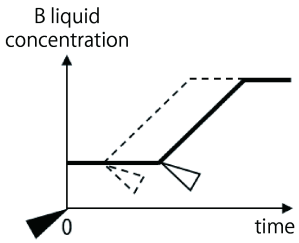
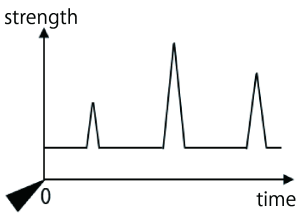
Reference Flow line location"2.3.1 Entire Flow Line" P.36

In addition, the method can be transferred without difficulties by synchronizing the start timing of the concentration gradient program of the systems having different inner volume using this function.

Parameter setting method

When using the start timing adjustment function for concentration gradient, select from the Main Analysis screen of the system - [Parameter Setting] - [Pump] - [Gradient Start Adjustment Mode] to make setting. The start timing of the concentration gradient program is adjusted by the volume set in [Delay Volume] or [Gradient Start Adjustment Volume].

Reference Operation Guide "5.1.1 Pump"
Operation Guide "5.2.5 Other"

Gradient Start Adjustment Mode	Concentration Gradient Program Examples	Chromatogram Examples	Explanation
[OFF]			Performs normal injection. Does not adjust the start timing of the concentration gradient program. Starts the concentration gradient program at the moment of injection.
[Auto]			Adjusts the start timing of the concentration gradient program earlier than the injection by the volume set in [Delay Volume]. Performs injection almost at the same time as the concentration gradient at the column end starts.
[Before Injection]			Adjusts the start timing of the concentration gradient program earlier than the injection by the volume set in [Gradient Start Adjustment Volume]. Use this mode when transferring the method from the system having smaller delay volume to this instrument that has larger delay volume.
[After Injection]			Delays the start timing of the concentration gradient program after the injection by the volume set in [Gradient Start Adjustment Volume]. Use this mode when transferring the method from the system having larger delay volume to this instrument that has smaller delay volume.

--------: B liquid concentration at the low-pressure gradient unit

————: B liquid concentration at the column end

◀ : Injection

◁ : Timing when the concentration gradient program starts
(B liquid concentration starts rising at the low-pressure gradient unit.)

◁ : Timing when the B liquid concentration starts rising at the column end

5 Cleaning

5.1 Rinsing, Cleaning, and Storing After Analysis

For safe use of the instrument, rinse, clean, and store as follows after analysis finishes:

- Rinse the flow line (P.128)
- Clean the leak sensor and leak tray (P.129)
- Clean the automatic rinsing kit (P.130)
- Rinse and store the column (P.131)
- Clean the monitor screen (P.131)
- Clean the exterior (P.131)

5.1.1 Rinsing the Flow Line

For safe use of the instrument, 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 entire flowline through pumping.

Reference "3.5.5 Performing an Autopurge" P.64

Use the following solvents for rinsing, depending on the mobile phase used for the analysis.

For cases when water is used for the mobile phase for analysis, including reversed phases and ion exchanges

Rinse the entire flow line with distilled water or de-ionized water, and then rinse with methanol.

For cases when water is not used for the mobile phase for analysis, including non-aqueous normal phases

Rinse the entire flow line with 2-propanol.

⚠ CAUTION

Instruction

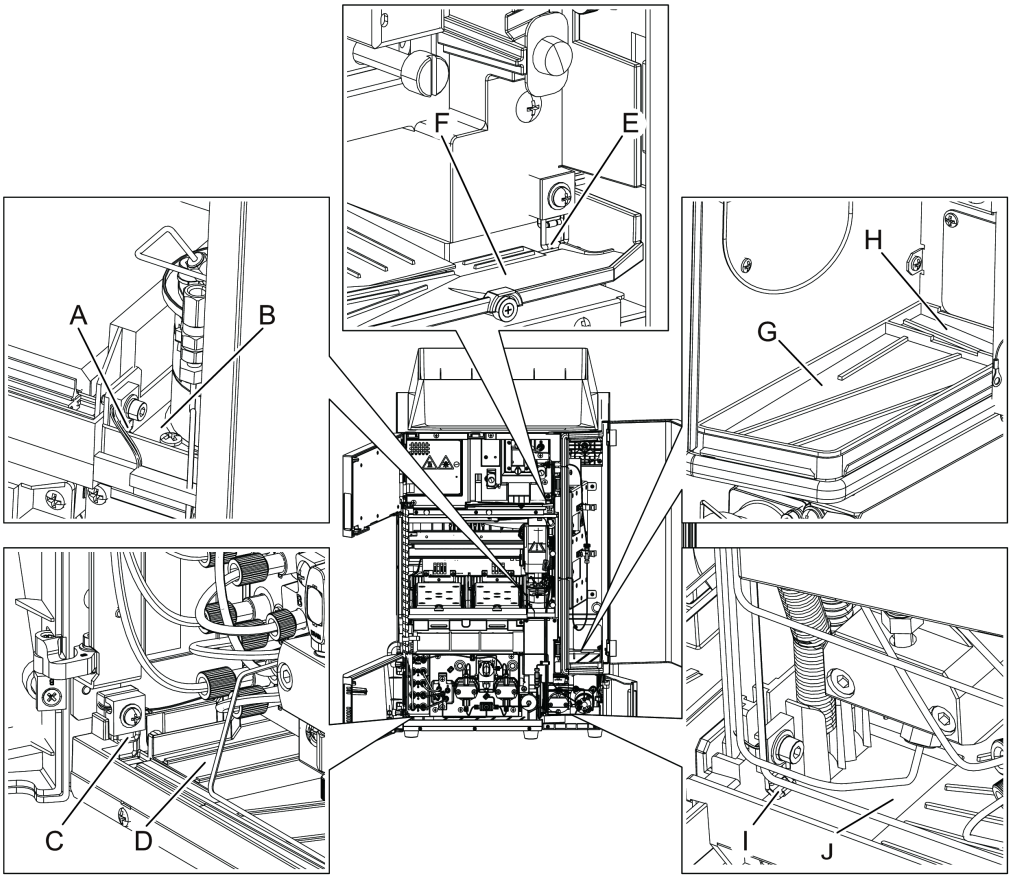
Once the analysis is finished, rinse the flow line.

If buffer solution was used as mobile phase solution or rinse solution, be sure to rinse the solution with distilled water or de-ionized water after operation. Otherwise, crystals formed from residual buffer solution due to volatilization may cause device failure and clogging in the flow line of the pump and autosampler.

5.1.2 Cleaning the Leak Sensor and Leak Tray

Wipe out dirt and liquid adhering to the sensor part in order to keep the leak sensor sensitivity at a normal level.
When a leakage occurs, completely wipe away the liquid accumulated in the leak tray.

■ Positions of the leak sensor and tray in each part



Letter	Name	Letter	Name
A	Leak Sensor of the High-Pressure Valve*1	F	Detector Leak Tray
B	High-Pressure Valve Leak Tray*1	G	Column Oven Leak Tray
C	Pump Leak Sensor	H	Column Oven Condensation Water Tray
D	Pump Leak Tray	I	Low-Pressure Valve Leak Sensor

Letter	Name	Letter	Name
E	Detector Leak Sensor	J	Low-Pressure Valve Leak Tray

*1 When cleaning the leak sensor and the high-pressure valve leak tray, remove the front panel.

Reference "4.4.5 Adjusting the Rack Positions" P.103

NOTE If buffer solution was used as mobile phase solution, crystals formed from dried leaked buffer solution may cause clogging in the drain of the leak tray. When buffer solution has leaked, quickly wipe away the liquid accumulated in the leak tray, and if the leak tray gets dirty with buffer solution crystals, wipe it with water.

5.1.3 Cleaning the Automatic Rinsing Kit

If there is whitish dirt inside the rinse solution bottle in the automatic rinsing kit, remove the dirt according to the following procedure.

NOTE If the 10% 2-propanol water in the rinse solution bottle is dirty, replace with new solution. Especially when getting dirty significantly, replace with new solution once a day. Even if it does not appear dirty, replace with new solution once a week.

1 **Remove the rinse cap of the automatic rinsing kit from the rinse solution bottle.**

2 **Pour distilled water into the rinse solution bottle and clean the inside of the rinse solution bottle using a brush, etc.**

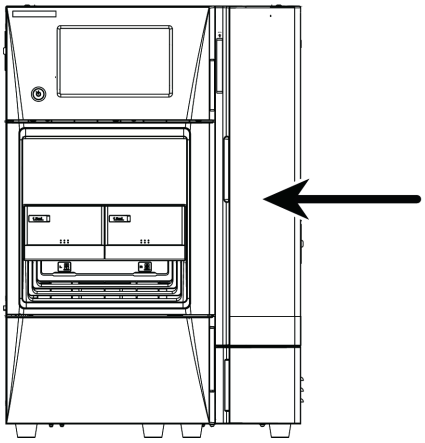
3 **Pour distilled water into the rinse solution bottle and rinse the inside of the rinse solution bottle for about 5 minutes using an ultrasonic bath.**

4 **Pour new 10% 2-propanol water into the rinse solution bottle, and return the cap and rinse solution bottle back to their original positions.**

5 **Replace the rinse tube if the inside is dirty.**

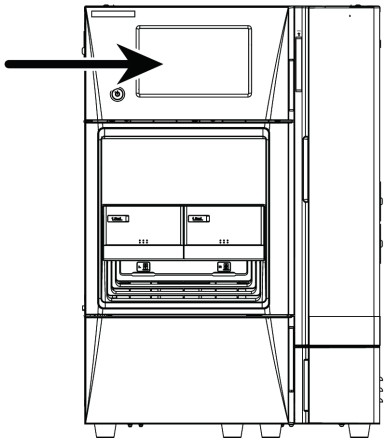
5.1.4 Rinsing and Storing the Column

When analysis will not be performed for a while, leaving used mobile phase in the column may lead to deterioration of the column. Drying the column can cause a gap inside or can cause the column packing to become cracked.
For rinsing and storing procedure, refer to the instruction manual for the column.



5.1.5 Cleaning the Monitor Screen

The monitor screen is a sensitive electronic part. When the screen gets dirty, remove the dirt according to the following procedure.



1 **Wipe it lightly with a soft rag or a rag soaked with a neutral detergent or a small amount of ethanol.**

NOTE
- Do not use any detergent other than a neutral one or ethanol.
- Do not wipe hard. Doing so may cause damage.
- Do not clamp any sharpened blade or sharp object onto it or rub with such objects. Doing so may cause damage.
- Damage may lead to the liquid crystal being leaked. Be careful not to allow the leakage into the eyes or mouth. In addition, if it comes into contact with skin, immediately wash away with soap.

5.1.6 Cleaning the Exterior

When the exterior of the instrument becomes dirty, wipe the dirt with a dry, soft rag or a piece of tissue paper.
If the dirt is significant, remove the dirt according to the following procedure.

1 **Wipe with a rag soaked with a diluted neutral detergent and wrung dry.**

2 **Wring dry a rag soaked with water, wipe the exterior so that the no detergent remains, and then wipe off the moisture with a dry rag.**

NOTE Do not leave it wet with water, and do not wipe with alcohol or a thinner-based solvent. Doing so may cause rust or discoloration.

6 Troubleshooting

6.1 Fault Diagnoses and Corrective Actions

This section explains the possible faulty place inferred from the "problem" and a "corrective action" taken for it. For detailed actions, check the "Reference" location for each item.
If the problem persists even after taking the "corrective actions" described here, or if the failure is not described here, contact your Shimadzu representative.

6.1.1 Problems from the Hardware Status Judged as an Error

Problem	Major Cause	Checked Location	Corrective Action
Even if the main power switch is turned ON, power is not applied.	Is the power cord plugged in?	Power supply switch on the main unit	Plug in the power cord properly.
	Is there any disconnection inside the power cord?	Power supply switch on the main unit	Replace with a power cord of the same type.
	Does the power supply comply with the specifications of the instrument?	Power supply switch on the main unit	Use a power supply that complies with the specifications of the instrument.
Pumping is not done at all. (The instrument does not operate either.)	Was [Pump] pressed? Is the [Pump] lamp illuminated?	Pump	Press [Pump]. The [Pump] lamp is illuminated.
	Does the flow rate remain displayed as "0"?	Pump	Set the flow rate.
	Are error messages displayed? (For example, P-MAX or P-MIN.)	Pump	Press [Clear] and remove the cause of the error.

Problem	Major Cause	Checked Location	Corrective Action
The instrument operates but does not pump.	Is the mobile phase empty?	Mobile phase	Replenish the mobile phase.
	Is the drain valve open?	Pump	Close the drain valve. *1
	Does liquid flow from the connection part of the flow line?	Pump	Retighten the connection part. If retightening does not stop the liquid leak, replace the connection part.
	Are there air bubbles inside the pump head?	Pump	Press [Purge] to remove air bubbles. Alternatively, connect a syringe to the end connection of the drain tubing to remove the air bubbles. ▶▶ Reference System Guide "4.2 Manually Purging the Pump"
	Does the air come in from the connection part of the suction filter and the pump?	Pump	Firmly connect the suction filter fitting.
	Is the check valve malfunctioning?	Pump	Pump 2-propanol to rinse the check valve. Note that, when using a buffer solution, first pump purified water to rinse the check valve. Then pump 2-propanol to rinse. If rinsing has no effect, perform an ultrasonic rinse of the check valve or replace it. ▶▶ Reference Maintenance Guide "4.4 Rinsing the Check Valve"
Pumping is unstable and the pulsating flow of the pump is excessive. / The flow rate is less than the set value.	Is the check valve malfunctioning?	Pump	Pump 2-propanol to rinse the check valve. Note that, when using a buffer solution, first pump purified water to rinse the check valve. Then pump 2-propanol to rinse. If rinsing has no effect, perform an ultrasonic rinse of the check valve or replace it. ▶▶ Reference Maintenance Guide "4.4 Rinsing the Check Valve"
	Is the check valve dirty?	Pump	Pump 2-propanol to rinse the check valve. Note that, when using a buffer solution, first pump purified water to rinse the check valve. Then pump 2-propanol to rinse. If rinsing has no effect, perform an ultrasonic rinse of the check valve or replace it.
	Is the suction filter clogged?	Pump	Perform an ultrasonic rinse of the suction filter. If the ultrasonic rinse has no effect, replace the filter.

Problem	Major Cause	Checked Location	Corrective Action
Pumping is unstable and the pulsating flow of the pump is excessive. / The flow rate is less than the set value.	Have air bubbles entered the suction filter tube?	Pump	Press [Purge] to wash away the mobile phase completely. Vibrate the suction filter to remove the air bubbles. When the suction filter becomes clogged*2, perform an ultrasonic rinse. If the ultrasonic rinse has no effect, replace the filter. Degas the mobile phase.
	Are there air bubbles inside the pump head?	Pump	Press [Purge] to remove air bubbles. Alternatively, connect a syringe to the end connection of the drain tubing to remove the air bubbles. ▶▶ Reference System Guide "4.2 Manually Purging the Pump"
	Does previous mobile phase remain inside the pump head?	Pump	Press [Purge] to wash away the mobile phase completely.
	Does liquid leak from the gap between the pump head and head holder?	Pump	Replace the plunger seal. If removing the plunger seal does not stop the liquid leak, replace the plunger. ▶▶ Reference Maintenance Guide "4.2 Replacing the Plunger Seal" and "4.3 Cleaning/Inspecting (Replacing) the Plunger and Diaphragm"
	Does liquid flow from the plunger seal?	Pump	Replace the plunger seal. When the lifetime of the plunger seal is extremely short, replace the plunger as well. ▶▶ Reference Maintenance Guide "4.2 Replacing the Plunger Seal" and "4.3 Cleaning/Inspecting (Replacing) the Plunger and Diaphragm"
	Is the drain valve open?	Pump	Close the drain valve. *1
	Does liquid flow from the connection part of the flow line?	Pump	Retighten the connection part. If retightening does not stop the liquid leak, replace the connection part.
	Is the line filter clogged or nearly clogged?	Pump	Perform an ultrasonic rinse of the line filter or replace it.

