

Solvent Delivery Module for Shimadzu  
Ultra High Performance Liquid Chromatograph

**LC-40D X3**

**LC-40D XS**

**LC-40D XSi**

**LC-40D XR**

**LC-40D**

**LC-40i**

## Instruction Manual

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 instruction manual describes the basic operation, and accessories and options 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 in booklet form or in PDF format. The PDF documentation is on the instruction manual DVD-ROM (Part No. 228-92350-41).

Document Name	Document No.	Description
Instruction Manual (PDF)	228-92320	This instruction manual.
System Guide (PDF)	228-92352	This manual provides details on how to use the system: system performance optimization, analysis procedure, troubleshooting, validation, installation, etc.
Safety Guideline (Booklet)	228-92326	Describes the precaution instructions to ensure safe operation.

Read "Safety Guideline" thoroughly before using the product.

"Safety Guideline" describes the information about the warranty, after-sales service, safety instructions and precautions to ensure safe operation of the instrument. Keep this manual for future reference.

### Important

- If the user or usage location changes, ensure that this Instruction 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 the accompanying booklet "Safety Guideline" 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.

**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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## Indications Used in This Manual

Precaution symbols are indicated using the following conventions:

Indication	Meaning
 <b>WARNING</b>	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or possibly death.
 <b>CAUTION</b>	Indicates a potentially hazardous situation which, if not avoided, may result in minor to moderate injury or equipment damage.
 <b>NOTE</b>	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.
 <b>Hint</b>	Indicates information provided to improve product performance.
 Reference	Indicates the location of related reference information.

## Electromagnetic Compatibility

Descriptions in this section apply only to the following models:

- 228-65002-58 LC-40D
- 228-65000-58 LC-40D XR
- 228-65077-58 LC-40D XS
- 228-65080-58 LC-40D XSi
- 228-65076-58 LC-40D X3
- 228-65013-58 LC-40i

This product complies with European standard EN61326, class B for electromagnetic interference (Emissions) and industrial electromagnetic environment (Immunity).

### ■ EN55011 Emissions (Electromagnetic Interference)

This is a class B product. When this product causes an electromagnetic disturbance to devices being used near this product, create an appropriate distance between those devices and this product in order to eliminate the disturbance.

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# 1 Overview

This instrument is a liquid delivery unit for high-performance liquid chromatography using a double plunger reciprocating-type pump developed to improve the precision and sensitivity of analysis.

LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D is a parallel-type double plunger reciprocating-type pump, and LC-40i is a serial-type double plunger reciprocating-type pump.

## 1.1 Features

### ■ Low Flow Pulsation and Pulsation Period Enable Precise Delivery

By reducing the discharge volume per plunger stroke to the microvolume level (10  $\mu\text{L}$ ), and applying high-speed drive, the flow pulsation and pulsation period have been reduced to levels significantly lower than those for other instruments.

### ■ Choice of Gradient Modes and Control Options

LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D/LC-40i can be used in both low- and high- pressure gradient modes.

The high-pressure gradient mode uses two pumps and is highly accurate with minimal time lag. In low-pressure gradient mode, a single pump unit plus the gradient unit provides a low cost option to combine up to four solvents.

There are three gradient modes available: fast LC mode or normal mode under control of the system controller, and normal mode under control of the instrument.

The fast LC mode for binary high-pressure gradient delivery supports ultra high speed high separation analysis with minimized gradient control steps.

### ■ Automatic Plunger Rinsing

An automatic rinsing kit is provided as standard for LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR and an optional part for LC-40D/LC-40i. It can rinse the plunger in the back of the plunger seal. When high-salt-concentration buffer solutions are used, in particular, it prevents premature seal failure due to crystallization, extending the service life of plunger seals.

### ■ High-pressure Flow is Available

LC-40D X3 and LC-40D XS/LC-40D XSi enable ultra high pressure solvent delivery up to 130 MPa and 105 MPa, respectively, supporting ultra fast high separation analysis in combination with Shim-pack XR-ODS III or other ultra fast high separation columns. For LC-40D XR, high-pressure solvent delivery up to 70 MPa is possible so high speed high separation analysis is supported in combination with Shim-pack XR-ODS II columns.

## 1.2 Component Parts

This instrument consists of the standard parts listed below. Check the parts against this list after unpacking.

No.	Part Name	Part No.	Q'ty	Remark
-	Main Unit LC-40D X3 LC-40D XS LC-40D XSi LC-40D XR LC-40D LC-40i	-	1	
-	Safety Guideline (Booklet)* <sup>1</sup>	228-92327	1	
-	Instruction manual/ System Guide (CD-ROM)* <sup>2</sup>	228-92350-41	1	
-	Bottle, 250 mL	228-74372	1	LC-40D X3/LC-40D XS/ LC-40D XSi/LC-40D XR only
1	Suction Filter Assy	228-45708-91	1	Including a tube, stainless (LC-40D X3/LC-40D XS/ LC-40D XR/LC-40D only)
		228-39181-94	1	Including a tube, ceramic (LC-40D XSi only)
		228-39181-41	1	Including a tube, ceramic (LC-40i only)
2	REMOTE CABLE ASSY	228-28253-91	1	
3	DRAIN TUBE SI(L1000)	228-25162-03	1	
4	STOP JOINT ASSY,B,D	228-46054-91	1	LC-40D X3/LC-40D XS/LC-40D XSi/ LC-40D XR/LC-40D only
	STOP JOINT ASSY,T	228-46054-92	1	LC-40i only
	SYRINGE TUBE ASSY,B,D	228-46055-91	1	LC-40D X3/LC-40D XS/LC-40D XSi/ LC-40D XR/LC-40D only
	SYRINGE TUBE ASSY,T	228-46055-92	1	LC-40i only
5	SYRINGE,SS-20ESZ	228-66048	1	
	NEEDLE ASSY,FOR SYRINGE	228-18216-91	1	
6	CLAMP,M9120	046-05522-02	1	
7	DRAIN ADAPTER	228-42204	1	
8	STANDARD OUT DRAIN	228-42205	1	
9	CTO OUT DRAIN	228-42206	1	
10	STRAIGHT JOINT	228-28163	1	
11	FITTING,L-TYPE 1253	035-61561-12	1	
12	CAP	228-79093	4	LC-40D XSi only

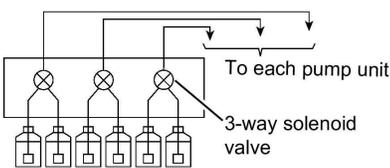
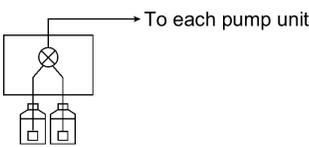
- \*1 It contains cautions for use regarding the instrument.
- \*2 The paper based Instruction manual (228-92320) /System Guide (228-92352) are available for a fee.

## 1.3 Optional Parts

Optional units available for this instrument are listed below.

For information about other optional units listed below, contact your Shimadzu representative.

### ■ Common Options for LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D/LC-40i

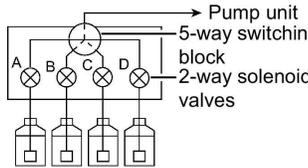
No.	Option	Part No.	Features
1	Degassing Unit (5 flow lines) DGU-405	228-65019-58	Degasses mobile phase by passing it through special tubing made of resin film, thereby reducing the pressure surrounding the tubing. It can separately degas up to 5 flow lines. Connected to pump unit.
2	Degassing Unit (3 flow lines) DGU-403	228-65018-58	Same as above, but able to separately degas up to 3 flow lines.
3	Flow Channel Selection Valve FCV-11AL	228-65611-58	<ul style="list-style-type: none"> <li>Switches between up to 2 liquids of mobile phase (for example, switches between mobile phase and rinse solution).</li> <li>Performs switching for up to 3 lines.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>NOTE</b> For use with the LC-40D XSi/LC-40i, replace the suction filter with a ceramic suction filter (228-25079-91).</p> </div> 
4	Flow Channel Selection Valve FCV-11ALS	228-65610-58	<ul style="list-style-type: none"> <li>Switches between up to 2 liquids (for example, switches between mobile phase and rinse solution) or two mobile phases.</li> <li>Performs switching for a single line.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>NOTE</b> For use with the LC-40D XSi/LC-40i, replace the suction filter with a ceramic suction filter (228-25079-91).</p> </div> 

No.	Option	Part No.	Features
5	Reservoir switching valve	228-65017-58	<ul style="list-style-type: none"> <li>Switches between 2 liquids (for example, switches between mobile phase and rinse solution) or two mobile phases.</li> <li>Installed inside of the instrument.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>NOTE</b> For use with the LC-40D XSi/LC-40i, replace the suction filter with a ceramic suction filter (228-25079-91).</p> </div>
6	CBM-40 LITE	228-65501-58	CBM-40 LITE system controller can be installed inside of the instrument.
7	Tool Kit	228-57647-43	Kit containing the necessary tools for preparation, inspection, and maintenance.
8	Column holder	228-35655-94	For use if the column is installed on the instrument.

### ■ Common Options for LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D

No.	Option	Part No.	Features
9	RINSING PUMP XR	228-39625-42	The rinsing pump kit is intended for continuously rinsing the back part of the plunger seal with rinsing solution. The rinsing volume can be selected.

### ■ Common Options for LC-40D X3/LC-40D XS/LC-40D XR/LC-40D

No.	Option	Part No.	Features
10	Low pressure gradient kit	228-65016-58	<p>Switches between up to 4 liquids of low-pressure gradient or mobile phase. It also can be used for auto rinsing of column flow lines. Installed inside of the instrument.</p> 
11	Mixer installation kit (MR40 LPGE, to be built in)	(w/ mixer recognition device) 228-65020-41	Gradient mixer (40 $\mu$ L internal capacity) exclusively for low-pressure gradient analysis. Fixed inside of the instrument.
12	Mixer MR40 LPGE (fixed inside column oven)	(w/o mixer recognition device) 228-45210-41	Gradient mixer (40 $\mu$ L internal capacity) exclusively for low-pressure gradient analysis. It can be installed inside of the CTO-40S/CTO-40C.
13	Mixer MR300 LPGE	(w/ mixer recognition device) 228-72653-42 (w/o mixer recognition device) 228-45210-42	<p>Gradient mixer (300 <math>\mu</math>L internal capacity) exclusively for low-pressure gradient analysis. It can be installed inside of the CTO-40S/CTO-40C.</p> <p>This option can be used for solvents that are hard to mix, such as TFA (trifluoroacetic acid), or for reducing the baseline fluctuation of the photo diode array detector.</p>
14	Gradient Mixer for High-Pressure Gradient Analysis	▶▶ Reference "Gradient Mixer for High-Pressure Gradient Analysis" P.13	
15	SUS Pipe (0.3×600)	228-53184-54	Plumbing for the pump outlet. ID 0.3 mm ×600 mm, Bended
16	SUS Pipe HP (0.3×1,000)	228-53184-96	Plumbing for the pump outlet. ID 0.3 mm ×1000 mm

### ■ Common Options for LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR

No.	Option	Part No.	Features
17	Plunger Seal GFP	228-52711-94	<p>The lifetime of the plunger seals under conditions where organic solvent is delivered.</p> <p>The maximum available pressure is 44 MPa. When using a non-polar organic solvent such as hexane or a solvent of alkyl sulfonic acid with TFA, use the standard plunger seal.</p>

### ■ Common Options for LC-40D X3/LC-40D XS

No.	Option	Part No.	Features
18	MAINTENANCE KIT,LC-40D X3/XS	228-53265-45	<p>A set of consumable parts and plumbing parts for LC-40D X3/LC-40D XS.</p> <p>▶▶ Reference "Maintenance Kit for LC-40D X3/LC-40D XS (Parts No. 228-53265-45)" P.174</p>

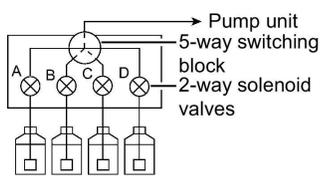
### ■ Common Options for LC-40D XR/LC-40D

No.	Option	Part No.	Features
19	Mixer SUS316L ASSY	(w/ mixer recognition device) 228-72654-41 (w/o mixer recognition device) 228-45093-93	<p>Gradient Mixer with excellent gradient performance. Capacity can be varies in 3 stages. It can be used for solvents that are hard to mix, such as TFA (trifluoroacetic acid).</p>

### ■ Common Options for LC-40D/LC-40i

No.	Option	Part No.	Features
20	Bottle,250 mL	228-74372	Rinse solution bottle (capacity 250 mL)
21	INJECTOR HOLDER, 20A	228-35659-92	Plate for installing manual injectors on the instrument
	Manual Injector		
22	Non-metal manual injector 9725i type	228-32650-93	Maximum withstand pressure is 35 MPa.

### Common Options for LC-40D XSi/LC-40i

No.	Option	Part No.	Features
23	Low pressure gradient kit INERT	228-65082-58	<p>Switches between up to 4 liquids of low-pressure gradient or mobile phase. It also can be used for auto rinsing of column flow lines. Installed inside of the instrument.</p> 

### Options for LC-40D XR

No.	Option	Part No.	Features
24	MAINTENANCE KIT, LC-40D XR	228-45593-49	<p>A set of consumable parts and plumbing parts.</p> <p>▶▶ Reference <a href="#">"Maintenance Kit for LC-40D XR (Parts No. 228-45593-49)" P.174</a></p>

### Options for LC-40D

No.	Option	Part No.	Features
25	MAINTENANCE KIT, LC-40D	228-45593-50	<p>A set of consumable parts and plumbing parts.</p> <p>▶▶ Reference <a href="#">"Maintenance Kit for LC-40D (Parts No. 228-45593-50)" P.175</a></p>
26	WASHING PUMP SEAL KIT	228-56201-41	For continuous automatic rinsing of the back side of the plunger seal, using a rinse solution. Used when system uses high-salt-concentration buffer solution.
27	Plunger Seal (polyethylene)	228-32628-91	Utilized when a nonpolarized organic solvent like hexane or a solvent of alkyl sulfonic acid with TFA added is used.
Manual Injector			
28	① Injector for general analysis 7725 type	228-32210-91	Maximum withstand pressure is 35 MPa.
29	② Injector for general analysis 7725i type	228-32210-93	
30	③ Semi micro injector 8125 type	228-23200-91	

### ■ Options for LC-40D XSi

No.	Option	Part No.	Features
31	MAINTENANCE KIT, LC-40D XSi	228-53265-47	A set of consumable parts and plumbing parts for LC-40D XSi. ▶▶ Reference "Maintenance Kit for LC-40D XSi (Parts No. 228-53265-47)" P.175
32	Mixer installation kit INERT (MR40 LPGE, to be built in)	228-65020-43	Gradient mixer (40 µL internal capacity) exclusively for low-pressure gradient analysis. Fixed inside of the instrument.
33	Mixer MR40 LPGE INERT (fixed inside column oven)	(w/ mixer recognition device) 228-65081-43	Gradient mixer (40 µL internal capacity) exclusively for low-pressure gradient analysis. It can be installed inside of the CTO-40S/CTO-40C.
34	Mixer MR300 LPGE INERT	(w/ mixer recognition device) 228-65081-44	Gradient mixer (300 µL internal capacity) exclusively for low-pressure gradient analysis. It can be installed inside of the CTO-40S/CTO-40C. This option can be used for solvents that are hard to mix, such as TFA (trifluoroacetic acid), or for reducing the baseline fluctuation of the photo diode array detector.
35	PEEK lined SS tube (0.3×600)	228-74346-46	Plumbing for the pump outlet. ID 0.3 mm×600 mm
36	PEEK lined SS tube (0.3×1,200)	228-74346-52	Plumbing for the pump outlet. ID 0.3 mm×1200 mm

### ■ Options for LC-40i

No.	Option	Part No.	Features
37	Mixer PEEK ASSY	(w/ mixer recognition device) 228-72654-42 (w/o mixer recognition device) 228-45093-92	Gradient Mixer with excellent gradient performance. Capacity can be varies in 2 stages.
38	WASHING PUMP SEAL KIT, 40i	228-56201-43	For continuous automatic rinsing of the back side of the plunger seal, using a rinse solution. Used when system uses high-salt-concentration buffer solution. (For LC-40i only)
39	Tool Kit, 40i	228-79997-41	Kit containing the necessary tools for preparation, inspection, and maintenance. (For LC-40i only)

### ■ Compatibility Table of Options

No.	Option	Part No.	40D X3	40D XS	40D XSi	40D XR	40D	40i
1	Degassing Unit (5 flow lines) DGU-405	228-65019-58	✓	✓	✓	✓	✓	✓
2	Degassing Unit (3 flow lines) DGU-403	228-65018-58	✓	✓	✓	✓	✓	✓
3	Flow Channel Selection Valve FCV-11AL	228-65611-58	✓	✓	✓	✓	✓	✓
4	Flow Channel Selection Valve FCV-11ALS	228-65610-58	✓	✓	✓	✓	✓	✓
5	Reservoir switching valve	228-65017-58	✓	✓	✓	✓	✓	✓
6	CBM-40 LITE	228-65501-58	✓	✓	✓	✓	✓	✓
7	Tool Kit	228-57647-43	✓	✓	✓	✓	✓	✓
8	Column holder	228-35655-94	✓	✓	✓	✓	✓	✓
9	RINSING PUMP XR	228-39625-42	✓	✓	✓	✓	✓	
10	Low pressure gradient kit	228-65016-58	✓	✓		✓	✓	
11	Mixer installation kit (MR40 LPGE, to be built in)	(w/ mixer recognition device) 228-65020-41	✓	✓	✓	✓	✓	
12	Mixer MR40 LPGE (fixed inside column oven)	(w/o mixer recognition device) 228-45210-41	✓	✓		✓	✓	
13	Mixer MR300 LPGE	(w/ mixer recognition device) 228-72653-42 (w/o mixer recognition device) 228-45210-42	✓	✓		✓	✓	
14	Gradient Mixer for High-Pressure Gradient Analysis	▶▶ Reference "Gradient Mixer for High-Pressure Gradient Analysis" P.13						
15	SUS Pipe (0.3×600)	228-53184-54	✓	✓		✓	✓	
16	SUS Pipe HP (0.3×1000)	228-53184-96	✓	✓		✓	✓	
17	Plunger Seal GFP	228-52711-94	✓	✓	✓	✓		
18	MAINTENANCE KIT, LC-40D X3/XS	228-53265-45	✓	✓				

No.	Option	Part No.	40D X3	40D XS	40D XSi	40D XR	40D	40i
19	Mixer SUS316L ASSY	(w/ mixer recognition device) 228-72654-41 (w/o mixer recognition device) 228-45093-93				✓	✓	
20	Bottle, 250 mL	228-74372					✓	✓
21	INJECTOR HOLDER, 20A	228-35659-92					✓	✓
22	Non-metal manual injector 9725i type	228-32650-93					✓	✓
23	Low pressure gradient kit INERT	228-65082-58			✓			✓
24	MAINTENANCE KIT, LC-40D XR	228-45593-49				✓		
25	MAINTENANCE KIT, LC-40D	228-45593-50					✓	
26	WASHING PUMP SEAL KIT	228-56201-41					✓	
27	Plunger Seal (polyethylene)	228-32628-91					✓	
28	Injector for general analysis 7725 type	228-32210-91					✓	
29	Injector for general analysis 7725i type	228-32210-93					✓	
30	Semi micro injector 8125 type	228-23200-91					✓	
31	MAINTENANCE KIT, LC-40D XSi	228-53265-47			✓			
32	Mixer installation kit INERT (MR40 LPGE, to be built in)	228-65020-43			✓			
33	Mixer MR40 LPGE INERT (fixed inside column oven)	(w/ mixer recognition device) 228-65081-43			✓			
34	Mixer MR300 LPGE INERT	(w/ mixer recognition device) 228-65081-44			✓			
35	PEEK lined SS tube (0.3×600)	228-74346-46			✓			
36	PEEK lined SS tube (0.3×1200)	228-74346-52			✓			

## 1 Overview

No.	Option	Part No.	40D X3	40D XS	40D XSi	40D XR	40D	40i
37	Mixer PEEK ASSY	(w/ mixer recognition device) 228-72654-42 (w/o mixer recognition device) 228-45093-92						✓
38	WASHING PUMP SEAL KIT, 40I	228-56201-43						✓
39	Tool Kit, 40I	228-79997-41						✓

## ■ Gradient Mixer for High-Pressure Gradient Analysis

The following gradient mixers for high-pressure gradient analysis are available for high performance liquid chromatographs.

### Only Gradient Mixer (For LC-40D X3/LC-40D XS/LC-40D XR/LC-40D)

Part Name	Part No.
MIXER,MR 20 $\mu$ L	(w/ mixer recognition device) 228-72652-41 (w/o mixer recognition device) 228-45209-41
MIXER,MR 40 $\mu$ L	(w/ mixer recognition device) 228-72652-42 (w/o mixer recognition device) 228-45209-42
MIXER,MR 100 $\mu$ L	(w/ mixer recognition device) 228-72652-43 (w/o mixer recognition device) 228-45209-43
MIXER,MR 180 $\mu$ L II	(w/ mixer recognition device) 228-72652-44 (w/o mixer recognition device) 228-45209-44

### Only Gradient Mixer (For LC-40D XSi)

Part Name	Part No.
MIXER,MR 20 $\mu$ L	(w/ mixer recognition device) 228-65081-41
MIXER,MR 180 $\mu$ L II	(w/ mixer recognition device) 228-65081-42

### Mixers described above are packaged in a set (For LC-40D X3/LC-40D XS/LC-40D XR/LC-40D)

Part Name	Part No.
Set of Two Mixers MR 40 $\mu$ L and MR 180 $\mu$ L II	228-45292-41
Set of Two Mixers MR 100 $\mu$ L and MR 180 $\mu$ L II	228-45292-42
Set of Three Mixers MR 40 $\mu$ L, MR 100 $\mu$ L and MR 180 $\mu$ L II	228-45292-43

### Recommended Mixers

The table below lists the mixers with the smallest volume among mixers that can be used in individual combinations of detectors and mobile phases.