Problem	Major Cause	Checked Location	Corrective Action
The pressure does not rise.	Is the drain valve open?	Pump	Close the drain valve. *1
	Does liquid flow from the connection part of the flow line?	Pump	Retighten the connection part. If retightening does not stop the liquid leak, replace the connection part.
The pressure becomes too high.	Is the line filter clogged?	Pump	Perform an ultrasonic rinse of the line filter or replace it.
	Is the inside diameter of the tubing too thin?	Pump	Use the specified pipe.
	Is the column clogged?	Column	Inspect the pressure of the column, and if the column is clogged, replace it.
	Is the flow line clogged?	All	Backwash the flow line. Inspect the flow line, and if it is clogged, replace the part. *2
The rinse liquid of the automatic rinsing kit increases.	Does liquid flow from the plunger seal?	Pump	Replace the plunger seal. When the lifetime of the plunger seal is extremely short, replace the plunger as well. Reference Maintenance Guide "4.2 Replacing the Plunger Seal" and "4.3 Cleaning/Inspecting (Replacing) the Plunger and Diaphragm"
The rinse liquid of the automatic rinsing kit decreases.	Does the rinse liquid leak from the backside of the head holder?	Pump	Inspect (replace) the diaphragm. Reference Maintenance Guide "4.3 Cleaning/Inspecting (Replacing) the Plunger and Diaphragm"
	Does liquid flow from the connection part of the flow line?	Pump	Retighten the connection part. If retightening does not stop the liquid leak, replace the connection part.
Liquid leaks from the gap in the high-pressure valve.	Has the airtightness between the rotor and stator degraded?	Autosampler	Inspect/replace the rotor and stator. Reference Maintenance Guide "3.4 Replacing (Inspecting) the High-Pressure Valve Rotor and High-Pressure Valve Stator"
Liquid leaks from the gap in the low-pressure valve.	Has the airtightness between the rotor and stator degraded?	Autosampler	Inspect/replace the rotor and stator. Reference Maintenance Guide "3.8 Replacing (Inspecting) the Low-Pressure Valve Rotor and Low-Pressure Valve Stator"

Problem	Major Cause	Checked Location	Corrective Action
Liquid leaks from the connection part of the flow line.	Is a connection part loose or damaged?	Autosampler	Retighten the connection part. If retightening does not stop the liquid leak, replace the connection part.
Even if mobile phase spills in the column oven, no error message is displayed. Even if mobile phase spills on the leak tray, no error message is displayed.	Is the gas sensor or leak sensor sensitivity poor?	Column oven / leak sensor	Clean the leak sensor. Reference System Guide "5.1.2 Cleaning the Leak Sensor and Tray"
			Validate the gas sensor and leak sensor. If NG, adjust the sensitivity. Reference Integrity Guide "2 Validation" and "3 Calibration"
The status does not become [Ready]. / The set temperature is not reached.	Is the column oven door open?	Column oven	Close the column oven door.
	Is the room temperature high or the set temperature low?	Column oven	Set the temperature for the column temperature control properly. The range of adjustable temperatures for the column temperature control varies according to the room temperature. Reference Operation Guide "5.1.3 Column Oven"
Cell temperature control does not work.	Is the connector plugged?	Detector	Firmly connect the connector.
	Is the set temperature appropriate?	Detector	Set the temperature for the cell temperature control properly. The setting range for the cell temperature control depends on the room temperature, column temperature, pump flow rate, and cooling pipe. Reference Operation Guide "5.1.4 Detectors"

Problem	Major Cause	Checked Location	Corrective Action
Intensity is low.	Have air bubbles accumulated in the flow cell?	Detector	Check whether the baseline changes significantly if the cell outlet tubing is held down. Alternatively, visually check if air bubbles are flowing into the flow cell. If air bubbles are flowing, follow the procedure described in "Countermeasures for bubbles" P.154 or disassemble and clean the flow cell. ▶▶ Reference Maintenance Guide "5.3 Disassembling and Cleaning the Flow Cell"
	Is the flow cell dirty?	Detector	Visually check for foreign particles in the flow cell and check how dirty the cell window is. If foreign particles or dirt is present, disassemble and clean the flow cell. If the dirt cannot be removed, replace with a new lens. ▶▶ Reference Maintenance Guide "5.3 Disassembling and Cleaning the Flow Cell" and "5.4 Replacing a Flow Cell Part"
	Is the aspiration of the mobile phase excessive?	Detector	Inspect the mobile phase solution and the flow line, and remove any foreign particles.
	Is the lamp deteriorated?	Detector	Even if an air cell[*3] has a small intensity, or if the lamp usage time is longer than 2,000 H, replace the lamp. ▶▶ Reference Maintenance Guide "5.5 Replacing the D2 Lamp"
	Is the exposure time setting appropriate?	Detector	Configure the automatic settings for the exposure time. ▶▶ Reference Integrity Guide "3.2.6 PDA Detector"
The wavelengths are misaligned.	Is the wavelength calibration properly performed?	Detector	Perform wavelength calibration. ▶▶ Reference Integrity Guide "3.2.6 PDA Detector"
Injection does not occur.	In "System settings" for the autosampler, is "Autosampler control" set to "Offline"?	Autosampler	Configure the set value for "Autosampler control" to "Online". ▶▶ Reference Operation Guide "2.3.4 System Settings Screen"

Problem	Major Cause	Checked Location	Corrective Action
The pressure changes excessively when switching between high-pressure valves.	Is the high-pressure valve clogged?	Autosampler	Disassemble and clean the high-pressure valve. Replace the rotor and stator if disassembling and cleaning has no effect. ▶▶ Reference Maintenance Guide "3.4 Replacing (Inspecting) the High-Pressure Valve Rotor and High-Pressure Valve Stator"
	Is the rotating position of the high-pressure valve misaligned?	Autosampler	Contact your Shimadzu representative.
	Is the flow line clogged?	Autosampler	Backwash the flow line. Inspect the flow line, and if it is clogged, replace the part. *2
A time program cannot be edited.	Is the instrument configuration at time program creation different from the current instrument configuration?	Controller	The function of a non-existing unit cannot be changed when the instrument configuration at time program creation differs from the current instrument configuration. Delete the relevant line and add a new line. ▶▶ Reference Operation Guide "3.1.2 Time Program Setting Examples ■ Creating a Gradient Program"
The scheduled end time does not match that of the actual analysis.	Has an extremely short analysis been repeated?	Controller	The scheduled end time is recalculated as each line of the sequence table is processed. For sequences performing multiple analyses (injections) in a line, the end time is calculated only for the first analysis.
	Was the oven temperature changed for each analysis?	Controller	Changing the oven temperature for each analysis causes a [Wait Oven] status. It is recommended that the oven temperature not be changed if possible.
When an analysis is started, autozero is not executed for the detector.	In the "System settings" for the detector, is "Perform auto zero at analysis start" set to "Disabled"?	Controller / Detector	Set the "Auto-zero when starting analysis" setting to "Enabled". ▶▶ Reference Operation Guide "2.3.4 System Settings Screen" and "5.2.4 Detector"
The external input/output terminal on the back does not operate.	Is the setting for the event input/output correct?	Controller	Check whether the "System settings" of the controller are properly set. ▶▶ Reference Operation Guide "5.1.5 Controller" and "5.2.5 Other"

Problem	Major Cause	Checked Location	Corrective Action
Analysis does not proceed in the [Pause] status.	Is the setting for the event input correct?	Controller	In "System settings" for the controller, set [Event In] to [Ready In]. Reference Operation Guide "5.2.5 Other"
If the CMD information is displayed, it turns into garbled characters.	Is the instrument shared with another one?	Controller	Reconfigure the settings from LabSolutions.
It is not possible to log in when starting the instrument.	Is the password correct?	Controller	Check whether the password is correct. If the problem persists, contact your Shimadzu representative. Reference Operation Guide "4.9 Checking Instrument Status from PC"
I want to print the maintenance information or instrument configuration for my web browser.	-	Controller	Press Ctrl + P on the keyboard. The browser's printing screen is displayed.
The web browser screen is not properly displayed.	Are the settings for Internet Explorer correct?	Controller	Check the Internet Explorer settings. Reference Operation Guide "4.9 Checking Instrument Status from PC"
Internet Explorer does not start.	Are the settings for Internet Explorer correct?	Controller	Check the Internet Explorer settings. Reference Operation Guide "4.9 Checking Instrument Status from PC"
Cannot add to Favorites in the web browser.	-	Controller	If using Internet Explorer to connect to the instrument, the Toolbar or Status Bar is not displayed, and it is not possible to add to Favorites on the browser screen. Create a shortcut on the desktop. Reference Operation Guide "4.9 Checking Instrument Status from PC"
A connection cannot be established if the installation location is changed.	Are the network settings for this device and PC correct?	Controller	Check whether the IP addresses, subnet masks, and default gateways of the instrument and the PC are appropriate for the network environment of the installation location.

Problem	Major Cause	Checked Location	Corrective Action
The version number displayed the web browser differs from the real version number.	Is switching between two "LC-2030 Plus"s having the same IP address and different version numbersoccuring? Or, has the LC-2030 Plus program been downgraded?	Controller	Delete the temporary files in Internet Explorer by selecting [Tools] - [Internet Options] - [Delete].
A link to an external detector cannot be established even though it is connected.	Is the connection with, or settings for, an external detector correct?	Controller	Check for dirt or foreign particles in the optical cable connector. Check whether the optical cable is inserted all the way. Check whether the link address of the external detector is set to "1".
The connected external detector cannot be properly controlled.	Are the settings for the external detector correct?	Controller	Check that the external detector is not in the local mode.

*1 If the drain valve is opened when the pressure is high, the mobile phase will spout from the tip of the drain tubing. Do NOT open the drain valve when the pressure is high. Be sure to insert the tip of the drain tubing into the waste container so that it is not exposed externally.

*2 If the pumping pressure has risen, the flow line may be clogged. Use the procedure in "Action taken when flow line clogging (pressure rise) occurs" P.150 to remove the connections downstream from the flow line sequentially and check the pressure.

*3 Air cell refers to a flow cell that has the lens and cell gasket removed and that does not have mobile phase inside.

6.1.2 Problems from a chromatogram judged as an error

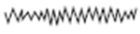
Problem	Major Cause	Checked Location	Corrective Action
The peak retention times vary.	Is the check valve defective?	Pump	Pump 2-propanol to rinse the check valve. Note that, when using a buffer solution, first pump purified water to rinse the check valve. Then pump 2-propanol to rinse. If rinsing has no effect, perform an ultrasonic rinse of the check valve or replace it.
	Is the mobile phase flow rate of the pump stable?	Pump	Check whether the pump operates normally and take corrective action.
	Has the temperature of the column changed?	Column oven	Use the column oven.
	Is the column deteriorated?	Column	Check whether the column oven operates normally, and if there is an abnormality, take corrective action. Check the column under the known analysis conditions, and if it has deteriorated, replace it.
	Does the ambient temperature vary much?	All	Install the instrument in a place where the temperature does not change excessively.
	Is the needle or tubing clogged?	Autosampler	Backwash the high-pressure valve. Replace the needle or the tubing if backwashing has no effect. Rinse the inside of the needle with mobile phase solution. Replace the needle or the tubing if rinsing has no effect. Reference Maintenance Guide "3.3 Replacing the Needle"
	Is the needle seal worn?	Autosampler	If the needle seal is worn, replace it. Reference Maintenance Guide "3.2 Replacing the Needle Seal"
	Is the flow line rinsing insufficient?	Autosampler	Purge or rinse the flow line.
	Has the flow rate or the composition of the mobile phase changed?	Pump Mobile phase	Check the pump and the mobile phase solution.
	Does liquid flow from the flow line?	All	Retighten the connection part. If retightening does not stop the liquid leak, replace the connection part.

Problem	Major Cause	Checked Location	Corrective Action
The peak shape is abnormal. (For example, the peak widths are too large, tailing, etc.).	Is the column deteriorated?	Column	Check the column under the known analysis conditions, and if it has deteriorated, replace it.
	Is the tubing of the pump and the column reversed?	Pump Column	Configure the tubing correctly.
	Is the needle or tubing clogged?	Autosampler	Backwash the high-pressure valve. Replace the needle or the tubing if backwashing has no effect. Rinse the inside of the needle with mobile phase solution. Replace the needle or the tubing if rinsing has no effect. ▶▶ Reference Maintenance Guide "3.3 Replacing the Needle"
	Is there a dead volume in the connection part of the flow line?	Autosampler	Inspect the connection part, and if there is a dead volume, connect properly.
	Does liquid flow from the flow line?	All	Retighten the connection part. If retightening does not stop the liquid leak, replace the connection part.
No peak appears.	Is the column deteriorated?	Column	Check the column under the known analysis conditions, and if it has deteriorated, replace it.
	Does the mobile phase solution flow?	Pump	Check whether the pump operates normally and take corrective action.
	Is there the required amount of sample in the sample vial?	Autosampler	Add the required amount of sample to the sample vial.
	Is the content of the time program correct?	Controller	Check the time program and correct it.
	Is the flow line through which the sample is injected clogged?	Autosampler	Backwash the flow line. Inspect the flow line, and if it is clogged, replace the part. *1
	Is the hole at the tip of the needle plugged by the bottom of the sample vial?	Autosampler	Change the needle stroke to a smaller value. ▶▶ Reference System Guide "4.4.4 Setting the Plate Type and Needle Stroke"
	Does the detector operate normally?	Detector	Check whether the detector operates normally and take corrective action.