		Mobile Phase		
		Solvent Containing Trifluoroacetic Acid (TFA)	Solvent Containing Formic Acid, Acetic Acid, etc.	Water (Including Buffer Solution), Organic Solvent, or Its Solvent Mixture
Detector	Photo Diode Array Detector	MR 180 $\mu$ L II	MR 180 $\mu$ L II	MR 180 $\mu$ L II
	UV Detector *	MR 180 $\mu$ L II (MR 180 $\mu$ L)	MR 100 $\mu$ L (MR 180 $\mu$ L)	MR 40 $\mu$ L (MR 180 $\mu$ L)
	LCMS, LCMSMS	-	MR 20 $\mu$ L	MR 20 $\mu$ L

\* Values in () are for LC -40D XSi

Using a mixer with a volume smaller than the recommendation shown above may cause excessive fluctuation of the baseline.

When connecting multiple detectors, use a mixer with the largest volume among the applicable mixers. For example, if using a Photo Diode Array and an LC/MS, the MR 180  $\mu$ L II mixer is recommended.

A larger than recommended mixer can be used to improve mixing performance, but will also increase the gradient delay volume.

## ■ Automatic Rinsing Kit

**3.4.** The plunger can be rinsed with the automatic rinsing kit at the back part of the plunger seal. LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR has the automatic rinsing kit as standard. For LC-40D/LC-40i, the automatic rinsing kit is optional. When using buffer solution, be sure to attach the automatic rinsing kit.

See the table below for the necessity of the automatic rinsing kit and rinsing solution.

Mobile Phase	LC-40D X3/LC-40D XS/ LC-40D XSi/LC-40D XR		LC-40D/LC-40i	
	Necessity	Recommended Rinsing Solution	Necessity	Recommended Rinsing Solution
Buffer Solution	Necessary	10 % 2-propanol water	Necessary	Water
Normal-phase solvent such as hexane	Not necessary	-	Not necessary	-
Other Solutions	Necessary	10 % 2-propanol water	Not specified	Water (10 % 2-propanol is also acceptable)

Necessary: The rinsing kit is necessary.

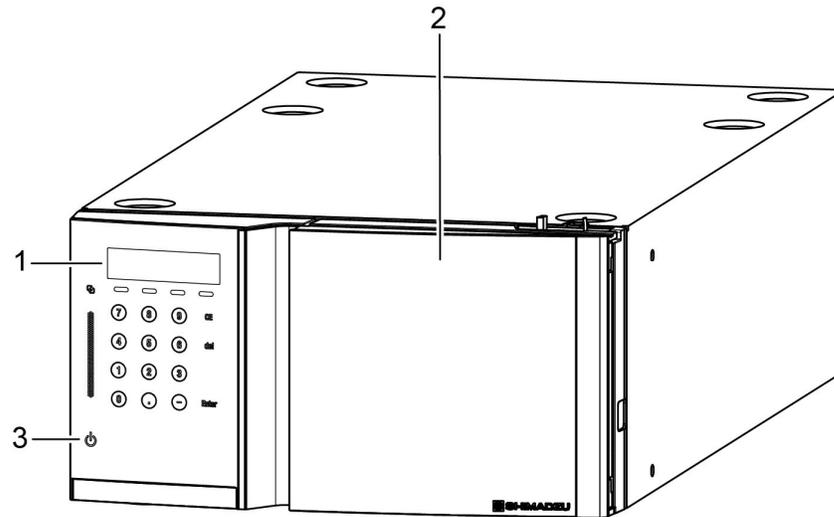
Not specified: The rinsing kit is not necessary (but can be used).

Not necessary: The rinsing kit should not be used.

- NOTE**
- For the application system, refer to the instruction manual of the application system.
  - If the rinse solution is dirty, replace with new solution. If getting significantly dirty, replace with new solution once a day. Even if it does not appear dirty, replace with new solution once a week.  
If using distilled water as rinsing solution, replace it once a day.

# 2 Parts Identification and Function

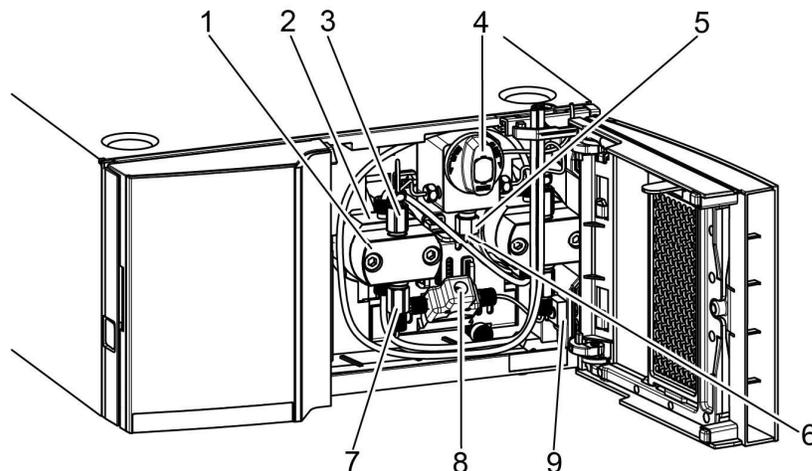
## 2.1 Front



No.	Name	Description
1	Operation Panel	Configure or operate the instrument with the operation keys. Touching the center part on the operation panel displays the operation keys.
2	Front Cover	This is the cover for the flow line.
3	 (Power button)	Switches ON/OFF the power. When the power is ON, the switch illuminates in white, and when the power is OFF, the switch illuminates in orange. Even when the power is OFF, the standby current is fed to the instrument. For the main power, see "2.3 Back" P.18. Note that, with a system controller SCL-40/CBM-40/CBM-40lite connected, the switch does not illuminate and the operation to the switch is ignored by default setting.  ▶▶ Reference "Setting the Power Button 《POWER BUTTON》" P.51

## 2.2 Behind Front Cover

### ■ LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D

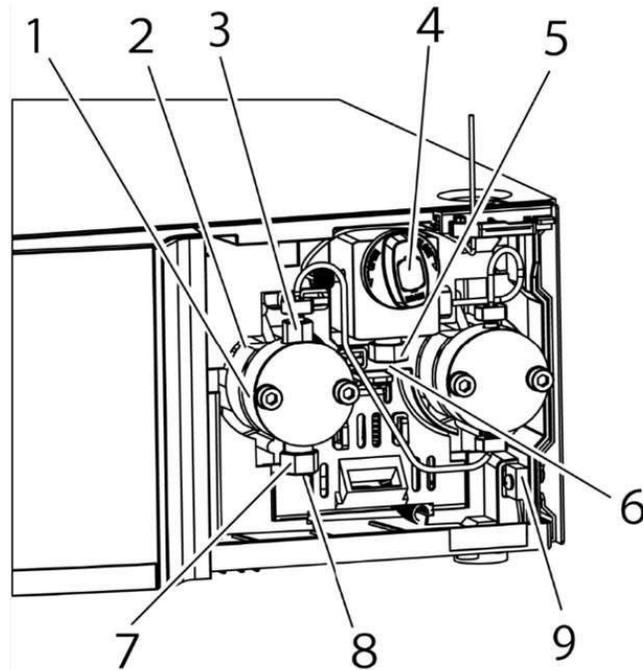


No.	Name	Description
1	Pump Head* <sup>1</sup>	The plunger inside it reciprocates to deliver solvent.
2	Head Holder* <sup>1</sup>	It has the rinsing flow path of the plunger inside. The pump head is attached to this part.
3	Check Valve OUT* <sup>1</sup>	A check valve on the outlet side.
4	Drain Valve	It is used to replace mobile phase solvent or remove air from the flow path. It has an internal pressure sensor.
5	Line Filter	A column protection filter for removing contaminants from mobile phase solvent.
6	Pump Outlet	A connection port of the tube connected to the autosampler/manual injector.
7	Check Valve IN* <sup>1</sup>	A check valve on the inlet side.
8	Pump Inlet	A connection port of the tube from the suction filter.
9	Leak Sensor	It detects liquid leaks. If the leak sensor detects a leak, delivery automatically stops, causing an alarm and message on the display.

**ERROR  
LEAK DETECTED**

\*<sup>1</sup> This is common to the right and left pump heads.

## ■ LC-40i

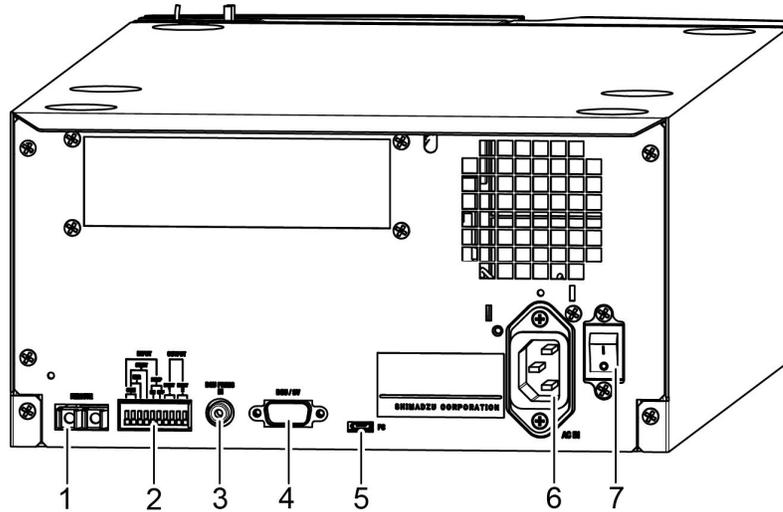


2

No.	Name	Description
1	Pump Head	The plunger inside it reciprocates to deliver solvent.
2	Head Holder*1	It has the rinsing flow path of the plunger inside. The pump head is attached to this part.
3	Check Valve OUT	A check valve on the outlet side.
4	Drain Valve	It is used to replace mobile phase solvent or remove air from the flow path. It has an internal pressure sensor.
5	Line Filter	A column protection filter for removing contaminants from mobile phase solvent.
6	Pump Outlet	A connection port of the tube connected to the autosampler/manual injector.
7	Check Valve IN	A check valve on the inlet side. This also functions as a connection port for the tube from the suction filter.
8	Pump Inlet	A connection port of the tube from the suction filter.
9	Leak Sensor	It detects liquid leaks. If the leak sensor detects a leak, delivery automatically stops, causing an alarm and message on the display.  <b>ERROR LEAK DETECTED</b>

\*1 This is common to the right and left pump heads.

## 2.3 Back



No.	Name	Description
1	[REMOTE] Connector	A connector for connecting the system controller.
2	External Input/Output Terminals	Connect to external equipment.
3	[DGU PRESS IN] Connector	To input the pressure signal from the external degassing unit.
4	[DGU/SV] Connector	A connector for connecting a flow path switching valve (FCV series), rinsing pump, or degassing unit.
5	[PC] Connector	A connector for service personnel. Normally unused.
6	Power Cord Connector	Connect the power cord.
7	Main Power Switch	It turns ON/OFF the power to the instrument. Normally keep it on.*1

\*1 Normally use  (power button) of the operation panel or system controller to turn ON/OFF the power. If the system controller is connected and the main power switch is on, the user can use  (power button) of the system controller to turn ON/OFF the power from the front of the instrument. If the instrument is not used for a long time, turn off the main power switch. Before turning off the main power switch, be sure to turn OFF the power using the power button.

▶▶ Reference "2.5 Name and Functions of the Operation Panel" P.20

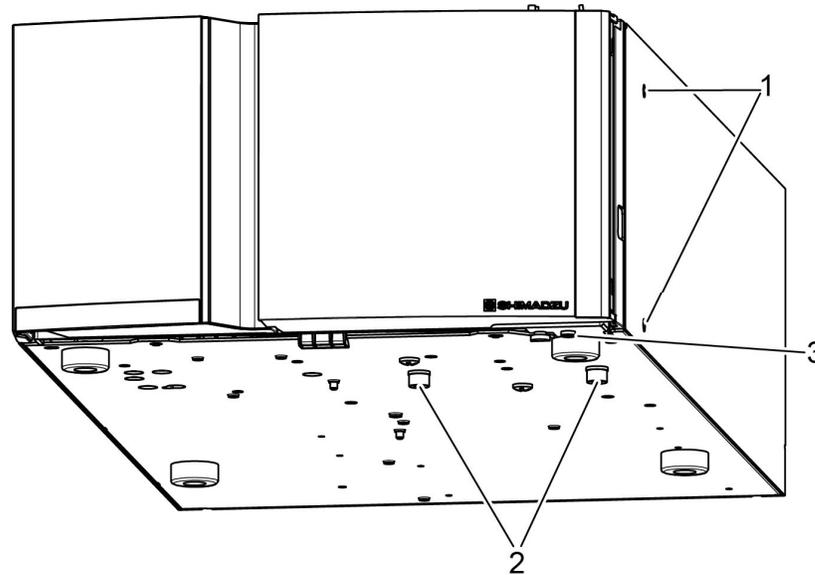
### CAUTION



Instruction

**Electrical outlet must be connected to the power supply earth leakage breaker.**  
A short circuit can lead to a major accident such as equipment failure or building fire.

## 2.4 Right Side and Bottom



2

No.	Name	Description
1	Mixer Mounting Holes	Used to install mixer and column holder.
2	Shipping Screws (Red)	To prevent damage during transportation. LC-40D X3, LC-40D XS and LC-40D XSi have three screws, and LC-40D XR, LC-40D and LC-40i have two screws. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>NOTE</b> Remove before installation.</p> </div>
3	Leakage Drain Outlet	Connect the provided drain tubing.

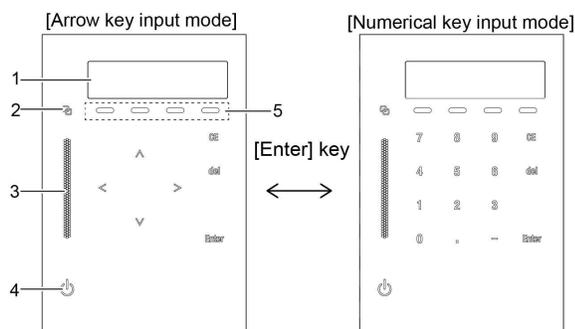
## 2.5 Name and Functions of the Operation Panel

This instrument is controlled through the keypad of the operation area. The display area allows verification of the instrument status.

The operation area has two input modes: [Arrow key input mode] to enable screen transfer, and [Numerical key input mode] to enable value input.

Pressing [Enter] switches between these input modes.

**NOTE** When turning off the main power switch on the back of the instrument after changing the parameters via panel operation, be sure to turn OFF the power with the power button at the front of the instrument, and turn off the main power switch. Otherwise, some of the changed parameters may return to their original values.



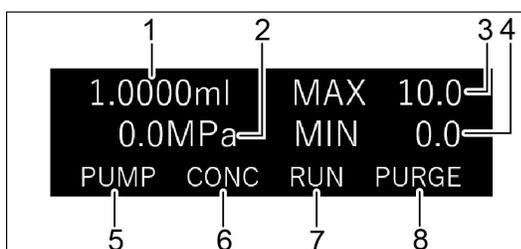
No.	Name	Description
1	Display Area	Displays various screens and settings.
2	Link LED	Illuminates when controlled by the system controller.
3	Status LED	<ul style="list-style-type: none"> <li>• Green: analysis ready</li> <li>• Red: error</li> <li>• Blue: analysis in progress (The indicator lights in green when CBM-20A is connected.)</li> <li>• Yellow: preparation for analysis in progress (The indicator normally lights in yellow while no solvent is delivered.)</li> <li>• Orange: sleep</li> </ul>
4	 (Power Button)*1	<p>Switches ON/OFF the power.</p> <ul style="list-style-type: none"> <li>• To turn the power ON: Press and hold the power button for at least 3 seconds.</li> <li>• To turn the power OFF: Holding down the power button 3 seconds or more displays the confirmation screen as shown below. Holding it down again 1 second turns off the power. Press [CE] to cancel the operation.</li> </ul> <div style="background-color: black; color: white; padding: 5px; text-align: center;"> <b>POWER : SHUT DOWN</b>  <b>CE : CANCEL</b> </div>
5	Direct Key	Delivery start/stop, gradient concentration setting, timeprogram start and purge can be performed directly.

- \*1 The button cannot be used by default setting if the instrument is connected with the systemcontroller SCL-40.  
 If SCL-40 is connected, pressing the power button of SCL-40 turns off the power of the entire system.  
 If CBM-40 or CBM-40lite is used, pressing the power button of the pump turns off the power of the entire system.  
 Note, however, that the following will apply in the case of a system with multiple pumps.  
 - When using CBM-40lite: The system power can be turned off using the power button of the pump where CBM-40lite is built in.  
 - When using CBM-40: The system power can be turned off using the power button of the pump with the lowest optical link number.

▶▶ Reference "Setting the Power Button 《POWER BUTTON》" P.51

## 2.5.1 Display Area

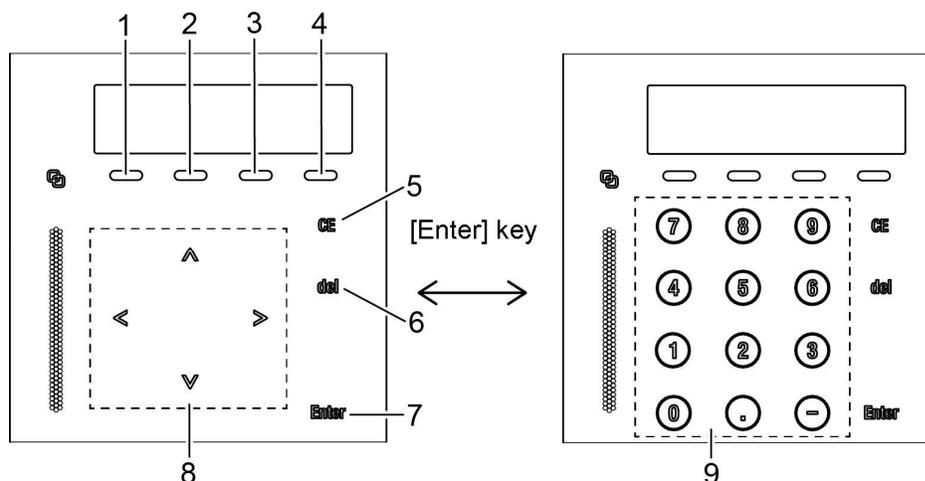
In this section the display on the initial screen is described.



No.	Name	Function
1	Flow/Press	In the constant flow delivery mode, the set flow rate (mL/min) is displayed. (Only for LC-40D XR/LC-40D/LC-40i) In the constant pressure delivery mode, the set pressure is displayed in the pressure unit set with the [PRESSURE UNIT] auxiliary function.
2	Pressure	Displays reading measured by pressure sensor, in units set with the [PRESSURE UNIT] auxiliary function.
3	P.MAX	The maximum pressure is displayed in the pressure unit set with the [PRESSURE UNIT] auxiliary function.
4	P.MIN	The minimum pressure is displayed in the pressure unit set with the [PRESSURE UNIT] auxiliary function.
5	PUMP	Highlighted during pump operation.
6	CONC	Highlighted in the low-pressure gradient mode or blinks in the high-speed LC mode.
7	RUN	Highlighted during execution of a time program or in the high-speed LC mode.
8	PURGE	Highlighted during purging.

## 2.5.2 Operation Area

Use the keys on the front to operate or configure the instrument. When you touch the key, the status LED lights up and accepts input.



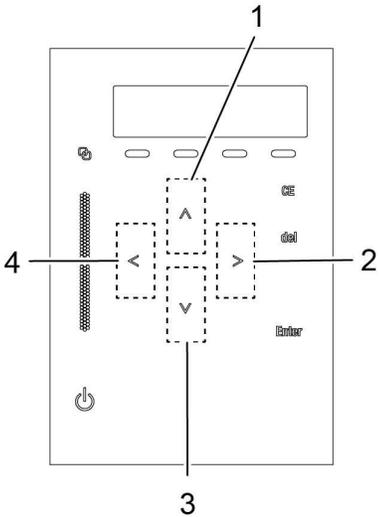
No.	Key	Name	Function
1	[PUMP]	Pump Key	Starts or stops the pump.
2	[CONC]	Concentration Key	Sets liquid concentrations in gradient analysis.
3	[RUN]	Run Key	Starts or stops a time program. (Key operation is ignored if a time program is not configured.)
4	[PURGE]	Purge Key	Starts or stops purging. Purging stops automatically 3 minutes after it begins. [PUMP] can also be used to stop purging. Purging time can be set with the [PURGE TIME] auxiliary function. <b>Hint</b> Refer " <a href="#">3.8 Delivery in the Low-Pressure Gradient Mode</a> " P.94 for the operation method on low-pressure gradient mode.
5	[CE]	Clear Key	This key is used for the following; <ul style="list-style-type: none"> <li>To initialize the screen</li> <li>To clear the values input up to that time while entering the values.</li> <li>To clear error message and cancel alarms.</li> </ul>
6	[del]	Delete Key	Use in the following cases. <ul style="list-style-type: none"> <li>To delete input values.</li> <li>To delete a line of the displayed time program while creating it.</li> </ul>
7	[Enter]	Enter Key	Confirms input values of the setting items
8	[↑][→] [↓][←]	Arrow Keys	Moves the cursor or switches the screen
9	[-] to [9]	Numeric Keys	Inputs values for the setting items.