Problem	Major Cause	Checked Location	Corrective Action
A ghost peak occurs.	Are the tubing, line filter, and suction filter dirty?	Pump	Inspect the suction filter for clogging. *2 Additionally, rinse according to the following procedure. 1 Deliver a 17% phosphoric acid solution at a flow rate of 1 mL/min for about 30 minutes. (Pumping pressure: 1 MPa to 5 MPa) 2 Deliver purified water at a flow rate of 9 mL/min for about 30 minutes. (Pumping pressure: 1 MPa to 5 MPa)
	Is the rinse liquid being pumped?	Autosampler	Check for rinse liquid.
	Is the rinsing port dirty?	Autosampler	Set the "Rinsing volume," the liquid replacement volume in the rinsing port, to a min. of 450 µL.
	Does previous mobile phase solution remain in the mobile phase flow line?	Autosampler	Rinse the flow line and replace with the mobile phase solution to be used.
	Does previous rinse liquid remain in the rinse liquid flow line?	Autosampler	Rinse the flow line and replace with the rinse liquid to be used.
	Is the high-pressure analysis flow line dirty, including the needle and the sample loop?	Autosampler	Rinse according to the following procedure. 1 Deliver a 17% phosphoric acid solution at a flow rate of 1 mL/min for about 30 minutes. (Pumping pressure: 1 MPa to 5 MPa) 2 Deliver purified water at a flow rate of 9 mL/min for about 30 minutes. (Pumping pressure: 1 MPa to 5 MPa)
The retention time of the target component significantly differs from when measured in another system.	Is the temperature of the column off?	Column oven	Validate the temperature accuracy of the column oven. If NG, adjust the temperature accuracy. ▶▶ Reference Integrity Guide "2.4.4 Column Oven" and Integrity Guide "3.2.4 Column Oven"

Problem	Major Cause	Checked Location	Corrective Action
The baseline drifts.	Are the tubing, line filter, and suction filter dirty?	Pump	Inspect the suction filter for clogging. *2 Additionally, rinse according to the following procedure. 1 Deliver a 17% phosphoric acid solution at a flow rate of 1 mL/min for about 30 minutes. (Pumping pressure: 1 MPa to 5 MPa) 2 Deliver purified water at a flow rate of 9 mL/min for about 30 minutes. (Pumping pressure: 1 MPa to 5 MPa)
	Is the flow line dirty?	All	Rinse the tubing and the detector of the instrument sufficiently according to the following procedure. 1 Deliver a 17% phosphoric acid solution at a flow rate of 1 mL/min for about 30 minutes. (Pumping pressure: 1 MPa to 5 MPa) 2 Deliver purified water at a flow rate of 9 mL/min for about 30 minutes. (Pumping pressure: 1 MPa to 5 MPa)
	Is the detector faulty?	Detector	Check whether the detector operates normally, and if there is an abnormality, take corrective action.
	Does the ambient temperature vary much?	All	Install the instrument in a place where the temperature does not change excessively.
	Has the mobile phase flow rate changed?	Pump	Check whether the pump operates normally, and if there is an abnormality, take corrective action.
	Are the mobile phase and column statuses stable?	Mobile phase Column	Check whether the drift decreases if pumping is stopped or by changing to an air cell*3. If it does, the mobile phase may be mixed with impurities or the column may not be well equilibrated. Perform checks including for the mobile phase, column, and analysis condition.
	Was the measurement conducted immediately after the lamp was illuminated?	Detector	It takes the instrument 1 hour after the lamp illuminates in order to become stabilized. When conducting a high sensitivity analysis, start the measurement about 1 to 1.5 hours after the lamp illuminates.

Problem	Major Cause	Checked Location	Corrective Action
The baseline drifts. 	Has the room temperature changed?	All	Stabilize the room temperature. Install in a location where temperature variations are minimal.
	Is a strong air current being blown, such as from an air conditioner?	All	Use a partition, etc., so that no air current is blown directly on the instrument. Install in a location where temperature variations are minimal.
	Have air bubbles accumulated in the flow cell?	Detector	Check whether the baseline changes significantly if the cell outlet tubing is held down. Alternatively, visually check if air bubbles are flowing into the flow cell. If air bubbles are flowing, follow the procedure described in "Countermeasures for bubbles" P.154 or disassemble and clean the flow cell. ▶▶ Reference Maintenance Guide "5.3 Disassembling and Cleaning the Flow Cell"
	Is liquid leaking from the flow cell?	Detector	Check for liquid leaking from the connection parts of the cell inlet tubing / outlet tubing or the cell window. If liquid is leaking, disassemble and clean. ▶▶ Reference Maintenance Guide "5.3 Disassembling and Cleaning the Flow Cell"
The baseline shifts. 	Is liquid leaking from the flow cell?	Detector	Check for liquid leaking from the connection parts of the cell inlet tubing / outlet tubing or the cell window. If liquid is leaking, disassemble and clean. ▶▶ Reference Maintenance Guide "5.3 Disassembling and Cleaning the Flow Cell"
	Is there any backlash or gap in the installation of the lamp or the flow cell?	Detector	If there is backlash or a gap, reinstall the parts in their proper status.
The baseline undulates. 	Is a strong air current being blown, such as from an air conditioner?	Detector	Use a partition, etc., so that no air current is blown directly on the instrument. Install in a location where temperature variations are minimal.

Problem	Major Cause	Checked Location	Corrective Action
The baseline undulates depending on the pump stroke. 	Are there air bubbles inside the pump head?	Pump	Press [Purge] to remove air bubbles. Alternatively, connect a syringe to the end connection of the drain tubing to remove the air bubbles. ▶▶ Reference System Guide "4.2 Manually Purging the Pump"
	Does liquid flow from the plunger seal?	Pump	Replace the plunger seal. When the lifetime of the plunger seal is extremely short, replace the plunger as well. ▶▶ Reference Maintenance Guide "4.2 Replacing the Plunger Seal" and "4.3 Cleaning/Inspecting (Replacing) the Plunger and Diaphragm"
The baseline does not vary.	Is the range set to "0"?	Detector	Set a proper range.
	Is the lamp turned off?	Detector	Set [LAMP] to [D2]. The lamp will be illuminated.
	Do signals scale out to the negative side (or the positive side)?	UV detector / controller	Press the zero button from the "Analysis" screen. Zero position adjustment will be performed. Also, set the "Perform auto zero at analysis start" setting to "Enabled". ▶▶ Reference Operation Guide "2.3.4 System Parameter Setting Screen" and 5.2.4 Detector
Noise is excessive. 	Is the intensity insufficient?	Detector	Check the intensity. If the intensity is low, take the corrective action for when "Intensity is low" as described in 6.1.1.
	Is the lamp deteriorated?	Detector	Even if an air cell[*3] has a small intensity or if the lamp usage time is longer than 2,000 H, replace the lamp. ▶▶ Reference Maintenance Guide "5.5 Replacing the D2 Lamp"
	Is a strong air current being blown, such as from an air conditioner?	Detector	Use a partition, etc., so that no air current is blown directly on the instrument. Install in a location where temperature variations are minimal.
	Does external vibration have an effect?	Detector	Install on a firm platform. Take countermeasures to lessen the vibration.

Problem	Major Cause	Checked Location	Corrective Action
Regular spike-shaped noise appears. 	Are the pulsations of the pump excessive?	Pump	Check whether the noise disappears if pumping is stopped. Check the pumping condition (pulsation), and if the pulsation is excessive, rinse the flow line. "Countermeasures for bubbles" P.154 should be taken. Reference Integrity Guide "2.4.2 Pump"
	Have air bubbles accumulated in the flow cell?	Detector	Check whether the baseline changes significantly if the cell outlet tubing is held down. Alternatively, visually check if air bubbles are flowing into the flow cell. If air bubbles are flowing, follow the procedure described in "Countermeasures for bubbles" P.154 or disassemble and clean the flow cell. Reference Maintenance Guide "5.3 Disassembling and Cleaning the Flow Cell"
Irregular spike-shaped noise appears. 	Have air bubbles accumulated in the flow cell?	Detector	Check whether the baseline changes significantly if the cell outlet tubing is held down. Alternatively, visually check if air bubbles are flowing into the flow cell. If air bubbles are flowing, follow the procedure described in "Countermeasures for bubbles" P.154 or disassemble and clean the flow cell. Reference Maintenance Guide "5.3 Disassembling and Cleaning the Flow Cell"
Saw-shaped noise appears. (The baseline drifts in the positive direction and suddenly returns in the negative direction, and this behavior is repeated.) 	Are the pulsations of the pump excessive?	Pump	Check whether the noise disappears if pumping is stopped. Check the pumping condition (pulsation), and if the pulsation is excessive, rinse the flow line. "Countermeasures for bubbles" P.154 should be taken. Reference Integrity Guide "2.4.2 Pump"
	Have air bubbles accumulated in the flow cell?	Detector	Check whether the baseline changes significantly if the cell outlet tubing is held down. Alternatively, visually check if air bubbles are flowing into the flow cell. If air bubbles are flowing, follow the procedure described in "Countermeasures for bubbles" P.154 or disassemble and clean the flow cell. Reference Maintenance Guide "5.3 Disassembling and Cleaning the Flow Cell"

Problem	Major Cause	Checked Location	Corrective Action
When using 2 wavelength mode, noise is 10 times more than 1 wavelength mode	Was the measurement performed with the wavelength where the variation in mobile phase absorbance is extremely excessive?	UV detector	Because the instrument detects 2 wavelengths by scanning gratings, measurement wavelengths vary within the range of wavelength reproducibility (±0.1 mm), thus making noise. Change the measurement wavelengths to smaller wavelengths whose changes cause as small a variation in mobile phase absorbance change as possible. Also, increase the response value within the allowable range.

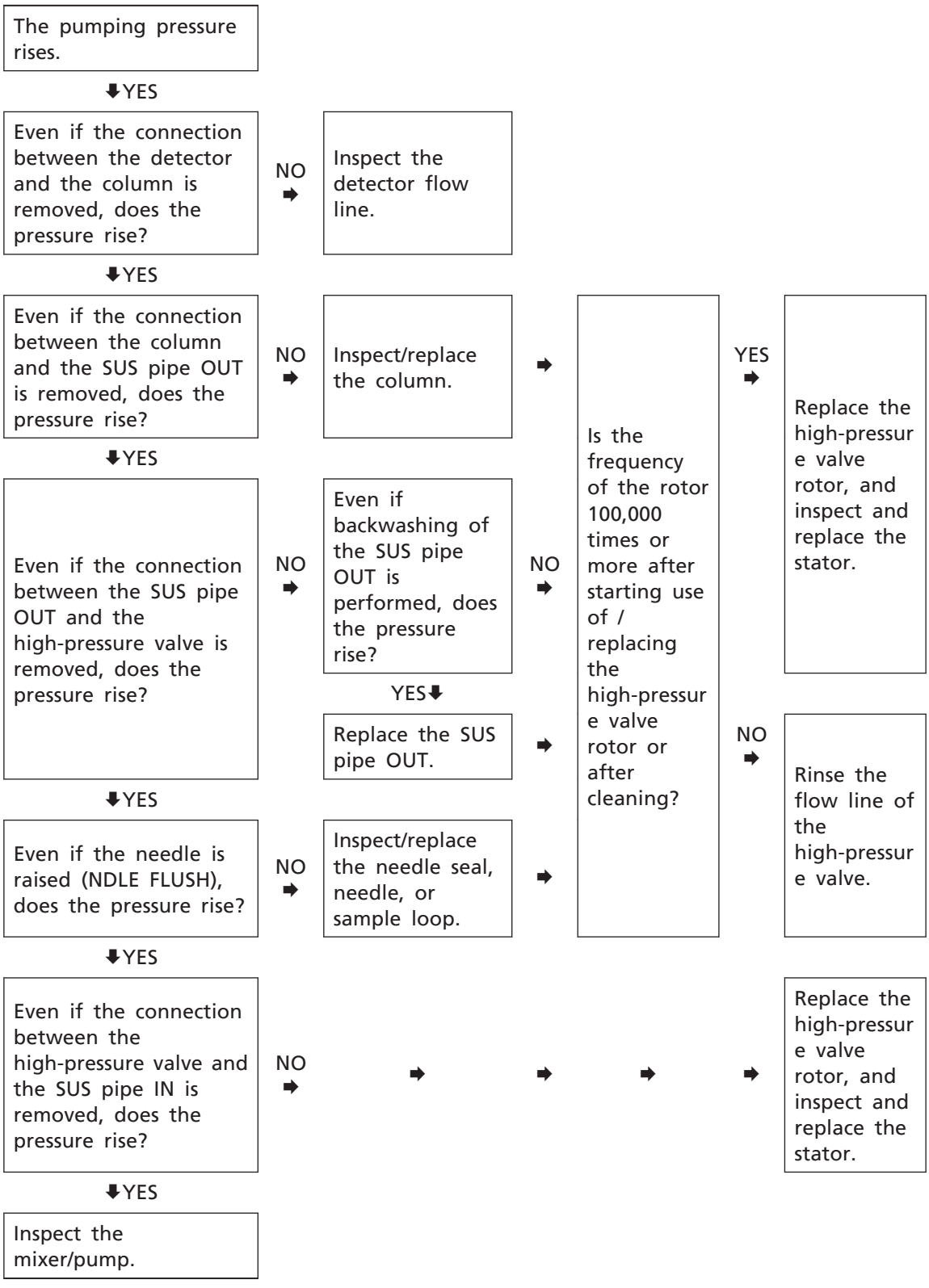
*1 If the pumping pressure has risen, the flow line may be clogged. Use the procedure in "Action taken when flow line clogging (pressure rise) occurs" P.150 to remove the connections downstream from the flow line sequentially and check the pressure.

*2 Suction filter clogging inspection: Remove the filter part and record the pressure waveform. If removal improves the pressure waveform, it means that the suction filter is clogged.

*3 Air cell refers to a flow cell that has the lens and cell gasket removed and that does not have mobile phase inside.

■ Action taken when flow line clogging (pressure rise) occurs

If the pumping pressure has rose, the flow line may be clogged.
Use the following procedure to remove the connections downstream from the flow line sequentially and check the pressure.



⚠ CAUTION

When removing a high-pressure flow line part, never pump.

When removing a high-pressure flow line part such as the SUS pipe, sample loop, needle, or needle seal, be sure to stop pumping first.

Check that the pumping pressure of the mobile phase being monitored on the Pump Display screen has dropped to zero and then remove the high-pressure flow line part.

When removing a high-pressure flow line part, wear protective goggles and protective gloves.

If solvent gets into the eyes, it can result in blindness. Should solvent enter the eyes, immediately wash it away and seek treatment from a doctor.

6.1.3 Countermeasure

■ Causes of and countermeasures against clogging in tubing

Causes of Clogged Tubing	Corrective Action	
Insoluble matter in the mobile phase	Because insoluble matter contained in salt can clog the tubing, particularly when using a buffer solution as the mobile phase, the buffer solution should be strained in advance. Use as mobile phase the buffer solution strained using a commercially available strainer with a membrane filter having a bore diameter of 0.45 µm max. This is also important for protecting the column.	
	Necessary Instrument	Membrane filter (with a bore diameter of 0.45 µm max.)
Insoluble matter in the sample	Insoluble matter contained in the sample can cause clogging in the tubing or the column, just as with insoluble matter in the mobile phase. If a sample solution has turbidity or if insoluble matter is observed, use a commercially available disposable filter to strain the sample solution in advance.	
	Necessary Instrument	Disposable filter (described in page 114 to 115 in the Shimadzu Column General Catalog)
Suspended particulates/dirt in the environment	Small dirt or dust in the environment can enter from the injection port and cause clogging. Normally, this is not a problem because analysis is performed with the front panel of the instrument closed. However, when working with the panel open, such as when doing the maintenance task, avoid dirty or dusty places as much as possible.	
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 may cut the needle seal. If this generates needle seal shavings, these shavings may clog the tubing. If the tubing is clogged, the misalignment of the needle can be checked on the injection port by selecting [Auxiliary Operation] - [Injection Port Operation Check] function to move the needle up and down. If misalignment of the needle is observed, adjustment of the injection port is necessary. ▶▶ Reference Operation Guide "2.2.3 Validation Tab" ■Auxiliary Operation Screen Integrity Guide "3.3.3 Adjusting the Injection Port Position"	
Shavings of the septum used for a sample vial	Some septa used for sample vials can have shavings that may 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 may vary. Shimadzu's specified septa are products that have passed continuous injection tests and resistance to solvents tests. Usually a thin membrane of solvent-resistant material (e.g. PTFE) is coated on the septum surface, but if using a different septum than designated by Shimadzu, when the needle penetrates the septum, septum shavings may be peeled off, which can cause clogging. To avoid such trouble, use Shimadzu's designated septum/sample vial.	