No.	Key	Name	Function
10	[ - ]	Minus Key	No use

**Regarding the acceptable part of the arrow keys on the touch panel.**

When operating the arrow keys, it responds by touching the part including the upper and lower range of each key indication on the operation panel.

No.	Description
1	Acceptable part of [↑] key input.
2	Acceptable part of [→] key input.
3	Acceptable part of [↓] key input.
4	Acceptable part of [←] key input.



# 3 Operation

## 3.1 Settings for the Basic Operation

Before operating this instrument, it is necessary to set the flow rate and the pressure limit to protect flow line parts such as columns.

See the product specifications before use.

- ▶▶ Reference "5.1.1 LC-40D X3/LC-40D XS/LC-40D XSi Specifications" P.163  
"5.1.2 LC-40D XR/LC-40D/LC-40i Specifications" P.164

### 3.1.1 Prior to Key Operation

Touching the central part of the operation panel displays the operation keys that the user can operate.

### 3.1.2 Setting Flow Rate

The following is the basic procedure for setting a flow rate [FLOW].

- 1 **Displays the initial screen (the screen that is displayed when the power is turned ON).**

If the initial screen is not displayed, press [CE] to display the initial screen.

```
0.0000ml  MAX 10.0
0.0MPa    MIN 0.0
PUMP CONC RUN PURGE
```

- 2 **Press [Enter].**

The cursor blinks at the input position indicating that the flow rate [FLOW] can be input.

- 3 **Input the flow rate with the numeric keypad and press [Enter].**

The flow rate [FLOW] is set and the display returns to the initial screen.

 **Hint** To cancel the input value, press [CE].

### 3.1.3 Setting Compressibility

- 3.5. 1 **Press [→] twice on the initial screen.**  
The FUNCTION setting group is displayed.

```
>PARAMETER
CONTROL
```

- 2** Move the cursor to [PARAMETER], and press [→].  
The PARAMETER setting group is displayed.

```
P . MAX      10 . 0
Input 1 . 0 - 70 . 0MPa
```

- 3** Press [↓] several times until [COMP] (compressibility correction) is displayed in the screen and press [Enter].  
The cursor blinks at the input position indicating that the compressibility [COMP] can be input.

```
COMP      0 . 45
Input 0 . 00 - 3 . 00
```

- 4** Input the compressibility [COMP] for the solvent to be used (0.45 for water) with the numeric keypad.

▶▶ Reference "Setting the compressibility of solvent «COMP» " P.43

3

### 3.1.4 Setting Maximum Pressure Limit

The maximum pressure limit is the pressure in the flow line that may not be exceeded.

```
P . MAX      10 . 0
Input 1 . 0 - 70 . 0MPa
```

If pressure exceeds the maximum limit, pumping stops automatically, and the error message will be displayed with the alarm sound.

```
ERROR
PRESSURE MAX
```

#### ■ Setting Procedure

The following is an example to set the maximum pressure [P.MAX] to 15.0 MPa.

- 1** Press [→] three times on the initial screen.  
The PARAMETER setting group is displayed.

- 2** Press [Enter].  
The cursor blinks at the input position indicating that [P.MAX] can be input.

```
P . MAX      10 . 0
Input 1 . 0 - 70 . 0MPa
```

3

Press [1], [5], [ . ], [0] and [Enter].

The maximum pressure is set to 15.0 MPa.

```
P . MAX      15 . 0
Input 1 . 0 - 70 . 0MPa
```

NOTE The allowable maximum pressure is 130 MPa for LC-40D X3, 105 MPa for LC-40D XS and LC-40D XSi, 70 MPa for LC-40D XR, 44 MPa for LC-40D, and 30 MPa (aqueous solvents)/22 MPa (organic solvents) for LC-40i. When connecting the instrument with other equipment, set the maximum pressure to the lowest allowable maximum pressure of the equipment.

▶▶ Reference "Setting the maximum pressure limit during pumping 《P.MAX》 " P.41

### 3.1.5 Setting Minimum Pressure Limit

The purpose of the minimum pressure limit is to prevent a pressure drop which can occur as a result of the following situations:

- When the mobile phase runs out, air will be pumped through the flow lines resulting in a pressure drop.
- When a leak occurs in the flow lines, a pressure drop may be observed.

If the pressure is lower than the minimum pressure limit after one minute during pumping, the flow stops automatically.

Then the error message will be displayed with the alarm sound.

```
P . MIN      0 . 0
Input 0 . 0 - 60 . 0MPa
```

```
ERROR
PRESSURE MIN
```

#### ■ Setting example

The following is an example to set the minimum pressure [P.MIN] to 2.0 MPa.

1

Press [→] three times on the initial screen.

The PARAMETER setting group is displayed.

2

Press [↓] once and on the [P.MIN] screen, press [Enter].

The cursor blinks at the input position indicating that [P.MIN] can be input.

```
P . MIN      0 . 0
Input 0 . 0 - 60 . 0MPa
```

**3****Press [2], [ . ], [0] and [Enter].**

The minimum pressure is set to 2.0 MPa.

```
P.MIN          2.0
Input 0.0 - 60.0MPa
```

▼ **NOTE** If [P.MIN] is set to "0", solvent delivery will not stop and an alarm will not sound even if the pressure has dropped. The minimum pressure can be set to 130 MPa max. for LC-40D X3, 105 MPa max. for LC-40D XS and LC-40D XSi, 60 MPa max. for LC-40D XR, 40 MPa max. for LC-40D, and 30 MPa max. (aqueous solvents)/22 MPa max. (organic solvents) for LC-40i.

▶▶ Reference "Setting the minimum pressure during delivery 《P.MIN》" P.42

**3**

## 3.2 Operation

There are two basic operating modes; one is in constant flow delivery mode and the other is in constant pressure delivery mode.

### 3.2.1 Operation in Constant Flow Delivery Mode

**1** Turn the drain valve knob clockwise as far as possible to close the drain valve.

**2** Press [CE].  
The initial screen is displayed.

**3** Press [Enter] once and set the flow rate to be delivered.

```
1 . 0 0 0 0 ml    MAX 15 . 0
0 . 0 MPa        MIN  2 . 0
```

 **Hint** To set 1 mL/min, press [1] and [Enter].

**4** Press [PUMP], and then [ENTER].  
[PUMP] on the display is highlighted and the pump starts operation.

```
1 . 0 0 0 0 ml    MAX 15 . 0
0 . 0 MPa        MIN  0 . 0
PUMP CONG  RUN  PURGE
```

**5** Check that the pump outlet pressure is increasing on the pressure indication display.

**6** To stop operation, press [PUMP], and then [ENTER].  
[PUMP] on the display stops being highlighted and the pump stops operation.

### CAUTION



Instruction

**Close the drain valve when not draining through the drain path.**

If the drain valve is left opened, a pressure difference may cause the mobile phase solvent to flow out of the drain outlet.

## 3.2.2 Operation in Constant Pressure Delivery Mode

This function is available only for LC-40D XR, LC-40D and LC-40i.

**1** Turn the drain valve knob clockwise as far as possible to close the drain valve.

**2** Press [→] twice on the initial screen.  
The FUNCTION setting group is displayed.

```
>PARAMETER
CONTROL
```

**3** Press [↓] once, move the cursor to [CONTROL] and press [→].  
The CONTROL setting group is displayed.

```
PARAMETER
>CONTROL
```

**4** Press [↓] twice and on the [MODE CHANGE] screen, press [Enter].  
The numeric keypad becomes active allowing the user to input numbers.

```
MODE CHANGE 0
0:Flow 1:Press
```

**5** Press [1] and [Enter].  
The delivery mode changes from the constant flow delivery mode to the constant pressure delivery mode.

```
MODE CHANGE 1
0:Flow 1:Press
```

▶▶ Reference "Switching the delivery mode «MODE CHANGE» (Only for LC-40D XR/LC-40D/LC-40i)" P.50

**6** After changing the mode, press [CE] once.  
The initial screen of the constant pressure delivery mode is displayed.

```
1.0MPa MAX 10.0
0.0MPa MIN 0.0
PUMP CONC RUN PURGE
```

**7** Press [Enter].  
[press] becomes ready to accept input.

**8** Set the pressure with the numeric keypad.

```
2.0MPa MAX 10.0
0.0MPa MIN 0.0
PUMP CONC RUN PURGE
```

💡 **Hint** To set 2.0 MPa, press [2], [ . ], [0] and [Enter].

**9**

**Press [PUMP], and then [ENTER].**

[PUMP] on the display is highlighted and the pump starts operation.

---

**10**

**Observe that the pump outlet pressure rises and pressure display stabilizes at about 2.0 MPa.**



**Hint** While monitoring the pressure, increase the flow rate until the pressure reaches the set value. If increasing the flow rate does not increase the pressure, stop increasing the flow rate at 1 mL/min.

---

**11**

**To stop operation, press [PUMP], and then [ENTER].**

[PUMP] on the display stops being highlighted and the pump stops operation.

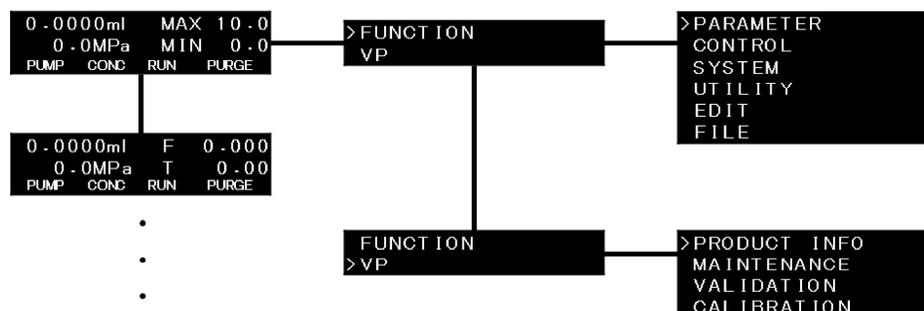
## 3.3 Types of Screens

Turning ON the power displays the initial screen.

By pressing the [↓] and [→] arrows on the initial screen, the screen can be switched from the initial screen to one of three screens below:

Displays Screen	Description
Monitor screen	View the status of the instrument. ▶▶ Reference "3.4 Monitoring Screens" P.32
Auxiliary functions screen	Configure various parameter settings and perform operations. ▶▶ Reference "3.5 Auxiliary Functions Screen (FUNCTION)" P.36
VP function screen	Supports the validation of the instrument with functions for viewing and checking instrument information. ▶▶ Reference "3.6 VP Functions Screen" P.61

Pressing [→] on the initial screen displays the screen to select the auxiliary functions screen [FUNCTION] or VP functions screen [VP]. Move the cursor to the desired option with [↓] or [↑] and press [→] to display the screen. Press [CE] to return to the initial screen.



## 3.4 Monitoring Screens

This section describes the monitoring screens.

Press [↓] on the initial screen to show the various types of information.

```
0.0000ml  MAX 10.0
0.0MPa    MIN 0.0
PUMP CONC RUN  PURGE
```

Name	Description	Reference
MONITOR FLOW/TIME	To show the actual flow rate during delivery. The elapsed time is shown while a time program runs.	P.32
MONITOR ID/SV	To show the pump ID and the flow path of the flow path switching valve.	P.32
CONDITION	<p>To show the Auto-Diagnostics result when Auto-Diagnostics is on. The delivery status of the pump is shown when Auto-Diagnostics is off.</p> <p>▶▶ Reference "Turning on/off Auto-Diagnostics 《AUTO DIAGNOSTICS》" P.84</p> <p> <b>Hint</b></p> <ul style="list-style-type: none"> <li>Auto-Diagnostics can cause a warning when a delivery failure is detected.</li> <li>This screen is not shown in the constant pressure delivery mode.</li> </ul>	P.33
DEGAS PRESSURE	To show the vacuum pressure of the degassing unit.	P.35
PC/WS*1	To show the status of the connection between the instrument and the PC/WS.	P.35

\*1 Shown only when CBM-40/CBM-40lite is connected.

### ■ Monitoring Program Elapsed Time 《MONITOR FLOW/TIME》

On the right side of the first line, the flow rate actually delivered is displayed in real time when the instrument is in the constant pressure delivery mode or while the flow rate is gradually increased with the [FLOW SLOPE] function. The elapsed time is displayed on the right side of the second line while a time program runs.

```
0.0000ml  F  0.000
0.0MPa    T  0.00
PUMP CONC RUN  PURGE
```

▶▶ Reference "Setting the time to reach the set flow rate after the start of delivery 《FLOW SLOPE》"

### ■ Displaying the pump ID and the port of the flow path switching valve connected to the instrument during remote control 《MONITOR ID/SV》

When the system controller is connected, one of the pump connection addresses (A, B, C, or D) of the system controller is displayed on the lower left side of the screen.

```
0.0000ml  IN-SV  A
PUMP A    EX-SV  AAB
PUMP CONC RUN  PURGE
```

On the right side of the screen, the open ports of the flow path switching valve connected to the instrument are displayed. In the previous figure, the flow path of the internal valve is set to port A, and for the external FCV-11AL, port 1 is set to A (left side), port 2 is set to A (left side), and port 3 is set to B (right side). The connection address of the system controller is set to A. When the low-pressure gradient valve is used, the set ports open only during delivery. While delivery is stopped, the screen displays "OFF".

The display shown in the figure to the right is when the FCV-11ALS is connected.

```
0.0000ml  IN-SV  A
PUMP A    EX-SV  A
PUMP CONC RUN  PURGE
```

### ■ Displays of Condition 《CONDITION》

The screen displays a delivery status Auto-Diagnostics result during analysis when the Auto-Diagnostics function is on. This screen is not displayed in the constant pressure delivery mode.

```
1.0000ml
Diag Off
PUMP CONC RUN  PURGE
```

▶▶ Reference "Switching the delivery mode 《MODE CHANGE》 (Only for LC-40D XR/LC-40D/LC-40i)" P.50

Display	Auto-Diagnostics Status	
Diag Off	The delivery status is not being judged. This is displayed while delivery is stopped or when not being analysed etc.	<pre>1.0000ml Diag Off</pre>
Diag Monitoring	Judgment of the delivery status is in progress.	<pre>1.0000ml Diag Monitoring</pre>
Diag NotDetected	Delivery failure was not detected.	<pre>1.0000ml Diag NotDetected</pre>
Diag Detected	Delivery failure was detected.	<pre>1.0000ml Diag Detected</pre>

■ **NOTE** Auto-Diagnostics issues a warning if a pulse exceeds a specific threshold. Note that very slight pressure variation may not be detected.

```
WARNING
PUMP CONDITION
```

The table shows a guideline of the conditions under which the Auto-Diagnostics function can correctly detect a delivery failure.

Item	Specification
Pumping Methods	Constant flow pumping ▶▶ Reference "Switching the delivery mode «MODE CHANGE» (Only for LC-40D XR/LC-40D/LC-40i)" P.50
Flow Rate	0.1 to 2 mL/min * Pumps should satisfy the above flow rate range in the high-pressure gradient mode.
Delivery Pressure	LC-40D X3: 5 to 130 MPa LC-40D XS/LC-40D XSi: 5 to 105 MPa LC-40D XR: 5 to 70 MPa LC-40D: 5 to 44 MPa LC-40i: 5 to 30 MPa
Pumping Modes	Isocratic, two-solvent high-pressure gradient, two-solvent low-pressure gradient

NOTE The Auto-Diagnostics function may not work in case of a significant pressure decrease, such as when a large bubble enters the pump head. For this reason, set the lower pressure limit P.MIN when using the function.

When Auto-Diagnostics is off, change in the pump pressure is detected and a delivery status is displayed.

```

1.0000ml
Press Stable
PUMP  CONC  RUN  PURGE
  
```

Display	Delivery Status
Press Stable	Delivery is stable.
Press Dec Left	The pressure of the pump head that is on the left when viewed from the front is decreasing during discharge.
Press Dec Right	The pressure of the pump head that is on the right when viewed from the front is decreasing during discharge.
Press Increase	The pressure is at least 10 % higher than that 5 minutes ago.
Press Decrease	The pressure is at least 10 % lower than that 5 minutes ago.

▼ **NOTE** [Press Increase] and [Press Decrease] are also displayed during normal operation, such as when the pumps start and stop.

(For LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D)

If [Press Dec Right] is displayed, it may indicate one of the following:

- Air remains inside the right pump head.
- There is a leak in the right pump head's seal.
- The right pump head's inlet check valve or the left pump head's outlet check valve are not operating properly.

If [Press Dec Left] is displayed, it may indicate that conditions described above have occurred for the left pump head.

(For LC-40i)

If [Press Dec Right] is displayed, it may indicate one of the following:

- Air remains inside the right pump head.
- There is a leak in the right pump head's seal.
- The left pump head's outlet check valve is not operating properly.

If [Press Dec Left] is displayed, it may indicate one of the following:

- Air remains inside the left pump head.
- There is a leak in the left pump head's seal.
- The left pump head's inlet check valve is not operating properly.

▶▶ Reference "Turning on/off Auto-Diagnostics «AUTO DIAGNOSTICS»" P.84

### ■ Monitoring Vacuum Pressure in Degassing Unit «DEGAS PRESSURE»

The screen displays the vacuum pressure of the degassing unit connected to the instrument.

```
DEGAS PRESSURE
      -94 kPa (OK)
PUMP  CONC  RUN  PURGE
```

- [(OK)] is displayed when the vacuum pressure is at a normal value.
- [(NG)] is displayed when the vacuum pressure is at an abnormal value.

[Disconnected] is displayed when a degassing unit is not connected.

```
DEGAS PRESSURE
      Disconnected
PUMP  CONC  RUN  PURGE
```

### ■ Displaying the status of connection with PC/WS «PC/WS»

The screen displays the status of connection with a PC/WS.

[Connected] is displayed when the instrument is connected with a PC/WS.

This screen is displayed only when the CBM-40/CBM-40lite is connected.

[Disconnected] is displayed when the instrument is not connected with a PC/WS.

```
PC/WS Connected
PUMP  CONC  RUN  PURGE
```

## 3.5 Auxiliary Functions Screen (FUNCTION)

The auxiliary functions screen has six setting groups. Switch the groups with [↑] or [↓] and press [→] to enter the screen of the desired setting group. Press [CE] to return to the initial screen.

Setting Group Name	Description
PARAMETER	The group allows the user to set analysis parameters.
CONTROL	The group enables specific operation.
SYSTEM	The group allows the user to set parameters related to the system such as parameters of connection with external equipment.
UTILITY	The group allows the user to set parameters not related to the analysis result such as display and buzzer parameters.
EDIT	Time programs can be edited.
FILE	Created time programs can be selected, copied, or deleted.

### 3.5.1 Auxiliary Functions (FUNCTION) List

#### ■ [PARAMETER] settings group

Name	Description	Remark	Ref.
P.MAX	Sets the maximum pressure limit for solvent delivery.	Initial value: 10 Set value: (LC-40D X3) 1.0 to 130.0 MPa (LC-40D XS/LC-40D XSi) 1.0 to 105.0 MPa (LC-40D XR) 1.0 to 70.0 MPa (LC-40D) 1.0 to 44.0 MPa (LC-40i) Aqueous solvents: 1.0 to 30.0 MPa Organic solvents: 1.0 to 22.0 MPa	P.41
P.MIN	Sets the minimum pressure limit for solvent delivery.	Initial value: 0 Set value: (LC-40D X3) 0 to 130.0 MPa (LC-40D XS/LC-40D XSi) 0 to 105.0 MPa (LC-40D XR) 0 to 60.0 MPa (LC-40D) 0 to 40.0 MPa (LC-40i) Aqueous solvents: 0 to 30.0 MPa Organic solvents: 0 to 22.0 MPa	P.42
COMP	Makes fine adjustment of compressibility correction of solvent.	Initial value: 0.45 Set value: 0.00 to 3.00	P.43

Name	Description	Remark	Ref.
INT.SV PORT	Sets the port of the internal low-pressure gradient kit or mobile phase switching valve.	Initial value: 1 Set value: 1: A 2: B 3: C 4: D	P.44
EXT.SV PORT CH1/CH2/CH3	Sets the port of the mobile phase switching valve FCV-11AL/FCV-11ALS connected to the SV connector on the back of the instrument.	Initial value: 1 Set value: 1: A 2: B	P.45
EVENT1	Sets the relay contact output 1.	Initial value: 0 Set value: 0: Off 1: On	P.45
EVENT2	Sets the relay contact output 2.	Initial value: 0 Set value: 0: Off 1: On	P.45
LPGE CYCLE	Sets the low-pressure gradient operation mode.	Initial value: 0 Set value: 0: Standard mode 2: 2-cycle mode 4: 4-cycle mode 8: 8-cycle mode (For LC-40i) Initial value: 0 Set value: 0: Standard mode 4: 4-cycle mode 8: 8-cycle mode 16: 16-cycle mode	P.46
PRESSURE RANGE*1	Switches the settable range of the upper pressure limiter.	Initial value: 0 Set value: 0: 1.0 to 22.0 MPa 1: 1.0 to 30.0 MPa	P.47
PURGE TIME	Sets a purge execution time.	Initial value: 3 Set value: 1 to 20 minutes	P.47
PURGE FLOW	Sets a purge flow rate.	Initial value: 4.0 Set value: 0.1 to 10.0 mL/min (For LC-40i) Initial value: 4.0 Set value: 0.1 to 5.0 mL/min	P.47
PURGE P.MAX	Sets maximum pressure limit at purging.	Initial value: 10.0 Set value: 1.0 to 10.0 MPa	P.48
RINSING OPERATE*2	Sets the delivery amount of the optional rinsing pump when the pump is used.	Initial value: 0 (OFF) Set value: 0 to 4	P.48
FLOW SLOPE	Sets the time to reach the set flow rate during delivery.	Initial value: 0 Set value: 0 to 30.00 minutes	P.49