<table>
<tr><th>Causes of Clogged Tubing</th><th colspan="2">Corrective Action</th></tr>
<tr><td rowspan="2">Abrasion powder from the PEEK rotor seal for the high-pressure valve</td><td colspan="2">As the rotation operation of the high-pressure valve repeats, abrasion powder is generated due to the initial abrasion of the PEEK rotor seal. Such abrasion powder is composed of such small particles that it rarely clogs tubing, but it can cause clogging in the column inlet. When replacing a PEEK rotor seal with a new one, do so by referring to the following reference, and rotate the valve to remove the initial abrasion powder.
Additionally, clogging in the tubing can be avoided by increasing the inside diameter of the tubing. However, this cannot be a fundamental countermeasure and is essentially not desirable. In this case, foreign particles causing the clogging of the tubing will accumulate at the column inlet. Therefore, first check the above point and the countermeasures. These considerations also apply when the instrument is used by connecting to a third-party LC.
Disassemble and clean the high-pressure valve approximately once every 10,000 injections.
▶▶ Reference Maintenance Guide "3.4 Replacing (Inspecting) the High-Pressure Valve Rotor and High-Pressure Valve Stator"</td></tr>
<tr><td>Necessary Instrument</td><td>Methanol or 2-propanol</td></tr>
<tr><td rowspan="2">Microscopic particles coming out of the pump</td><td colspan="2">The following may come out of the pump:
• Dirt from parts (e.g., suction filter, line filter)
When installing a new part, before connecting it to the instrument, be sure to rinse it by delivering methanol or 2-propanol (5 mL/min, 15 minutes).
• Worn plunger seal fragments
Because these are trapped by the line filter of the pump, replace the line filter periodically.</td></tr>
<tr><td>Necessary Instrument</td><td>Methanol or 2-propanol</td></tr>
<tr><td rowspan="2">Dirt from the tubing itself</td><td colspan="2">When replacing tubing with a new one, before connecting, rinse it completely. To rinse tubing, deliver methanol or 2-propanol (5 mL/min, 15 minutes).</td></tr>
<tr><td>Necessary Instrument</td><td>Methanol or 2-propanol</td></tr>
</table>

■ Countermeasures for bubbles

To remove air bubbles from inside the flow cell

NOTE Conduct pumping, hold down the tip of the cell outlet tubing with a finger or a rubber band, and apply pressure inside the cell. By repeatedly holding down and releasing the tip several times, air bubbles will contract, expand, and begin to flow out.

To not generate air bubbles

NOTE Degas the mobile phase fully before use (by using a degassing unit). For mobile phase that cannot be degassed or one that easily generates air bubbles even after being degassed, connect the cell outlet to a 0.3 mmID × 2 m pipe.

When a 0.3 mmID × 2 m pipe is connected, if water is run at 1 mL/min, back-pressure of about 0.2 MPa {2 kgf/cm^2} is applied. Before applying back-pressure, first remove the flow cell from the instrument for the sake of safety, then check that there is no liquid leakage, and reinstall. Should a liquid leakage occur, retighten the cell retaining screw with a flathead screwdriver.

If the inner wall of the flow cell is dirty, air bubbles will accumulate easily (especially when a water-based mobile phase is used). Rinse the flow cell with a liquid like alcohol.

Reference Maintenance Guide "6.3 Disassembling and Cleaning the Flow Cell"

6.2 Error Message

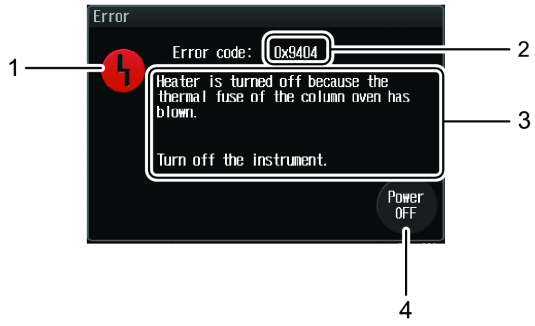
6.2.1 Error Window

If an error is detected, an alarm sounds and the error window is displayed. To return to the original screen, press the [Clear] button. In addition, if the error level is [Fatal Error], it is necessary to turn the power off.

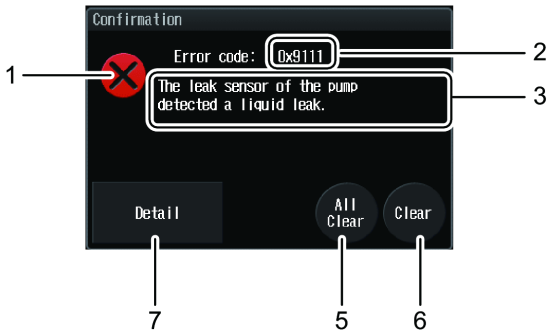
Hint The settings can be configured so that no alarm sound occurs when an error occurs in the [System Parameter Setting] screen.

Reference Operation Guide "5.2.5 Other"

Fatal error



Error, warning



No.	Name	Explanation
1	Error Type	Displays the error type.
	 (Fatal error)	Indicates a hardware problem.
	 (Error)	Indicates an error related to instrument use.
	 (Warning)	Indicates a caution and recommendation.
2	Error Code	Displays the error code. Reference System Guide "6.2.2 Error List"
3	Error Message	Displays the error content and countermeasures.
4	Power OFF	Turns the instrument power off.
5	All Clear	Clears all the current errors and returns the display to the original screen.
6	Clear	Clears the error being displayed and returns the display to the original screen. If there are several errors occurring at the same time, another error will be displayed.

No.	Name	Explanation
7	Detailed Display Button	Displays the error location. This appears only for some types of errors.

6.2.2 Error List

■ Error types

There are three types of errors. Each type has a different action in the instrument.

Display	Name	Explanation
	Fatal error	Recovery from this type of error is not possible because it is a hardware error. The time program that is running stops and the autosampler aborts operation as well. Of all buttons, only the [Power OFF] button is displayed. Press [Power OFF] to turn the power to the instrument off.
	Error	The time program that is running stops and the autosampler aborts operation as well. There are three levels of errors, and depending on the level, the following operation is performed.
	Error 1	If [System Protection] in the system settings is set to [Enable], the system continues pumping at half the flow rate with the column oven turned OFF. *1 If [System Protection] is [Disable], the system turns OFF both the column oven and the pump.
	Error 2	Turns OFF both the column oven and the pump.
	Error 3	Turns OFF neither the column oven nor the pump.
	Warning	The instrument does not perform error handling in particular.

*1 Once [All Clear] or [Clear] is pressed, pumping will stop.

■ List of Error Messages

Error Code	Error Message	Explanation	
0x0046	Operation mode is local. Set the operation mode to remote.	Type: Warning	
		Cause	Displayed when the external detector (RF/RID) is set to the local mode.
		Corrective Action	Set the external detector (RF/RID) to the remote mode.

Error Code	Error Message	Explanation	
0x0047	Ex grating motor home position error.	Type: Fatal error	
		Cause	Displayed when the home position sensor of the excitation side grating motor for an external detector (RF) does not operate properly.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x0048	Em grating motor home position error.	Type: Fatal error	
		Cause	Displayed when the home position sensor of the emission side grating motor for the external detector (RF) does not operate properly.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x004B	Lamp is turned off because the lamp is over-heated.	Type: Fatal error	
		Cause	Possible causes are either hardware failure or due to the external detector (RF) being used in a high-temperature environment.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x0050	No scan data	Type: Warning	
		Cause	Displayed when performing the spectrum output for a file that has not been scanned by the external detector (RF).
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x00A0	Zero glass home position error.	Type: Fatal error	
		Cause	The external detector (RID) cannot properly detect the home position of the zero glass drive section.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.

Error Code	Error Message	Explanation	
0x00A1	Leak error is detected.	Type: Error 2	
		Cause	Displayed when a liquid leak is detected in the external detector (RF / RID).
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x00A4	The inside of the external detector is over-heated.	Type: Error 3	
		Cause	Displayed when the temperature of the measurement part inside the external detector (RID) exceeded 63 °C.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x870E	Cannot write in EEPROM.	Type: Fatal error	
		Cause	Displayed when a writing error occurs the non-volatile memory (EEPROM) of the external detector (RF).
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x8710	Lamp mirror home position error.	Type: Fatal error	
		Cause	Displayed when the home position sensor of the lamp mirror motor for the external detector (RF) does not operate properly.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x8714	Xe lamp does not light.	Type: Error 2	
		Cause	Displayed when the Xe (xenon) lamp for the external detector (RF) cannot be turned on.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.

Error Code	Error Message	Explanation	
0x8719	Hg lamp does not light.	Type: Error 3	
		Cause	Displayed when the low-pressure mercury lamp for the external detector (RF) cannot be turned on.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x871A 0x871B 0x871C	The wavelength shift is greater than 2 nm.	Type: Error 2	
		Cause	Displayed if the deviation of the wavelength was greater than 2 nm when the wavelength for the external detector (RF) was checked or upon wavelength calibration.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x871D	Flow cell is overheated.	Type: Error 2	
		Cause	Displayed when the temperature of the flow cell for the external detector (RF) has risen abnormally.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x871E	Lamp cover is open.	Type: Error 2	
		Cause	Displayed when the lamp cover for the external detector (RF) has been left open.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x871F	Fan for the Peltier unit has stalled.	Type: Error 3	
		Cause	Displayed when the Peltier cooling fan for the external detector (RF) stopped.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.

Error Code	Error Message	Explanation	
0x8720	Cooling fan for the Xe lamp power has stalled.	Type: Error 2	
		Cause	Displayed when the power supply cooling fan of the Xe (xenon) lamp for the external detector (RF) stopped.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x8721	The set temperature of the flow cell is too low. Cannot maintain the set temperature.	Type: Warning	
		Cause	Displayed when the room temperature becomes a min. of 10 °C higher than the flow cell set temperature for the external detector (RF).
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x8723	Error in the flow cell's cooling unit.	Type: Fatal error	
		Cause	Displayed when the temperature of the flow cell does not reach the set temperature, even if a min. of 30 minutes have elapsed after the external detector (RF) was powered on.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x8724	Error in the flow cell's heating unit.	Type: Fatal error	
		Cause	Displayed when the temperature of the flow cell does not reach the set temperature, even if a min. of 30 minutes have elapsed after the external detector (RF) was powered on.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x8725	Leak sensor wire is broken.	Type: Fatal error	
		Cause	The leak sensor for the external detector (RF / RID) has abnormal detected value(s). The leak sensor may be disconnected.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.

Error Code	Error Message	Explanation	
0x8726	Leak sensor is short-circuited.	Type: Fatal error	
		Cause	The leak sensor for the external detector (RF) has abnormal detected value(s). The leak sensor may be short-circuited.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x8728	Abnormality in temperature sensor.	Type: Fatal error	
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x8729	Abnormality in the hardware.	Type: Fatal error	
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x874B	The lamp is turned off because of abnormal high temperature.	Type: Error 2	
		Cause	Displayed when the internal temperature of the external detector (RF) has risen abnormally.
		Corrective Action	Take the corrective action for the error as described in the instruction manual of the external detector. If the error cannot be removed, contact your Shimadzu representative.
0x9003	The backup parameters of the controller are corrupted. The method file and sequence file were initialized.	Type: Error 3	
		Corrective Action	Set the method and the sequence again.
0x9004	The backup parameters of the controller are corrupted. The method file and sequence file were initialized.	Type: Error 3	
		Cause	Because the backup parameters are damaged, the method and the sequence have returned to the statuses for the last startup.
		Corrective Action	Check the method and the sequence.

Error Code	Error Message	Explanation	
0x9006	Illegal backup parameters. System information has been changed.	Type: Error 3	
		Cause	Because an error was found in the backup parameter, the instrument information (system name, group name) was initialized.
		Corrective Action	Set the instrument information (system name, group name) again.
0x9010	Connection between the external detector and the instrument was disconnected.	Type: Error 1	
		Cause	Communication can no longer be established with the external detector connected to the optical cable connector of the instrument.
		Corrective Action	Check whether the external detector is powered ON. If the power of the external detector is turned ON, check that the optical cable is properly connected.
0x9020	An undefined fatal error has occurred.	Type: Fatal error	
		Corrective Action	Check whether the external detector displays an error and take the corrective action by following the instruction manual for the external detector.
0x9021	An undefined error (Level 1) has occurred.	Type: Error 1	
		Cause	An error (level 1) has occurred in the external detector.
		Corrective Action	Check whether the external detector displays an error and take the corrective action by following the instruction manual for the external detector.
0x9022	An undefined error (Level 2) has occurred.	Type: Error 2	
		Cause	An error (level 2) has occurred in the external detector.
		Corrective Action	Check whether the external detector displays an error and take the corrective action by following the instruction manual for the external detector.
0x9023	An undefined error (Level 3) has occurred.	Type: Error 3	
		Cause	An error (level 3) has occurred in the external detector.
		Corrective Action	Check whether the external detector displays an error and take the corrective action by following the instruction manual for the external detector.

Error Code		Error Message	Explanation	
0x9030 0x9031 0x9032 0x9033 0x9034 0x9035 0x9036 0x9037 0x9038	0x9040 0x9041 0x9042 0x9043 0x9044 0x9045 0x9046 0x9047 0x9048	Communication between the instrument and the workstation was disconnected.	Type: Warning	
			Cause	Communication with the workstation was disconnected.
			Corrective Action	Check the network connection status. If the error cannot be removed, contact your Shimadzu representative.

Error Code	Error Message	Explanation	
0x9050 0x9051	The buffer memory of the controller has overflowed.	Type: Warning	
		Cause	The buffer memory for transmission from the instrument to the workstation is full.
		Corrective Action	Check the network connection status. If the error cannot be removed, contact your Shimadzu representative.
0x9052	The IP address was set to "192.168.200.96" because the instrument failed to automatically obtain an IP address.	Type: Error 3	
		Corrective Action	Contact the network administrator. Configure the proper settings (Automatically obtain / Manually obtain) for the IP Address.
0x9053	Renewal/refresh of the IP address failed.	Type: Error 2	
		Cause	Renewal/refresh of the IP address failed.
		Corrective Action	Contact the network administrator. Configure the proper settings (Automatically obtain / Manually obtain) for the IP Address.
0x9055	The maximum number of systems (10) that can be registered in the same group was exceeded.	Type: Warning	
		Cause	Ten or more instruments were connected in the same group.
		Corrective Action	Check the number of instruments connected in the instrument group where the error occurred.
0x9060	A timeout occurred in communication between the pump and controller.	Type: Error 2	
		Cause	An error occurred in the communication between the pump and the controller, and the communication was disconnected.
		Corrective Action	Clear the error. If the error occurs again, contact your Shimadzu representative.

Error Code	Error Message	Explanation	
0x9061	An error occurred in communication between the pump and controller.	Type: Warning	
		Cause	An error occurred in the communication between the pump and the controller, but the communication was recovered.
		Corrective Action	Clear the error.
0x9062	A timeout occurred in communication between the autosampler or column oven and controller.	Type: Error 2	
		Cause	An error occurred in the communication between the autosampler or column oven and the controller, and the communication was disconnected.
		Corrective Action	Clear the error. If the error occurs again, contact your Shimadzu representative.
0x9063	An error occurred in communication between the autosampler or column oven and controller.	Type: Warning	
		Cause	An error occurred in the communication between the autosampler or column oven and the controller, but the communication was recovered.
		Corrective Action	Clear the error. If the error occurs again, contact your Shimadzu representative.
0x9070	An error signal was input from an external device connected to the external input (Alarm Input) on the back of the instrument.	Type: Error 2	
		Cause	An error signal was received from an external device connected to the external input terminal.
		Corrective Action	Handle the error by following the instructions for the external device connected to the external input terminal.
0x9071	The external detector set on the instrument is not connected.	Type: Error 3	
		Cause	The analysis was started while a different detector from the one set in the simple parameter in the Main Analysis screen was connected.
		Corrective Action	Connect the detector set in the simple parameter in the Main Analysis screen or change the parameter to the connected detector.
0x9074	The system check is timed out.	Type: Warning	
		Corrective Action	Perform the system check again. If the error cannot be removed, contact your Shimadzu representative.

Error Code	Error Message	Explanation	
0x9075	Purge was executed because the pump pressure reached the minimum pressure.	Type: Error 2	
		Cause	Because the pump pressure reached the [P.Min] method parameter, a purge was executed.
		Corrective Action	Inspect the flow line for liquid leakage, and if there is no abnormality, set the [P.Min] method parameter to an appropriate value.
0x9076	The injection volume set in the sequence is outside the setting range.	Type: Error 3	
		Cause	The injection volume has exceeded the set value for [Max Injection Volume] in the system settings.
		Corrective Action	Set the injection volume to a value that is equal to or lower than the set value for [Max Injection Volume] in the system settings.
0x9077	A vial number that is different from the sample vial number set in the sequence may have been notified to the instrument.	Type: Error 3	
		Corrective Action	Clear the error and perform analysis again.
0x9078	A rack number that is different from the rack number set in the sequence may have been notified to the instrument.	Type: Error 3	
		Corrective Action	Clear the error and perform analysis again.
0x9079	The temperature of the column oven was not stable.	Type: Error 2	
		Cause	During validation and calibration, the temperature of the column oven did not stabilize at the set temperature.
		Corrective Action	Check for an abnormality in the column oven.
0x907A	There is no sample vial set in the autosampler rack.	Type: Warning	
		Cause	No sample vial is set for the sample vial number set in the sequence.
		Corrective Action	Set a sample vial for the sample vial number set in the sequence. If [Vial Skip] in the system settings is set to [Enabled], analysis for which no sample vial has been set will not be executed, but the next analysis will be executed.

Error Code	Error Message	Explanation	
0x907B	The temperature of the sample cooler was not stable.	Type: Error 2	
		Cause	During validation and calibration, the temperature of the sample cooler did not stabilize at the set temperature.
		Corrective Action	Check for an abnormality in the sample cooler.
0x907C	The power to the instrument was turned OFF during analysis.	Type: Error 2	
		Cause	The power to the instrument was turned OFF during analysis.
		Corrective Action	Check if the power of the instrument and the workstation have been turned OFF. If they have not, check the power status.
0x907D	An error occurred in communication between the detector and controller.	Type: Warning	
		Corrective Action	Clear the error. If the error occurs again, contact your Shimadzu representative.
0x907E	There is no sample vial set for the next analysis in the autosampler rack.	Type: Warning	
		Cause	No sample vial has been set for the sample vial number set in the next analysis.
		Corrective Action	Clear the error. If the error occurs again, contact your Shimadzu representative.
0x9100	An sealing ability error occurred in the vacuum flow path of the degassing unit.	Type: Warning	
		Corrective Action	Check the vacuum pressure of the degassing unit. Vacuum performance may be temporarily unstable due to influence such as condensation of the solvent gas in the vacuum system. If the vacuum pressure is "NG", set the method parameter for the degassing unit power to [OFF] and then set the power to [ON] again. A warning may appear again depending on the condensation conditions. In this case, repeat the steps above. If the vacuum pressure becomes "OK", there is no problem. If a warning appears even after repeating the above steps a few times or a liquid continues to leak, the degassing unit may be malfunctioning. If the error occurs again, contact your Shimadzu representative.

Error Code	Error Message	Explanation	
0x9101	The remaining amount of Mobile Phase A-1 liquid is low.	Type: Warning	
		Corrective Action	Replace the mobile phase and set the mobile phase volume again.
0x9102	The remaining amount of Mobile Phase B-1 liquid is low.	Type: Warning	
		Corrective Action	Replace the mobile phase and set the mobile phase volume again.
0x9103	The remaining amount of Mobile Phase C-1 liquid is low.	Type: Warning	
		Corrective Action	Replace the mobile phase and set the mobile phase volume again.
0x9104	The remaining amount of Mobile Phase D-1 liquid is low.	Type: Warning	
		Corrective Action	Replace the mobile phase and set the mobile phase volume again.
0x9105	The remaining amount of Mobile Phase A-2 liquid is low.	Type: Warning	
		Corrective Action	Replace the mobile phase and set the mobile phase volume again.
0x9106	The remaining amount of Mobile Phase B-2 liquid is low.	Type: Warning	
		Corrective Action	Replace the mobile phase and set the mobile phase volume again.
0x9107	The remaining amount of Mobile Phase C-2 liquid is low.	Type: Warning	
		Corrective Action	Replace the mobile phase and set the mobile phase volume again.
0x9108	The remaining amount of Mobile Phase D-2 liquid is low.	Type: Warning	
		Corrective Action	Replace the mobile phase and set the mobile phase volume again.
0x9109	The degassing unit is not connected.	Type: Fatal error	
		Corrective Action	*1
0x910A	The leak sensor of the pump is malfunctioning.	Type: Fatal error	
		Corrective Action	*1
0x910B	The leak sensor of the pump has detected an abnormal condition .	Type: Fatal error	
		Corrective Action	*1
0x910C	The backup parameters of the pump are corrupted.	Type: Fatal error	
		Corrective Action	*1
0x910D	The consumable part count data of the pump is corrupted.	Type: Fatal error	
		Corrective Action	*1

Error Code	Error Message	Explanation	
0x910E	The pump pressure exceeded the maximum pressure. Check the flow paths for cloggings, and check the maximum pressure setting.	Type: Error 1	
		Cause	The pump pressure exceeded the maximum pressure.
		Corrective Action	Inspect the flow line for clogging, and if there is no abnormality, set the [P.Max] method parameter to an appropriate value or decrease the flow rate.
0x910F	The pump pressure does not reach the minimum pressure. Check the flow paths for leaks, and check the minimum pressure setting.	Type: Error 2	
		Cause	The pump pressure does not reach the minimum pressure.
		Corrective Action	Inspect the flow line for liquid leakage, and if there is no abnormality, set the [P.Min] method parameter to an appropriate value. Due to this error, the pump will not operate for 1 minute after pumping starts.
0x9110	Could not detect the home position of the pump motor.	Type: Error 2	
		Corrective Action	Press (Power button) to turn the power OFF, then press (Power button) again to turn the power ON. Next, press [Pump] from the Main Analysis screen. If the same error message is displayed even after this operation, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x9111	The leak sensor of the pump detected a liquid leak.	Type: Error 2	
		Corrective Action	Inspect the flow line for liquid leakage and wipe off the liquid around the leak sensor.
0x9112	The remaining amount of Mobile Phase A liquid is low.	Type: Warning	
		Corrective Action	Replace the mobile phase and set the mobile phase volume again.
0x9113	The remaining amount of Mobile Phase B liquid is low.	Type: Warning	
		Corrective Action	Replace the mobile phase and set the mobile phase volume again.
0x9114	The remaining amount of Mobile Phase C liquid is low.	Type: Warning	
		Corrective Action	Replace the mobile phase and set the mobile phase volume again.
0x9115	The remaining amount of Mobile Phase D liquid is low.	Type: Warning	
		Corrective Action	Replace the mobile phase and set the mobile phase volume again.

Error Code	Error Message	Explanation	
0x9116	The pressure increased during purge of the pump.	Type: Error 2	
		Corrective Action	If an error message is displayed during autopurge operation, inspect the flow line for clogging.
0x9117	Pump is stopped because a rotation error was detected in the cooling fan for the pump.	Type: Fatal error	
		Corrective Action	*1
0x9200	There is a mistake in the analysis parameters or settings.	Type: Error 1	
		Corrective Action	Check the analysis condition for mistakes or inconsistencies. If no mistake or inconsistency is found, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x9201	The leak sensor of the autosampler low pressure valve has detected a liquid leak.	Type: Error 2	
		Cause	Liquid leaks from the low-pressure valve, measuring pump, or a unit (e.g., a high-pressure valve, column oven, or detector) positioned above the low-pressure valve.
		Corrective Action	Inspect the low-pressure valve, measuring pump, or a unit (e.g., high-pressure valve, column oven, or detector) positioned above the low-pressure valve for liquid leakage, and wipe off the liquid around the leak sensor.
0x9202	The leak sensor of the autosampler high pressure valve has detected a liquid leak.	Type: Error 2	
		Cause	Liquid leaks from the high-pressure valve or a unit (e.g., detector) positioned above the high-pressure valve.
		Corrective Action	Inspect the high-pressure valve or a unit (e.g., detector) positioned above the high-pressure valve for liquid leakage, and wipe off the liquid around the leak sensor.
0x9203	Could not detect the rotation direction home position of the autosampler measuring pump.	Type: Fatal error	
		Corrective Action	*1
0x9204	Temperature control is turned off because voltage of the autosampler rack L cooling unit is too high.	Type: Fatal error	
		Corrective Action	*1
0x9206	Temperature control is turned off because voltage of the autosampler rack R cooling unit is too high.	Type: Fatal error	
		Corrective Action	*1

Error Code	Error Message	Explanation	
0x9207	Temperature control is turned off because voltage of the autosampler dehumidifier unit is too high.	Type: Fatal error	
		Corrective Action	*1
0x9208	Temperature control is turned off because the autosampler rack L heater has overheated and the thermal fuse has blown.	Type: Fatal error	
		Corrective Action	*1
0x920A	Temperature control is turned off because the autosampler rack R heater has overheated and the thermal fuse has blown.	Type: Fatal error	
		Corrective Action	*1
0x920B	The leak sensor in the autosampler low pressure valve has detected an abnormal condition.	Type: Fatal error	
		Corrective Action	*1
0x920C	The leak sensor in the autosampler low pressure valve is malfunctioning.	Type: Fatal error	
		Corrective Action	*1
0x920D	The leak sensor in the autosampler high pressure valve has detected an abnormal condition.	Type: Fatal error	
		Corrective Action	*1
0x920E	The leak sensor in the autosampler high pressure valve is malfunctioning.	Type: Fatal error	
		Corrective Action	*1
0x920F	Temperature control is turned off because the temperature sensor in autosampler rack L is malfunctioning.	Type: Fatal error	
		Corrective Action	*1
0x9210	Temperature control is turned off because the temperature sensor in autosampler rack L has detected an abnormal condition.	Type: Fatal error	
		Corrective Action	*1
0x9213	Temperature control is turned off because the temperature sensor in autosampler rack R is malfunctioning.	Type: Fatal error	
		Corrective Action	*1
0x9214	Temperature control is turned off because the temperature sensor in autosampler rack R has detected an abnormal condition.	Type: Fatal error	
		Corrective Action	*1

Error Code	Error Message	Explanation	
0x9215	Temperature control is turned off because the temperature sensor in the autosampler dehumidifier unit is malfunctioning.	Type: Fatal error	
		Corrective Action	*1
0x9216	Temperature control is turned off because the sensor in the autosampler dehumidifier unit has detected an abnormal condition.	Type: Fatal error	
		Corrective Action	*1
0x9217	The backup parameters for the autosampler and column oven are corrupted.	Type: Fatal error	
		Corrective Action	*1
0x9218	The consumable part count data for the autosampler and column oven is corrupted.	Type: Fatal error	
		Corrective Action	*1
0x9219	The front panel of the autosampler may not be attached correctly. Alternatively, the sensor that detects the position of the front panel is malfunctioning.	Type: Fatal error	
		Corrective Action	First, check if the front panel is properly attached. ▶▶ Reference Maintenance Guide "3.1 Removing/Attaching the Front Panel" If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x921A	Temperature control is turned off because a rotation error was detected in the cooling fan of the autosampler.	Type: Fatal error	
		Corrective Action	*1
0x921B	A rotation error was detected in the exhaust heat fan at the top of the rear of the instrument.	Type: Fatal error	
		Corrective Action	*1
0x921C	Could not detect the home position of the autosampler high pressure valve.	Type: Fatal error	
		Corrective Action	*1
0x921D	Teaching has not been executed for the autosampler injection port.	Type: Error 2	
		Corrective Action	Adjust the position of the needle for the injection port.
0x921E	Could not detect the X-direction home position of the autosampler needle.	Type: Fatal error	
		Corrective Action	*1
0x921F	Could not detect the Y-direction home position of the autosampler needle.	Type: Fatal error	
		Corrective Action	*1

Error Code	Error Message	Explanation	
0x9220	Could not detect the Z-direction home position of the autosampler needle.	Type: Fatal error	
		Corrective Action	*1
0x9221	Could not detect the forward and backward home position sensor of the autosampler measuring pump.	Type: Fatal error	
		Corrective Action	*1
0x9222	There is no sample vial set in the autosampler rack.	Type: Error 3	
		Cause	No sample vial is set for the sample vial number set in the sequence.
		Corrective Action	Set a sample vial for the sample vial number set in the sequence. If [Vial Skip] in the system settings is set to [Enabled], analysis for which no sample vial has been set will not be executed, but the next analysis will be executed.
0x9223	Could not detect the home position of the autosampler low pressure valve.	Type: Fatal error	
		Corrective Action	*1
0x9224	System Error	Type: Fatal error	
		Corrective Action	*1
0x9225	The temperature sensor in the autosampler dehumidifier unit has detected an abnormal value.	Type: Fatal error	
		Corrective Action	*1
0x9227	Temperature control is turned off because the temperature sensor in autosampler rack plate L has detected an abnormal condition.	Type: Fatal error	
		Corrective Action	*1
0x9228	Temperature control is turned off because the temperature sensor in autosampler rack plate R has detected an abnormal condition.	Type: Fatal error	
		Corrective Action	*1
0x9229	Analysis was stopped because the position of the needle for the autosampler rack has not been adjusted.	Type: Error 3	
		Cause	Because the position of the needle for the rack is not adjusted, analysis was stopped.
		Corrective Action	Adjust the position of the needle for the rack.
0x922A	The position of the needle for the rack set in autosampler rack plate L has not been adjusted.	Type: Warning	
		Cause	The position of the needle for the left rack is not adjusted.
		Corrective Action	Adjust the position of the needle for the left rack.

Error Code	Error Message	Explanation	
0x922B	The position of the needle for the rack set in autosampler rack plate R has not been adjusted.	Type: Warning	
		Cause	The position of the needle for the right rack is not adjusted.
		Corrective Action	Adjust the position of the needle for the right rack.
0x922C	The rack ID of the rack set in the autosampler is not correct.	Type: Warning	
		Cause	The rack ID is not correct.
		Corrective Action	Set the correct ID for the rack.
0x922D	Racks that have the same ID are set in the autosampler.	Type: Warning	
		Corrective Action	Change either the left or right rack ID.
0x922E	Rack plate L cooler was turned off because there was no rack set in autosampler rack plate L for more than 30 minutes.	Type: Warning	
		Cause	Because the left rack has not been set for more than 30 minutes, sample cooler temperature control for the left side was canceled.
		Corrective Action	Setting the left rack will resume sample cooler temperature control.
0x922F	Rack plate R cooler was turned off because there was no rack set in autosampler rack plate R for more than 30 minutes.	Type: Warning	
		Cause	Because the right rack has not been set for more than 30 minutes, sample cooler temperature control for the right side was canceled.
		Corrective Action	Setting the right rack will resume sample cooler temperature control.
0x9230	The setting for the autosampler sample vial number is outside the setting range.	Type: Error 3	
		Cause	In the sequence, a sample vial number outside the setting range has been set for the set plate.
		Corrective Action	Check the sequence.Alternatively, check whether the plate is properly set.
0x9231	The autosampler needle X-direction motor has slipped.	Type: Fatal error	
		Corrective Action	*1
0x9232	The autosampler needle Y-direction motor has slipped.	Type: Fatal error	
		Corrective Action	*1
0x9233	The remaining autosampler rinse solution is low.	Type: Warning	
		Corrective Action	Replenish the autosampler rinse solution.