\*1 LC-40i only

\*2 LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D only

## ■ [CONTROL] settings group

Name	Description	Remark	Ref.
PLUNGER SET	Moves the plunger position. Replace the plunger or the plunger seal.	Initial value: 0 Set value: 0: Stop 1: L 2: R 3: M	P.49
ZERO ADJUST	Performs zero adjustment of pressure screen.	-	P.49
MODE CHANGE	(Only for LC-40D XR/LC-40D/LC-40i) Switches between the constant flow delivery mode and the constant pressure delivery mode.	Initial value: 0 Set value: 0: Constant flow 1: Constant pressure	P.50

## ■ [SYSTEM] setting group

Name	Description	Remark	Ref.
LOCAL MODE	Selects independent operation or control via system controller.	Initial value: 0 Set value: 0: Remote 1: Local	P.50
LINK ADDRESS	Sets address of the instrument for control via system controller.	Initial value: 4 Set value: 1 to 12	P.50
POWER BUTTON	Sets whether to enable individual operation from the power button on the front of the instrument even when connected to the system controller SCL-40/CBM-40/CBM-40lite.	Initial value: 0 Set value: 0: CBM 1: Module	P.51
CONTROLLER LINK	Selects the type of the connected system controller.	Initial value: 1 Set value: 0: Int 1: Ext	P.52
SELECT EVENT1	Uses the [EVENT1] output as a start signal of a time program.	Initial value: 0 Set value: 0: EVENT 1: Start	P.52
SELECT EVENT2	Uses the [EVENT2] output as a stop signal of external equipment in case of an error.	Initial value: 0 Set value: 0: EVENT 1: Error	P.52
PUMP CONFIG (SYS)	Input values according to the system used.	Initial value: 1 Set value: 1: Standard 4: Low-pressure gradient mode	P.53
SYSTEM PROTECT	Reduces the flow rate without stopping the pumping when the pressure exceeds the P.MAX value.	Initial value: 0 Set value: 0: Clear 1: Set	P.53
WAIT PURGE MODE	Displays the status that prompts purging on the LabSolutions/SCL-40 screen.	Initial value: 0 Set value: 0: Ready 1: Wait	P.54

Name	Description	Remark	Ref.
EXT.SV TYPE	Sets a type of reservoir switching valve connected to the SV connector on the back of the instrument.	Initial value: 0 Set value: 0: - 1: 11AL 2: 11ALS	P.54
EXT.SV SERIAL	Input the serial number of the mobile phase switching valve connected to the SV connector on the back of the instrument.	Initial value: - Set value: -	P.54
EXT.SV CHANNEL	Sets the flow path of the reservoir switching valve connected to the SV connector on the back of the instrument.	Initial value: 0 Set value: 0 to 3	P.54
PRESSURE UNIT	Sets the unit of the displayed pressure.	Initial value: 0 Set value: 0: MPa 1: kgf/cm <sup>2</sup> 2: bar 3: psi	P.55
INNER VOLUME	Input the tube volume.	Initial value: 0 Set value: 0 to 9999.9	P.56

#### ■ [UTILITY] setting group

Name	Description	Remark	Ref.
KEY CLOSE	Disables the key input.	-	P.58
BRIGHTNESS	Sets the brightness of display screen.	Initial value: 4 Set value: 1 to 4	P.58
BEEP MODE	Sets the operation of buzzer.	Initial value: 0 Set value: 0: ON 1: Alarm 2: OFF	P.58
VOLUME	Sets the buzzer volume.	Initial value: 2 Set value: 1 to 3	P.58
DISP OFF TIME	The operation panel turns off after the time set here elapses.	Initial value: 1 Set value: 0 to 10 min	P.58
DIRECT KEY MODE	Specifies whether to display the confirmation screen when the direct key is operated.	Initial value: 0 Set value: 0: Confirm 1: Direct	P.59

#### ■ [EDIT] group

Use this group to create a time program. For details, see "[3.7 Creating Time Program](#)" P.85.

#### ■ [FILE] operation group

Name	Description	Remark	Ref.
FILE NUMBER	Selects a program file No.	Initial value: 0 Set value: 0 to 9	P.60
FILE COPY	Copies a file.	Initial value: 0 Set value: 0 to 9	P.60
FILE DELETE	Deletes a time program from a file.	-	P.60

#### **About files:**

The instrument can store up to 10 files of flow rate and other parameter values, and time programs in memory. File No. 0 to 9 are assigned to each file. The auxiliary functions except [INT.SV PORT] and [EXT.SV PORT] are common functions. Use [FILE NUMBER] of the file operation group to switch the files.

## 3.5.2 [PARAMETER] Setting Group

This setting group is relevant to solvent delivery parameters.

### ■ Setting the maximum pressure limit during pumping 《P.MAX》

When the delivery pressure exceeds the set value, an error will occur and stop delivery.

Input the value with the numeric keypad and press [Enter].

```
P.MAX      10.0
Input 1.0 - 70.0MPa
```

Setting Range						Setting Step
LC-40D X3	LC-40D XS /LC-40D XSi	LC-40D XR	LC-40D	LC-40i		
				Aqueous Solvents	Organic Solvents	
1.0 to 130.0 MPa	1.0 to 105.0 MPa	1.0 to 70.0 MPa	1.0 to 44.0 MPa	1.0 to 30.0 MPa	1.0 to 22.0 MPa	0.1 MPa
10 to 1326 kgf/cm <sup>2</sup>	10 to 1071 kgf/cm <sup>2</sup>	10 to 714 kgf/cm <sup>2</sup>	10 to 449 kgf/cm <sup>2</sup>	10 to 306 kgf/cm <sup>2</sup>	10 to 224 kgf/cm <sup>2</sup>	1 kgf/cm <sup>2</sup>
10 to 1300 bar	10 to 1050 bar	10 to 700 bar	10 to 440 bar	10 to 300 bar	10 to 220 bar	1 bar
142 to 19000 psi	142 to 15235 psi	142 to 10157 psi	142 to 6388 psi	142 to 4353 psi	142 to 3186 psi	1 psi

$$1 \text{ kgf/cm}^2 = 0.098 \text{ MPa} = 0.98 \text{ bar} = 14.2 \text{ psi}$$

### ■ Setting the minimum pressure during delivery 《P.MIN》

When the delivery pressure falls below the set value for a specific time, an error will occur and stop delivery.

Input the value with the numeric keypad and press [Enter].

P.MIN 0.0  
Input 0.0 - 60.0MPa

Setting Range						Setting Step
LC-40D X3	LC-40D XS /LC-40D XSi	LC-40D XR	LC-40D	LC-40i		
				Aqueous Solvents	Organic Solvents	
0 to 130.0 MPa	0 to 105.0 MPa	0 to 60.0 MPa	0 to 40.0 MPa	0 to 30.0 MPa	0 to 22.0 MPa	0.1 MPa
0 to 1326 kgf/cm <sup>2</sup>	0 to 1071 kgf/cm <sup>2</sup>	0 to 612 kgf/cm <sup>2</sup>	0 to 408 kgf/cm <sup>2</sup>	0 to 306 kgf/cm <sup>2</sup>	0 to 224 kgf/cm <sup>2</sup>	1 kgf/cm <sup>2</sup>
0 to 1300 bar	0 to 1050 bar	0 to 600 bar	0 to 400 bar	0 to 300 bar	0 to 220 bar	1 bar
0 to 19000 psi	0 to 15235 psi	0 to 8706 psi	0 to 5805 psi	0 to 4353 psi	0 to 3186 psi	1 psi

$$1 \text{ kgf/cm}^2 = 0.098 \text{ MPa} = 0.98 \text{ bar} = 14.2 \text{ psi}$$

### ■ Setting the compressibility of solvent «COMP»

Although the instrument corrects the compressibility to suppress pulse increase caused by the effect of the compressibility of the solvent, setting a compressibility suitable for the solvent used enables more accurate correction.

Input the compressibility (GPa)<sup>-1</sup> with the numeric keypad and press [Enter]. The initial value is 0.45.

```
COMP          0.45
Input 0.00 - 3.00
```

Mobile Phase	compressibility (GPa) <sup>-1</sup>
Water	0.45
Acetonitrile	1.20
Methanol	1.25
Ethanol	1.20
2-propanol	1.20
Hexane	1.60
Heptane	1.25
Cyclohexane	1.25
Ethyl Acetate	1.10
Chloroform	1.10
Benzene	1.00

#### Single solvent

Set the compressibility according to the table.

#### Mixture of water and organic solvent

If the concentration of the organic solvent is 50 % or less, "0.45" is recommended for the compressibility of water. If the concentration is more than 50 %, make the value closer to the compressibility of organic solvent according to the mixture ratio.

Example) When the ratio between water and acetonitrile is 50 : 50, set "0.45".

When the ratio between water and acetonitrile is 30 : 70, set "0.75".

#### In other cases or when rigorous adjustment is required

1

Connect a resistance tube (or column) that can create pressure similar to the desired delivery pressure at 1.0 mL/min or less and wait until delivery becomes stable.

3

2

While monitoring fluctuation on the pressure monitor of the instrument, gradually increase the set value of [COMP] from 0.45 in 0.05 increments to find the COMP value with the minimum fluctuation on the pressure monitor.

In the low-pressure gradient mode, the setting screen will be as shown in the figure.

Press [→] to enter the [COMP A] (mobile phase A compressibility) setting screen. Press [↓] or [↑] to set the compressibilities of the four solvents (A, B, C, and D). Solvents are delivered at the compressibility optimized according to the set mixture ratio.

```
>COMP
```

```
COMP A          0.45
Input 0.00 - 3.00
```

When both the low-pressure gradient kit and FCV-11AL/FCV-11ALS are used, compressibility setting screens for eight solvents, or [COMP A1], [COMP A2], [COMP B1], [COMP B2], etc are displayed. Set the compressibility for the flow path used.

Press [CE] to return to the initial screen.

▶▶ Reference "3.8 Delivery in the Low-Pressure Gradient Mode" P.94

### ■ Setting the port of the internal solenoid valve «INT.SV PORT»

Select the mobile phase port used for delivery when the optional low-pressure gradient kit is used as a mobile phase switching valve or when the internal reservoir switching valve is used. Input the value (the set value in the table) of the desired mobile phase port with the numeric keypad and press [Enter].

(Default screen)

```
INT.SV PORT      1
1:A 2:B
```

(Screen for low-pressure gradient kit)

```
INT.SV PORT      1
1:A 2:B 3:C 4:D
```

Solenoid Valve Type	Set value	Mobile Phase Port
Low-Pressure Gradient Kit	1	Solvent A
	2	Solvent B
	3	Solvent C
	4	Solvent D
Reservoir Switching Valve	1	Solvent A
	2	Solvent B



**Hint** The value cannot be input if the instrument has no internal solenoid valve.

### ■ Setting the flow path of the mobile phase switching valve connected to the back of the instrument 《EXT.SV PORT CH1 / CH2 / CH3》

Select the mobile phase port used for delivery when the optional mobile phase switching valve FCV-11AL/FCV-11ALS is used.

```
EXT - SV PORT CH1 1
1 : A 2 : B
```

Input the value (the set value in the table) of the desired mobile phase port with the numeric keypad and press [Enter]. Set all channels of FCV that are used. When using FCV-11ALS, set CH1 only.