Error Code	Error Message	Explanation	
0x9234	When the autosampler needle was lowered, it hit a foreign object causing excessive force to be exerted on it.	Type: Fatal error	
		Corrective Action	Press (Power button) to turn the power OFF, and check the inside of the instrument for masking that prevents the needle from the dropping operation. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x9304	The detector parameters are corrupted.	Type: Error 2	
		Cause	A failure occurred in the non-volatile memory of the detector, or an error occurred when writing to the non-volatile memory.
		Corrective Action	Perform calibration (wavelength calibration, absorbance compensation, and linearity compensation) of the detector. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x9321	The leak sensor of the detector detected a liquid leak.	Type: Error 2	
		Cause	Liquid is leaking from the detector.
		Corrective Action	Inspect the detector for liquid leakage and wipe off the liquid around the leak sensor.
0x9341	The buffer memory of the detector has overflowed.	Type: Error 3	
		Cause	The buffer memory for transmission from the instrument to the workstation is full.
		Corrective Action	Check the communication environment and operating status between the instrument and the workstation. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.

Error Code	Error Message	Explanation	
0x9344	Could not resend the data because the buffer memory of the detector overflowed during analysis.	Type: Error 3	
		Cause	The recovery failed when trying to resend the transmission data from the instrument to the workstation.
		Corrective Action	Check the communication environment and operating status between the instrument and the workstation. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x9345	Light intensity was exceeded because the detector took a long exposure time.	Type: Error 3	
		Corrective Action	Calibrate the exposure time.
0x9352	Communication between the instrument and the workstation has timed out.	Type: Warning	
		Cause	Communication between the instrument and the workstation was disconnected.
		Corrective Action	Check the communication environment and operating status between the instrument and the workstation. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x9353	The detector cell temperature does not reach the set temperature.	Type: Error 3	
		Corrective Action	Replace the temperature-controlled flow cell. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x9356	The IP address of the instrument is duplicated.	Type: Error 3	
		Cause	The IP address of the instrument overlaps with that of another instrument.
		Corrective Action	Avoid duplicate IP addresses. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.

Error Code	Error Message	Explanation	
0x9361	Temperature control of the cell is turned off because the detector cell temperature has exceeded the set value.	Type: Fatal error	
		Cause	The control circuit of the temperature-controlled flow cell is defective.
		Corrective Action	Replace the temperature-controlled flow cell.
0x9363	The detector cell temperature does not lower to the set temperature.	Type: Warning	
		Cause	Even after 5 minutes, the temperature of the temperature-controlled flow cell has not dropped to the set temperature.
		Corrective Action	Configure the setting for the [Cell Temp.] method parameter relatively high. Change the setting for the cell temperature to be room temperature plus 15 °C min.
0x9374	The setting of the detector cell temperature is outside the setting range.	Type: Error 3	
		Cause	The setting for the [Cell Temp.] method parameter is outside the setting range.
		Corrective Action	Set the [Cell Temp.] method parameter within the setting range.
0x9378	The leak sensor of the detector is malfunctioning.	Type: Fatal error	
		Corrective Action	*1
0x9379	The leak sensor of the detector is malfunctioning.	Type: Fatal error	
		Corrective Action	*1
0x937A	The lamp is turned off because the temperature sensor of the detector lamp housing is malfunctioning.	Type: Fatal error	
		Corrective Action	*1
0x93C2	The D2 lamp cannot light because the lamp current of the detector is too large.	Type: Error 2	
		Cause	Either the D2 lamp or the lighting circuit is defective.
		Corrective Action	Replace the D2 lamp. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.

Error Code	Error Message	Explanation	
0x93C3	The D2 lamp cannot light because the lamp current of the detector is too small.	Type: Error 2	
		Cause	The constant current circuit is defective, or there is a lighting failure in the D2 lamp due to a broken filament, the lifetime of the lamp, or a failure of the lamp itself.
		Corrective Action	Replace the D2 lamp. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x93C4	The W lamp cannot light because the lamp current of the detector is too small.	Type: Error 2	
		Cause	Either there is a lighting failure in the W lamp due to a broken filament, or the lighting circuit is defective.
		Corrective Action	Replace the W lamp. If replacing the W lamp does not remove the error, contact your Shimadzu representative.
0x93C6	The detector lamp housing cover is open. Turn the lamp off.	Type: Error 3	
		Cause	The cover of the lamp housing was opened or the cover sensor is defective.
		Corrective Action	Close the lamp housing cover. If the error cannot be removed, replace the cover sensor.
0x93C7	The D2 lamp cannot light because the heater current of the detector is too large.	Type: Error 2	
		Cause	Either the D2 lamp or the lighting circuit is defective.
		Corrective Action	Replace the D2 lamp. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.

Error Code	Error Message	Explanation	
0x93C8	The lamp is turned off because the temperature of the detector lamp housing is high.	Type: Error 2	
		Corrective Action	Take action in the following order. 1 Check if the fan on the back of the instrument is blocked. 2 Clean or replace the filter on the back of the instrument, the filter on the left side, and the filter on the front side (back of the lamp housing cover) of the lamp. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x93C9	The W lamp cannot light because the lamp current of the detector is too large.	Type: Error 2	
		Cause	Either the W lamp or the W lamp lighting circuit is defective.
		Corrective Action	Replace the W lamp. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x93CA	The D2 lamp cannot light because the heater current of the detector is too small.	Type: Error 2	
		Cause	Either the D2 lamp or the lighting circuit is defective.
		Corrective Action	Replace the D2 lamp. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x93CB	The detector D2 lamp is not connected.	Type: Error 2	
		Cause	The connector of the D2 lamp is not connected. Or, the cable of the D2 lamp is broken or the board is defective.
		Corrective Action	Take action in the following order. 1 Check whether the D2 lamp is connected. 2 Replace the D2 lamp. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.

Error Code	Error Message	Explanation	
0x93CC	The detector W lamp is not connected.	Type: Error 2	
		Cause	The connector of the W lamp is not connected. Or, the cable of the W lamp is broken or the board is defective.
		Corrective Action	Take action in the following order. 1 Check whether the W lamp is connected. 2 Replace the W lamp. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x93CD	The W lamp cannot light because the lamp voltage of the detector is too large.	Type: Fatal error	
		Cause	The lighting circuit is defective.
		Corrective Action	*1
0x93D1	Could not detect the filter home position in the detector.	Type: Fatal error	
		Corrective Action	*1
0x93D2	The temperature of the detector board is high.	Type: Warning	
		Corrective Action	Take action in the following order. 1 Check if the fan on the back of the instrument is blocked. 2 Clean or replace the filter on the back of the instrument, the filter on the left side, and the filter on the front side (back of the lamp housing cover) of the lamp. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.

Error Code	Error Message	Explanation	
0x93D3	The lamp is turned off because the temperature of the detector board is high.	Type: Error 2	
		Cause	The fan or inlet is blocked, or the lighting circuit is defective.
		Corrective Action	Take action in the following order. 1 Check if the fan on the back of the instrument is blocked. 2 Clean or replace the filter on the back of the instrument, the filter on the left side, and the filter on the front side (back of the lamp housing cover) of the lamp. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x93D4	The D2 lamp cannot light because the lamp voltage of the detector is too large.	Type: Fatal error	
		Cause	The lighting circuit is defective.
		Corrective Action	*1
0x93D5	The D2 lamp cannot light because the heater voltage of the detector is too large.	Type: Fatal error	
		Cause	The lighting circuit is defective.
		Corrective Action	*1
0x93D6	The lamp is turned off because a rotation error was detected in the detector fan.	Type: Fatal error	
		Corrective Action	*1
0x93D8	Temperature control is turned off because the temperature of the optical unit is high.	Type: Fatal error	
		Corrective Action	*1
0x93D9	Temperature control is turned off because the temperature sensor of the optical unit is malfunctioning.	Type: Fatal error	
		Corrective Action	*1
0x93DA	The instrument is turned off because the ADC module on the board is malfunctioning. The instrument is stopped.	Type: Fatal error	
		Corrective Action	*1
0x93DB	The optical unit temperature does not reach the set temperature. Temperature control is turned off.	Type: Fatal error	
		Corrective Action	Contact your Shimadzu representative.
0x93DC	Temperature control is turned off because the heater of the optical unit is malfunctioning.	Type: Fatal error	
		Cause	The monochromator heater is short-circuited or the circuit is defective.
		Corrective Action	*1

Error Code	Error Message	Explanation	
0x93E2	Failed to receive the detector signal.	Type: Error 3	
		Corrective Action	*1
0x93E4	Failed to receive the detector signal.	Type: Error 3	
		Corrective Action	*1
0x93F1	Could not detect the filter home position in the detector.	Type: Fatal error	
		Corrective Action	*1
0x93F2	Could not detect the grating home position in the detector.	Type: Fatal error	
		Corrective Action	*1
0x93F4	Results of wavelength accuracy check at instrument startup differ by more than 1nm. There may be bubbles in the flow cell.	Type: Warning	
		Corrective Action	Conduct the pumping, remove air bubbles, and then run the performance check to verify the wavelength accuracy.
0x9400	The column oven door is open when the column oven is at high temperature. Close the column oven door as soon as possible in mind, such as burns.	Type: Warning	
		Cause	The column oven door is open with the column oven temperature at 50 °C min.
		Corrective Action	Clear the error. There will be no alarm sound or error message. Work while taking sufficient care for avoiding burns.
0x9401	Temperature control is turned off because liquid leak was detected inside the column oven.	Type: Error 2	
		Corrective Action	Take action in the following order. 1 If organic solvent leaks inside the column oven, take action to stop the leak in the tubing. 2 Check around the instrument for organic solvent gas, and if there is such gas, sufficiently ventilate the room. 3 After confirming that there is no abnormality in the above two points, calibrate the sensitivity of the gas sensor.
0x9402	An error was detected with the flow channel selection valve in the column oven.	Type: Fatal error	
		Corrective Action	*1
0x9403	The gas sensor of the column oven has detected an abnormal condition.	Type: Fatal error	
		Corrective Action	*1
0x9404	Temperature control is turned off because the thermal fuse of the column oven has blown.	Type: Fatal error	
		Corrective Action	*1

Error Code	Error Message	Explanation	
0x9405	Temperature control is turned off because the Peltier unit of the column oven has detected an abnormal condition.	Type: Fatal error	
		Corrective Action	*1
0x9406	Temperature control is turned off because the Peltier unit of the column oven has detected an abnormal condition.	Type: Fatal error	
		Corrective Action	*1
0x9407	Temperature control is turned off because a rotation error was detected in the Peltier unit fan(outside) of the oven.	Type: Fatal error	
		Corrective Action	*1
0x9408	Temperature control is turned off because a rotation error was detected in the Peltier unit fan(inside) of the oven.	Type: Fatal error	
		Corrective Action	If foreign objects such as the tubing prevent the fan from rotating, press (Power button) to turn the power OFF, and remove the foreign objects. If foreign particles cannot be removed or the error cannot be removed, contact your Shimadzu representative.
0x9409	Temperature control is turned off because the Peltier unit of the column oven has detected an abnormal condition.	Type: Fatal error	
		Corrective Action	*1
0x940A	The room temperature sensor of the instrument has detected an abnormal condition.	Type: Fatal error	
		Corrective Action	*1
0x940B	Temperature control is turned off because the temperature of the column oven exceeded the maximum temperature.	Type: Error 1	
		Cause	The column oven temperature has exceeded the set value for the [Temperature Limit(Maximum)] method parameter.
		Corrective Action	Configure the settings so that the set value for the column oven temperature simple parameter and that for the [Temperature Limit(Maximum)] method parameter are different by approximately 5 °C. If the difference is too small, the column oven temperature may exceed the value for the [Temperature Limit(Maximum)] method parameter before it becomes the set value.
0x940C	Temperature control is turned off because the temperature sensor of the column oven is malfunctioning.	Type: Fatal error	
		Corrective Action	*1

Error Code	Error Message	Explanation	
0x940D	Temperature control is turned off because the temperature sensor of the column oven is malfunctioning.	Type: Fatal error	
		Corrective Action	*1
0x940E	The column oven temperature setting is too low compared to the room temperature.	Type: Warning	
		Corrective Action	Check the set value of the oven temperature simple parameter, and if the value is different from the room temperature by 12 °C min., adjust the setting so that the difference becomes 12 °C max.
0x940F	Failed to write to the column management device (CMD).	Type: Warning	
		Cause	The CMD is defective.
		Corrective Action	Replace the CMD. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x9410	Temperature control is turned off because the heater of the column oven is malfunctioning.	Type: Fatal error	
		Corrective Action	*1
0x9411	The upper part of the column oven door may be open. Alternatively, the column oven door sensor is malfunctioning.	Type: Error 1	
		Corrective Action	First, check if the column oven door is properly closed. If the error cannot be removed, press (Power button) to turn the power OFF, and contact your Shimadzu representative.
0x9413	The set temperature of the column oven is set to 86 degrees Celsius or higher while the column management device (CMD) is connected.	Type: Error 1	
		Corrective Action	Please set the column temperature lower than 85 °C when CMD is connected.

*1 Press the [Power OFF] button in the error window to turn the power to the instrument off, and contact your Shimadzu representative.

7 Technical Information

7.1 Specifications

7.1.1 Hardware Specifications

Automation Functions	• Automatic shutdown • Autopurge • Automatic validation (wavelength, lamp intensity, pressure pulsation, temperature control precision, absorbance, baseline drift, baseline noise, pressure limiter, and gradient concentration accuracy) • Autmatic pretreatment function
Dimensions	W410 × D500 × H605 mm (Depth is the desk installation space)
Weight	• Model without a sample cooler: 58 kg • Model with a sample cooler: 63 kg
Operating noise	53 dB max. (Waiting, under the specified conditions)
Usable Solvent Types	• Organic solvents (excluding fluorine organic solvents like HFIPA) • Aqueous solutions by diluting acid/alkali, and their mixtures (excluding hydrohalic acids like hydrochloric acid)*1
Available pH Range	1-13 (Some types of mobile phases may damage the flow cell quartz if used for a long period of time at pH10 or more, resulting in transformation of the transparent characteristics.)
Material of Wetted Parts	Stainless steel (SUS316L, SUS316), FEP, PEEK, PTFE, perfluoroelastomer, ruby, sapphire, Hastelloy C, GFP, ceramic, PFA, quartz, PPS
Operating Temperature Range	4 °C to 35 °C
Humidity Range	20 % to 85 %
Usable Maximum Pressure	44 MPa
System Delay Volume	Approx. 650 µL
Setting for Analysis Time	In steps of 0.01 min
Suction Filter	10 µm (filtering accuracy)
Leak Sensor	Detects leakage from the degassing unit, pump, autosampler, column oven, UV detector, or PDA detector

*1 Because PEEK tubing is used for the column oven outlet, depending on the solvent, the strength of the material may cause a problem.

■ Power supply

LC-2030 Plus (Model with a UV detector and without a sample cooler)

Part No.	Power Supply Voltage*1	Power Consumption	Frequency
S228-65800-58	AC100 V to 240 V	600 VA	50/60 Hz

LC-2030C Plus (Model with a UV detector and sample cooler)

Part No.	Power Supply Voltage*1	Power Consumption	Frequency
S228-65801-58	AC100 V to 240 V	600 VA	50/60 Hz

LC-2030C 3D Plus (Model with a PDA detector and sample cooler)

Part No.	Power Supply Voltage*1	Power Consumption	Frequency
S228-65802-58	AC100 V to 240 V	600 VA	50/60 Hz

*1 Mains supply voltage fluctuations are not to exceed 10 % of the nominal supply voltage.

■ Pump

Gradient mode		Quaternary low-pressure gradient
Pump Type		Parallel double plunger system (approx. 10 µL in 1 stroke)
Pumping Method		Constant Flow Delivery
Constant Flow Delivery	Flow Rate Settings Range	0.0001 to 5 mL/min (1.0 MPa to 44.0 MPa) 5.0001 to 10 mL/min (1.0 MPa to 22.0 MPa) (During autopurge: 8 mL/min)
	Flow Rate Accuracy	Larger value of either ±1 % or ±2 µL/min (0.01 mL/min to 2 mL/min) ±2 % (2 mL/min to 5 mL/min) * At 1.0 MPa to 40 MPa with the water/room temperature fixed at 20 °C. However, for a flow rate faster than 8 mL/min, use a LPGE-OUT pipe-Long for the tubing from the low-pressure gradient unit to the pump inlet block.
	Flow Rate Precision	No more than the larger value calculated with either 0.06 % RSD or 0.02 min SD
Pressure Limiter Operations		Upper/lower limits can be set
Plunger, Seal		Plunger: Sapphire Seal: GFP (standard) or PE (optional)
Solvent Switching		4 liquids
Line Filter		5 µm (filtering accuracy)
Drain Valve		Autodrain using the high-pressure valve of the autosampler (With a manual valve installed)
Pulsatioin		0.1 MPa max. (1.0 mL/min, 10 MPa, Water)
Pressure Display Accuracy		Larger value of either ±2 % or ±0.5 MPa

Plunger Rinsing		Automatic rinsing function (standard equipment)
Purge Function		Autopurge function, manual purge function
Gradient	Number of Solvents Mixed	4 liquids
	Range of Set Concentrations	0 to 100 % (in steps of 0.1 %)
	Concentration Accuracy	±0.5 % max. * 0.1 mL/min to 2 mL/min, 1.0 MPa to 20.0 MPa, applicable to water and caffeine solutions
	Concentration Fineness	±0.1 % (1 mL/min, 10 MPa, under the specified conditions)
	Mixer	Approx. 40 µL (default)
Degassing Unit		Membrane-type online degassing unit, Volume: Approx. 400 µL, Number of lines: 5 (4 ports for mobile phase, 1 port for rinse solution) **NOTE** The following is the range of flow rates usable without blisters when performing a low-pressure gradient. Connection of 1 flow line per solvent: Water/methanol = 1.5 mL/min If using at a min. rate of 1.5 mL/min, first perform ultrasonic degassing for the mobile phase.

■ Autosampler

Injection Method		Injection of total sample, variable injection volume (sample loss during injection is zero)
Injection Volume	Setting Range	0.1 µL to 100 µL (default) or 0.1 µL to 2000 µL (optional)
	Step	0.1 µL to 9.9 µL: 0.1 µL, 10 µL to 2000 µL: 1 µL.
Samples for Processing		• When using 1 mL sample vials: 336 • When using 1.5 mL sample vials: 216 • When using 4 mL sample vials: 112 • When using a 96-well microtiter plate with 4 wells: 384 • When using a 384-well microtiter plate with 4 wells: 1536 • When using a 96-well deep-well plate with 4 wells: 384 • When using a 384-well deep-well plat with 4 wells: 1536
Sample Vial		1.5 mL glass vial, 1.1 mL glass vial, 1 mL glass vial, 4 mL glass vial, 0.3 mL glass vial (with plastic spacer), 0.3 mL glass vial (type contained in a 4 mL bottle), 1 mL plastic vial, 0.2 mL plastic vial, 4 mL plastic vial, 96-well microtiter plate, 384-well microtiter plate, 96-well deep-well plate, 384-well deep-well plate
Injection Volume Reproducibility		RSD ≤ 1.0 % (0.5 µL to 0.9 µL) RSD ≤ 0.5% (1.0 µL to 1.9 µL) RSD ≤ 0.25 % (2.0 µL to 4.9 µL) RSD ≤ 0.2 % (5.0 µL to 2000 µL)
Cross Contamination		0.0025 % max. (Depends on the specified condition)
Injection Volume Accuracy		±1 % (50 µL, n = 10) max.
Injection Volume Linearity		> 0.9999 (1 µL to 100 µL, under the specified conditions)
Injection Cycle Time		14 seconds min. (under the specified conditions)
Sample Aspiration Rate		0.1 µL/sec to 15 µL/sec (in steps of 0.1 µL/sec)
Rinse Solution Aspiration Rate		35 µL/sec
Rinse Solution Degassing		Standard equipment
Sample Cooler * Only for Models with Sample Cooler	Type	Direct cooling system (when the set temperature is 4 °C, use in environmental conditions of a room temperature of 30 °C max. and humidity of 70 % max.), dehumidification function built-in
	Temperature Setting Range	4 °C to 45 °C * Possible to cool down to 4 °C when the room temperature is 30 °C max. and humidity is 70 % max. * Possible to heat up to 45 °C when the room temperature is 15 °C min.
	Temperature Accuracy	±3 °C (not possible to cool to 1 °C or below)

■ Column oven

Heating and Cooling Method	Forced air circulation method
Temperature Setting Range	4 °C to 90*1 °C (in steps of 1 °C)
Temperature Accuracy	±0.8 °C (on the outer surface of a column, temperature control 50 °C, room temperature 25 °C, under the specified conditions)
Temperature Control Precision	Fluctuation ≤ 0.2 °C
Temperature Control Range	Room temperature -12 °C to 90*1 °C
Containable Column Size	6 pcs at 10 cm max., 3 pcs at 10 cm to 30 cm
Safety Measures	• To prevent overheating, the highest operating temperature can be set. • Built-in thermal fuse • Built-in gas sensor When the gas sensor operates, the pump liquid delivery, column oven temperature control, and sample injection will stop.

*1 Please set the column temperature lower than 85 ºC when CMD is connected.

■ UV detector

Flow Cell	Built-in temperature control function (Allowable temperature input range: 19 °C to 50 °C, step: 1 °C) Cell length: 10 mm, Cell volume: 12 µL, Cell withstanding pressure: 12 MPa
Light Source	Deuterium (D2) lamp
Wavelength Range	190 nm to 700 nm
Spectral Bandwidth	8 nm
Wavelength Accuracy	±1 nm max.
Wavelength Reproducibility	±0.1 nm max.
Drift	1×10^{-4} AU/h max. * For 250 nm with air in the cell and a constant room temperature
Temperature Coefficient	1×10^{-4} AU/°C max. * For 250 nm with air in the cell
Noise Level	±0.25 x 10^{-5} AU max. * For 2 sec responses at 250 nm with air in the cell
Linearity	Up to 2.5 AU (Caffeine, 272 nm)
Automatic Wavelength Accuracy Checking Function	Checks using an built-in Ho filter (241 nm) and D2 lamp (656.1 nm)
Automatic Absorbance Accuracy Checking Function	Built-in filter to check absorbance
Response	Corresponds to the time constants 0.05, 0.1, 0.5, 1.0, 1.5, 2.0, 3.0, 6.0, 8.0, and 10.0 sec, and switches among these 11 steps (time constants) without a digital filter

Zero Adjustment	Autozero function
Polarity Switching	Supported
Simultaneous Monitoring of 2 Wavelengths	Measurement wavelengths: Any 2 wavelengths of 190 nm to 370 nm or 371 nm to 700 nm Sampling frequency: 0.5 sec for one wavelength
Output	Integrator output: 0.5, 1, 1.25, 2, 2.5, 4 AU/V (1 V full scale), 6-step switching

■ PDA detector

Flow Cell	Built-in temperature control function (Allowable temperature input range: 19 °C to 50 °C, step: 1 °C) Cell length: 10 mm, Cell volume: 10 µL, Cell withstanding pressure: 12 MPa
Light Source	Deuterium (D2) lamp (standard) or tungsten lamp (optional)
Number of Photodiode Array Elements	1024
Wavelength Range	190 nm to 800 nm
Device Resolution	0.6 nm/device
Slit Width	1.2 nm, 8 nm (Slit switching possible)
Spectral Resolution	1.4 nm max. * For a 253.7 nm low-pressure mercury lamp and 1.2 nm slit
Wavelength Accuracy	± 1 nm max.
Drift	5×10^{-4} AU/h max. * For 250 nm (reference: 350 nm), methanol pumping at 1 mL/min, and constant room temperature
Temperature Coefficient	5×10^{-4} AU/°C max. * For 250 nm (reference: 350 nm) and methanol pumping at 1 mL/min are used
Noise Level	± 0.3 x 10^{-5} AU max. * For a 2 sec time constant, 8 nm slit width, 250 nm (reference: 350 nm), methanol pumping at 1 mL/min, and the ASTM method
Linearity	Up to 2.0 AU (Caffeine, 272 nm, 1.2 nm slit)
Automatic Wavelength Accuracy Checking Function	Checks using the built-in Ho filter (241.5 nm/360.8 nm) and D2 lamp (656.1 nm/486.0 nm)
Sampling Rates	10, 25, 80, 160, 240, 320, 640, 1280, 2000 (ms)
Time Constants	10, 25, 50, 80, 100, 160, 240, 320, 480, 640, 960, 1280, 2000 (ms), OFF(0)
Zero Adjustment	Autozero function
Polarity Switching	Supported
Output	Integrator output: 0.5, 1, 1.25, 2, 2.5, 4 AU/V (1 V full scale), 6-step switching

■ Controller

Display Field	LCD with backlight (800 × 480 dots)
Input/Output Terminals	External input: 2, External output: 4. Optical link: 1 (for external detector), Analog output: 2 ch
Connectible Units	Recycle Valve Optional A/D board and optical link board
Number of Files	Method files: 20, Shutdown-files: 2. Sequence files: 1
Pump Control	Flow rate, concentration (straight line, step, exponential function), maximum pressure, minimum pressure
Autosampler Control	Sample injection volume, number of repeated analyses, analysis time or analysis-file number, etc.
Column Oven Control	Column oven temperature, upper temperature limit
UV Detector Control	Detector wavelength, time constant, lamp ON/OFF, cell temperature, etc.
PDA Detector Control	Detector wavelength, time constant, lamp ON/OFF, cell temperature, etc.
Self-Diagnosis, Safety Measures	Memory check, maximum/minimum pressures, upper oven temperature limit, lamp current, abnormality monitoring of motor rotation, etc., for each part, leak sensor, lamp cover sensor, upper lamp housing temperature limit

7.2 Consumable Parts / Maintenance Parts / Replacement Parts / Tools

Parts with no description in the model name are common to the LC-2030 Plus series.

NOTE
- When replacing a part, be sure to use a part described in this section.
- For the replacement procedure, refer to the Maintenance Guide.

7.2.1 Consumable Parts

Part Name	Model Name	Part No.	Related Unit
Line Filter		S228-35871-96	Pump
Plunger Seal (GFP)		S228-35146	Pump
Needle ASSY 2030		S228-41024-99	Autosampler
High-Pressure Valve Stator		S228-56253-42	Autosampler
High-Pressure Valve Rotor		S228-56098	Autosampler
Low-Pressure Valve Rotor		S228-36923	Autosampler
Needle Seal XR (PEEK)		S228-50390	Autosampler
Needle Seal XR Kit		S228-50452-93	Autosampler
Plunger Seal (GFP)		S228-35145	Autosampler

Part Name	Model Name	Part No.	Related Unit
Sample Loop ASSY 100 µL 2030		S228-56074-42	Autosampler
Rinsing Port Cap Set (Without Hole)		S228-48331-91	Autosampler
Rinsing Port Cap Set (with Hole)		S228-48331-92	Autosampler
SUS pipe 0.3x600 OUT		S228-56217-44	Autosampler
D2 Lamp UV	LC-2030 Plus LC-2030C Plus	S228-55626	UV detector
Cell Gasket (2 pcs)	LC-2030 Plus LC-2030C Plus	S228-35097-95	UV detector
D2 Lamp PDA	LC-2030C 3D Plus	S228-55626-01	PDA detector
Cell Gasket (2 pcs)	LC-2030C 3D Plus	S228-35097-96	PDA detector
Air Filter for Detector		S228-55674-02	UV detector / PDA detector
Suction Filter		S228-45707-91	Tubing
Side Air Filter		S228-55674	Entire system
Front Air Filter	LC-2030C Plus LC-2030C 3D Plus	S228-55674-01	Entire system

7.2.2 Maintenance Parts

Part Name	Model Name	Part No.	Related Unit
Check Valve IN ASSY		S228-48249-96	Pump
Check Valve OUT ASSY		S228-45705-91	Pump
Plunger Holder ASSY		S228-35281-97	Pump
Diaphragm (2 pcs)		S228-55272-41	Pump
Rack Panel		S228-56268-41	Autosampler
Front Panel		S228-55569-44	Autosampler
Wiper Rack		S228-57561-41	Autosampler
Cell Window	LC-2030 Plus LC-2030C Plus	S228-18058	UV detector flow cell
Lens		S228-14572	UV / PDA detector flow cell

7.2.3 Replacement Parts

Part Name	Model Name	Part No.	Related Unit
Head Holder		S228-38022-01	Pump
Pump Head		S228-34541-01	Pump

Part Name	Model Name	Part No.	Related Unit
Drain Tubing ASSY (for Pump)		S228-25495-94	Pump
ETFE Tubing (1.6 x 0.5)		S228-18495-04	Pump
Drain Valve ASSY		S228-45574-95	Pump
SUS Tubing L		S228-56206-01	Pump
SUS Tubing R		S228-56206-02	Pump
FEP Tubing (3 x 1.5)		S670-10321-05	Pump
SF Nut, 1/8		S228-56687-42	Pump
SF Ferrule, 1/8		S228-56687-43	Pump
SF Ferrule, 1/16		S228-56687-44	Pump
LPGE-OUT TUBE		S228-58589-41	Pump
Bush		S228-39084	Pump
Ferrule 1.6		S228-39677-01	Pump
Pump Automatic Rinsing		S228-56201-41	Pump
40 µL Mixer ASSY		S228-56213-43	Pump
Plunger ASSY		S228-35010-91	Autosampler
Plate Number Identification Label L12R34		S228-56222	Autosampler
Plate Number Identification Label L13R24		S228-56222-01	Autosampler
Plate Identification Tag		S228-56073	Autosampler
Cap, Needle Seal XR		S228-50392	Autosampler
Housing, Needle Seal XR		S228-50391	Autosampler
High-Pressure Valve Housing Top		S228-56278-41	Autosampler
High-Pressure Valve Gasket		S228-56061	Autosampler
Low-Pressure Valve Stator		S228-36917-01	Autosampler
Gasket 5PV		S228-38654	Autosampler
Column Clamp ASSY B5		S228-15617-91	Column oven
UV Detector Standard Cell	LC-2030 Plus LC-2030C Plus	S228-56167-41	UV detector
PDA Detector Standard Cell	LC-2030C 3D Plus	S228-42593-43	PDA detector
Drain Tubing		S228-18495-03	UV detector / PDA detector
Lens Setscrew ASSY		S228-40239-91	UV detector / PDA detector
Male Nut PEEK (0.8MN)		S228-46363	UV detector / PDA detector flow cell

Part Name	Model Name	Part No.	Related Unit
Coupling (1.6C-0.8C)		S228-40998-10	UV detector / PDA detector flow cell
Resistance Tube PEEK		S228-38994	Tubing
Ferrule (1.6F, 316L)		S228-16000-10	Tubing
Male Nut (1.6MN)		S228-16001	Tubing
Male Nut (1.6MN, W6)		S228-16001-03	Tubing
Coupling (1.6C 316L)		S228-16004-13	Tubing
Male Nut (1.6MN, PEEK)		S228-35403	Tubing
Suction Filter ASSY		S228-56200-49	Tubing
Drain Tubing	LC-2030 Plus	S228-56223-41	Tubing
Drain Tubing	LC-2030C Plus LC-2030C 3D Plus	S228-56223-42	Tubing
Drain Tube, Silicone		S228-25162-04	Tubing
Drain Tube Clamper		S228-46695-91	Tubing
PTFE Tube (OD 7.0 mm x ID 6.0 mm)		S016-37507	Tubing
Drain Tube (ETFE) ASSY		S228-44608-91	Tubing
PTFE Tube (OD 8.0 mm x ID 6.0 mm)		S016-37519	Tubing
Power Cord (for UL/CSA)		S071-60821-08	Entire system
Power Cord (for EU)		S071-60825-51	Entire system
Power Cord (for China)		S465-06046	Entire system
Cable, LD-CT/BU2/RS		S088-81104-84	Entire system
SIGNAL CABLE EMC, Terminal		S228-35047-92	Entire system
Remote Cable		S228-28253-91	Entire system
Clamp, UL-23G		S072-60314-03	Entire system
Reservoir Tray ASSY		S228-57714-42	Entire system
1000 ML Reservoir Bottle (5 pcs)		S228-38583-91	Entire system
1.5 mL Sample Vial Plate (2 pcs)	LC-2030 Plus	S228-50830-92	Entire system
1.5mL Sample Vial Metal Plate	LC-2030C Plus LC-2030C 3D Plus	S228-61615-42	Entire system
1.5 mL Sample Vial ASSY (5 pcs)		S228-38446-92	Entire system

7.2.4 Tools (for Maintenance)

Part Name		Part No.
Tool Kit		S228-57647-41
	Allen Wrench (for 3 mm)	S086-03804
	Allen Wrench (for 4 mm)	S086-03805
	Allen Wrench (Special Shape for 3 mm)	S670-18928-04
	Double-Ended Wrench (6×8)	S086-03047-01
	Double-Ended Wrench (8×10)	S086-03047-06
	Tube Cutter	S228-32930-01
	Screwdriver with Handle	S228-28767-91
	Seal Remover Tool	S228-62458-41
	Diaphragm Jig	S228-54852
	Plunger Tool	S228-34672-02
	Seal Installer Tool	S228-25142-01
	Needle seal XR Remover Tool	S228-50570
	Rotor Replacement Jig	S228-48899-91
	20 mL Syringe	S046-00038-01
	Adapter, Syringe	S228-18216-91
	3 mL Syringe	S046-00017-91
	Adapter, Syringe	S228-15672-91
	UHPLC Fitting Tool	S228-56866
	Plunger press plate	S228-70388
Air Blower		S086-78801-02
Flathead Screwdriver		S086-10504-18
Coil Resistance Tube (inner diameter: 0.1 mm, length: 2 m)		S228-57908-41

7.3 Supplementary Information

7.3.1 Mobile Phase Characteristics

The table on next page shows the characteristics of typical mobile phase.
The following describes the annotations in the table.

(1)	An asterisk (*) indicates solvents most suitable for LC, with boiling points (>45 °C) and low viscosity(<0.5 cp). Double asterisks (**) indicates solvents with very low viscosity and boiling point.
(2)	LC indicates that grade of solvent specifically for LC is commercially available from companies like the following: Burdick & Jackson, Baker Chemical, Mallinckrodt Chemical, Fischer Scientific, Waters Associate, Manufacturing Chemists. Inc. GC indicates that a particular solvent is used as a stationary phase for gas chromatography, and can be purchased from companies selling GC columns and stationary phases. (These solvents are used as stationary phase in liquid-to-liquid LC.)
(3)	The wavelength below which the solvent becomes opaque.
(4)	Refractive index at 25 °C.
(7)	Polarity parameter of solvent.
(8)	Solvent's strength parameter in relation to liquid-to-solid adsorption in alumina.
(9)	Water solubility (%W) at 20 °C of solvent used in liquid-to-solid adsorption.
(10)	"Dielectric Constant e20" shows the dielectric constant.
(11)	Function consisting of p' (proportional to solvent strength) plus the dielectric constant, in ion chromatography.
Source	A.M.Krstulovic and P.R.Brown, Reversed-Phase High-Performance Liquid Chromatography, Wiley Interscience, 1982.

	(1)	(2)	(3)	(4)	(5)	(6)
	Solvent (*) $\eta \leq 0.5$ cp, B.P. > 45 °C (**) $\eta \leq 0.5$ cp, B.P. < 45 °C	Source	UV Cutoff	$R.I._{25°}$	Boiling Point (°C)	Viscosity (cP,25 °C)
1	FC-78(*) FC-75(Fluorescent solvent) FC-43	(LC specific)	210 nm 210(opaque under 210)	1.267 1.276 1.291	50 102 174	0.4 0.8 2.6
2	Isooctane(*)(2,2,4-tri methylpentane)	LC	197	1.389	99	0.47
3	n-Heptane(*)	LC	195	1.385	98	0.4
4	n-Hexane(*)	LC	190	1.372	69	0.3
5	n-Pentane(**)	LC	195	1.355	36	0.22
6	Cyclohexane	LC	200	1.423	81	0.9
7	Cyclopentane(*)	LC	200	1.404	49	0.42
8	I-Chlorobutane(*)	LC	220	1.4	78	0.42
9	Carbon disulfide	LC	380	1.624	46	0.34
10	2-Chloropropane(**)	LC	230	1.375	36	0.3
11	Carbon tetrachloride	LC	265	1.457	77	0.9
12	n-Butyl ether		220	1.397	142	0.64
13	Triethylamine			1.398	89	0.36
14	Bromoethane(*)			1.421	38	0.38
15	i-Propyl ether(*)		220	1.365	68	0.38
16	Toluene	LC	285	1.494	110	0.55
17	p-Xylene		290	1.493	138	0.6
18	Chlorobenzene			1.521	132	0.75
19	Bromobenzene			1.557	156	1.04
20	Iodobenzene					
21	Phenyl ether			1.58	258	3.3
22	Phenetole			1.505	170	1.14
23	Ethyl ether(**)	LC	218	1.35	35	0.24
24	Benzene	LC	280	1.498	80	0.6
25	Tricresy phosphate					
26	Ethyl iodide			1.51	72	0.57
27	n-Octanol		205	1.427	195	7.3
28	Fluorobenzene			1.46	85	0.55
29	Benzylether			1.538	288	4.5
30	Methylene chloride(**)	LC	233	1.421	40	0.41
31	Anisole			1.514	154	0.9
32	i-Pentanol			1.405	130	3.5
33	1,2-Dichloroethane	LC	228	1.442	83	0.78

	(1)	(7)	(8)	(9)	(10)	(11)
	Solvent (*) $\eta \leq 0.5$ cp, B.P. > 45 °C (**) $\eta \leq 0.5$ cp, B.P. < 45 °C	p'	e°a	Water Solubility %^{W} in$^{20\ °C}$ Solvent	Dielectric Constant e^{20}	p'+ 0.25e
1	FC-78(*) FC-75(Fluorescent solvent) FC-43	< -2 < -2 < -2	-0.25 -0.25 -0.25		1.88 1.86 1.9	p' and Dielect const (Function proportional to strength)
2	Isooctane(*)(2,2,4-tri methylpentane)	0.1	0.01	0.011	1.94	0.1
3	n-Heptane(*)	0.2	0.01	0.01	1.92	0.5
4	n-Hexane(*)	0.1	0.01	0.01	1.88	0.5
5	n-Pentane(**)	0	0	0.01	1.84	0.5
6	Cyclohexane	-0.2	0.04	0.012	2.02	0.5
7	Cyclopentane(*)	-0.2	0.05	0.014	1.97	0.6
8	I-Chlorobutane(*)	1	0.26		7.4	2.8
9	Carbon disulfide	0.3	0.15	0.005	2.64	1.7
10	2-Chloropropane(**)	1.2	0.29		9.82	3.7
11	Carbon tetrachloride	1.6	0.18	0.008	2.24	2.3
12	n-Butyl ether	2.1	0.25	0.19	2.8	2.4
13	Triethylamine	1.9	0.54		2.4	2.4
14	Bromoethane(*)	2	0.35		9.4	4.3
15	i-Propyl ether(*)	2.4	0.28	0.62	3.9	3.2
16	Toluene	2.4	0.29	0.046	2.4	2.9
17	p-Xylene	2.5	0.26		2.3	3
18	Chlorobenzene	2.7	0.3		5.6	4.1
19	Bromobenzene	2.7	0.32		5.4	4.1
20	Iodobenzene	2.8	0.35			
21	Phenyl ether	3.4			3.7	3.7
22	Phenetole	3.3			4.2	4.9
23	Ethyl ether(**)	2.8	0.38	1.3	4.3	4
24	Benzene	2.7	0.32	0.058	2.3	3.6
25	Tricresy phosphate					
26	Ethyl iodide	2.2			7.8	4.2
27	n-Octanol	3.4	0.5	3.9	10.3	5.8
28	Fluorobenzene	3.1			5.4	4.6
29	Benzylether	4.1				
30	Methylene chloride(**)	3.1	0.42	0.17	8.9	5.6
31	Anisole	3.8			4.3	4.6
32	i-Pentanol	3.7	0.61	9.2	14.7	7.3
33	1,2-Dichloroethane	3.5	0.44	0.16	10.4	6.3

	(1)	(2)	(3)	(4)	(5)	(6)
	Solvent (*) $\eta \leq 0.5$ cp, B.P. > 45 °C (**) $\eta \leq 0.5$ cp, B.P. < 45 °C	Source	UV Cutoff	$R.I._{25°}$	Boiling Point (°C)	Viscosity (cP,25 °C)
34	t-Butanol			1.385	82	3.6
35	n-Butanol	LC	210	1.397	118	2.6
36	n-Propanol	LC	240	1.385	97	1.9
37	Tetrahydrofuran(*)	LC	212	1.405	66	0.46
38	Propylamine(*)			1.385	48	0.35
39	Ethylacetate(*)	LC	256	1.37	77	0.43
40	i-Propanol	LC	205	1.384	82	1.9
41	Chloroform(*)	LC	245	1.443	61	0.53
42	Acetophenone			1.532	202	1.64
43	Methylethyl	LC	329	1.376	80	0.38
44	Cyclohexanone			1.45	156	2
45	Nitrobenzene			1.55	211	1.8
46	Benzonitrile			1.536	191	1.2
47	Dioxane	LC	215	1.42	101	1.2
48	Tetramethyl urea	LC	265	1.449	175	
49	Quinoline			1.625	237	3.4
50	Pyridine			1.507	115	0.88
51	Nitroethane		380	1.39	114	0.64
52	Acetone(*) Benzyl alcohol	LC	330	1.356 1.538	56 205	0.3 5.5
53	Tetramethyl guanidine					
54	Methoxyethanol	LC	210	1.4	125	1.6
55	Tris(cyanoethoxy) propane	GC				
56	Propylene carbonate	LC				
57	Ethanol	LC	210	1.359	78	10.8
58	Oxydipropionitrile	GC				
59	Aniline			1.584	184	3.77
60	Acetic acid			1.37	118	1.1
61	Acetonitrile(*)	LC	190	1.341	82	0.34
62	N,N-dimethylacetamide	LC	268	1.436	166	0.78
63	Dimethylformamide	LC	268	1.428	153	0.8
64	Dimethylsulfoxide	LC	268	1.477	189	2
65	N-methyl-2-pyrolidone	LC	285	1.468	202	1.67
66	Hexamethyl phosphoric acid triamide			1.457	233	3

	(1)	(7)	(8)	(9)	(10)	(11)
	Solvent (*) $\eta \leq 0.5$ cp, B.P. > 45 °C (**) $\eta \leq 0.5$ cp, B.P. < 45 °C	p'	e°a	Water Solubility %^{W} in^{20} °C Solvent	Dielectric Constant e^{20}	p'+ 0.25e
34	t-Butanol	4.1	0.7	miscible	12.5	
35	n-Butanol	3.9	0.7	20.1	17.5	8.3
36	n-Propanol	4	0.82	miscible	20.3	
37	Tetrahydrofuran(*)	4	0.57	miscible	7.6	
38	Propylamine(*)	4.2		miscible	5.3	
39	Ethylacetate(*)	4.4	0.58	8.8	6	5.8
40	i-Propanol	3.9	0.82	miscible	20.3	
41	Chloroform(*)	4.1	0.4	0.072	4.8	5.6
42	Acetophenone	4.8			17.4	8.7
43	Methylethyl	4.7	0.51	23.4	18.3	9.1
44	Cyclohexanone	4.7			18.3	9.1
45	Nitrobenzene	4.4			34.8	13.2
46	Benzonitrile	4.8			25.2	10.9
47	Dioxane	4.8		miscible	2.2	
48	Tetramethyl urea	6	0.56		23	10.7
49	Quinoline	5			9	7.4
50	Pyridine	5.3		miscible	12.4	
51	Nitroethane	5.2		0.9		
52	Acetone(*) Benzyl alcohol	5.1 5.7	0.71	miscible	13.1	8.8
53	Tetramethyl guanidine	6.1	0.6			
54	Methoxyethanol	5.5		miscible	19.9	
55	Tris(cyanoethoxy) propane	6.6	0.56			
56	Propylene carbonate	6.1				
57	Ethanol	4.3		miscible	24.6	
58	Oxydipropionitrile	6.8				
59	Aniline	6.3			6.9	8.1
60	Acetic acid	6		miscible	6.2	
61	Acetonitrile(*)	5.8		miscible	37.5	
62	N,N-dimethylacetamide	6.5	0.88		37.8	
63	Dimethylformamide	6.4			36.7	
64	Dimethylsulfoxide	7.2	0.62	miscible	4.7	
65	N-methyl-2-pyrolidone	6.7			32	
66	Hexamethyl phosphoric acid triamide	7.4	0.65		30	

	(1)	(2)	(3)	(4)	(5)	(6)
	Solvent (*) $\eta \leq 0.5$ cp, B.P. > 45 °C (**) $\eta \leq 0.5$ cp, B.P. < 45 °C	Source	UV Cutoff	$R.I._{25°}$	Boiling Point (°C)	Viscosity (cP,25 °C)
67	Methanol(*)	LC	205	1.326	65	0.54
68	Nitromethane		380	1.38	101	0.61
69	m-Cresol			1.54	202	14
70	N-methylformamide			1.447	182	1.65
71	Ethylene glycol			1.431	182	16.5
72	Formamide			1.447	210	3.3
73	Water	LC		1.333	100	0.89

	(1)	(7)	(8)	(9)	(10)	(11)
	Solvent (*) $\eta \leq 0.5$ cp, B.P. > 45 °C (**) $\eta \leq 0.5$ cp, B.P. < 45 °C	p'	e°a	Water Solubility %^{W} in$^{20\ °C}$ Solvent	Dielectric Constant e^{20}	p'+ 0.25e
67	Methanol(*)	5.1		miscible	32.7	
68	Nitromethane	6		2.1		
69	m-Cresol	7.4			11.8	10
70	N-methylformamide	6		miscible	182	
71	Ethylene glycol	6.9		miscible	37.7	
72	Formamide	9.6		miscible	111	
73	Water	10.2			80	

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