Solenoid Valve Type	Set value	Mobile Phase Port
Reservoir Switching Valve FCV-11AL/FCV-11ALS	1	Switching the channel to side A (left side)
	2	Switching the channel to side B (right side)

▼ **NOTE** Before setting EXT.SV PORT, input a value in [EXT.SV TYPE] to select the solenoid valve to be used. Without a solenoid valve selected, the user cannot input the port value.

▶▶ Reference "Selecting the type of external solenoid valve 《EXT.SV TYPE》" P.54

### ■ Setting the EVENT1 output terminal 《EVENT1》

Set "ON" (close) / "OFF" (open) of the [EVENT1] output (relay contact) on the back of the instrument.

```
EVENT 1 0
0 : O f f 1 : O n
```

Set Value	EVENT1 Output
0	Relay 1 OFF
1	Relay 1 ON

### ■ Setting the EVENT2 output terminal 《EVENT2》

Set "ON" (close) / "OFF" (open) of the [EVENT2] output (relay contact) on the back of the instrument.

```
EVENT 2 0
0 : O f f 1 : O n
```

Set Value	EVENT2 Output
0	Relay 2 OFF
1	Relay 2 ON

3

### ■ Setting the low-pressure gradient mode 《LPGE CYCLE》

Set the operation mode of low-pressure gradient.

```
LPGE CYCLE      0
0:Std- or 2,4,8cyc
```

(For LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D)

Set Value	Low-Pressure Gradient Mode
0 (Standard)	The mode is automatically selected according to the flow rate. 2.0000 mL/min or less: 4-cycle mode 2.0001 mL/min or more: 8-cycle mode
2	2-cycle mode Select this mode when using a low-capacity mixer with 300 $\mu$ L or less internal capacity. In any other mode, concentration will be more uneven resulting in a wavier baseline on the detector.
4	4-cycle mode This mode is suitable for a mixer with approximately 0.5 mL internal capacity.
8	8-cycle mode This mode is suitable for a mixer with a 1.5 mL or higher internal capacity.

(For LC-40i)

Set Value	Low-Pressure Gradient Mode
0 (Standard)	The mode is automatically selected according to the flow rate. 2.0000 mL/min or less: 8-cycle mode 2.0001 mL/min or more: 16-cycle mode
4	4-cycle mode Select this mode if you want to improve the density resolution in low-flow gradient analysis.
8	8-cycle mode This mode is suitable for a mixer with approximately 0.4 mL internal capacity.
16	16-cycle mode This mode is suitable for a mixer with a 1.6 mL or higher internal capacity.

### ■ Setting the settable range of the maximum pressure limit 《PRESSURE RANGE》

Although the maximum pressure limit (P.MAX) for LC-40i is 1.0 to 30.0 MPa for aqueous solvents and 1.0 to 22.0 MPa for organic solvents, the default setting range is defined to 1.0 to 22.0 MPa for safety.

When using an aqueous solvent at 22.0 MPa or higher pressure, switch the P.MAX value to 1.0 to 30.0 MPa using this parameter.

```
PRESSURE RANGE 0
0 : 22 MPa 1 : 30 MPa
```

Set Value	Settable Range of Maximum Pressure Limit
0	1.0 to 22.0 MPa
1	1.0 to 30.0 MPa

#### CAUTION



Instruction

When using organic solvents, be sure to set the value to 0 (P.MAX range of 1.0 to 22.0 MPa).

Plumbing parts may be damaged if they are applied with 22 MPa or higher pressure during pumping of organic solvents.

### ■ Setting the purging time 《PURGE TIME》

Set the purging time.

The value can be set in the range from 1 minute to 20 minutes in one minute increments.

```
PURGE TIME 3
Input 1 - 20min
```

### ■ Setting the purging flow rate 《PURGE FLOW》

Set the purging flow rate. This setting is effective for both purging with the [PURGE] operation in the instrument and auto purging with the system controller.

```
PURGE FLOW 4.0
Input 0.1 - 10.0ml
```

The value can be set in the range from 0.1 mL/min to 10.0 mL/min for LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D, 0.1 to 5.0 mL/min for LC-40i in 0.1 mL/min increments.

 **NOTE** The flow rate set here is approximate for replacing the mobile phase in the pump.

■ **Setting the maximum pressure during purging** 《PURGE P.MAX》

Set the maximum pressure during auto purging.

```
PURGE P-MAX      10.0
Input 1.0 - 10.0MPa
```

For a purging operation started by the [PURGE] key of the instrument, the maximum pressure limit function works at 2.0 MPa and displays the error shown in the figure as well as stopping delivery.

```
ERROR
OPEN DRAIN VALVE
```

Setting Range	Setting Step
1.0 to 10.0 MPa	0.1 MPa
10 to 102 kgf/cm <sup>2</sup>	1 kgf/cm <sup>2</sup>
10 to 100 bar	1 bar
142 to 1451 psi	1 psi

1 kgf/cm<sup>2</sup> = 0.098 MPa = 0.98 bar = 14.2 psi

■ **Setting the delivery amount of the rinsing pump** 《RINSING OPERATE》

Set the delivery amount of the optional rinsing pump. (LC-40i is not supported.)

```
RINSING OPERATE 0
Off , Input 0-4
```

During delivery or purging operation, if the setting is "standard", the rinsing pump starts with 6-second delivery and then delivers rinsing solution for 2 seconds at intervals of 1 minute. The other settings double or triple the 2-second delivery time.

The user can set the delivery amount to one of the four levels below.

Selecting "0" disables the rinsing pump.

Based on the delivery amount per hour in the following table, prepare necessary the amount of the rinse solution for the analysis time.

- **NOTE**
- The delivery amount in the table is approximate for rinsing.
  - Select "0" when not using the rinsing pump.

- 💡 **Hint**
- The approximate delivery amount necessary for replacing the rinse solution in the rinsing flow path is approximately 10 mL.
  - To replace the rinse solution in the rinsing flow path, select "4" and operate the pump approximately 3 minutes.

Set Value	Delivery Amount per Hour (mL/h)	Remark
0	0	The rinsing pump is disabled.
1	30	Half of standard
2	60	Standard
3	120	Twofold amount of standard
4	240	Fourfold amount of standard

### ■ Setting the time to reach the set flow rate after the start of delivery 《FLOW SLOPE》

Set the time to reach the set flow rate after the start of delivery.

The value can be set in the range from 0 minutes to 30.00 minutes in 0.01 minute increments.

Selecting "0" disables this function.

```
FLOW SLOPE    0.00
Input 0 - 30.00min
```

3

## 3.5.3 [CONTROL] Setting Group

### ■ Setting the plunger stop position 《PLUNGER SET》

Set the plunger stop position. This setting is used for maintenance.

[PUMP] on the display is highlighted and the plunger starts moving. [PUMP] on the display stops being highlighted after the plunger finishes moving.

```
PLUNGER SET    0
0:Stop 1:L 2:R 3:M
```

Set Value	Function
0	The plunger stops moving.
1	The plunger on the left when viewed from the front is retracted. In this state, the left pump head is removed.
2	The plunger on the right when viewed from the front is retracted. In this state, the right pump head is removed.
3	The plunger stops at the middle position.

### ■ Zero adjustment of pressure sensor 《ZERO ADJUST》

Set the reference value for the zero point of the pressure sensor.

1

Open the drain valve to remove pressure completely.

```
ZERO ADJUST
Enter to ZeroAdj
```

2

Press [Enter].

■ Switching the delivery mode 《MODE CHANGE》 (Only for LC-40D XR/LC-40D/LC-40i)

Switch between the constant flow delivery mode and the constant pressure delivery mode.

```
MODE CHANGE 0
0:Flow 1:Press
```

▼ NOTE Stop the pump before switching the delivery mode. Switching the delivery mode while the pump is operating is not possible.

### 3.5.4 [SYSTEM] Setting Group

This group is relevant to the system configuration such as connection with external equipment.

■ Selecting the local/remote mode 《LOCAL MODE》

When the system controller is connected, the user can select whether to operate the instrument independently or with the system controller.

```
LOCAL MODE 0
0:Remote 1:Local
```

Set Value	Mode	Function
0	Remote	The instrument is operated with the system controller.
1	Local	The instrument is operated independently (local mode).

■ Setting the link address 《LINK ADDRESS》

Set the address (channel No.) used to connect with the system controller.

```
LINK ADDRESS 4
1 - 12
```

Address	Function
1 to 12	A channel number for connecting with the system controller

### ■ Setting the Power Button 《POWER BUTTON》

Sets the power button on the front of the instrument.  
Input the value with the numeric keypad and press [Enter].

Set Value	Function
0	Operation of the power button from the instrument is disabled according to the control of the system controller only. (Initial value)
1	In addition to being controlled by the system controller, it is also possible to turn off the power individually from the instrument.

```
POWER BUTTON 0
0 : CBM 1 : Module
```

 **Hint** When the instrument is connected to the system controller SCL-40/CBM-40, the power control of the instrument follows the system controller, and the shutdown and startup functions operate from the system controller throughout the system.

-  **NOTE**
- If you turn off the power to the instrument individually with the setting [1], the connection to the system controller will also be lost. Therefore, the system startup function does not turn on the instrument. you need to turn the power on again by pressing and holding the power button on the instrument. The system shutdown function is still enabled with setting [1]. However, if the power is turned off by the shutdown function, turning on the power by pressing the power button of the instrument is disabled, and the system must be started up from the system controller.
  - If the [OPERATION MODE] is set to [1] and connected as LC-30AD/LC-20ADXR/LC-20AD, the power control function by the system controller is not available. Therefore, you can always operate the power button of the instrument regardless of the setting of this function.
  - This function is not available on pumps that meet the following conditions because the power button functions as the power button for the entire system.
    - Pumps with an integrated CBM-40lite
    - The pump with the lowest optical link number among the pumps connected to the CBM-40

▶▶ Reference "Setting the link address 《LINK ADDRESS》" P.50  
"Setting the operation mode 《OPERATION MODE》" P.75

### ■ Setting the link destination of the system controller 《CONTROLLER LINK》

Select the type of the connected system controller.

```
CONTROLLER LINK 1
0: Int 1: Ext
```

Set Value	Function
0	The instrument is internally connected to CBM-40lite (optional).
1	The instrument is connected to an external system controller (SCL-40, CBM-40, etc.) via an optical cable connected to the [REMOTE] connector.

Installing CBM-40lite in the instrument and setting the link destination of the system controller to internal connection causes the link address to be set to "5" with [LINK ADDRESS] displayed as shown in the figure.

```
LINK ADDRESS 5
Fixed by Int-CBM
```

### ■ Setting the function of the EVENT1 output terminal 《SELECT EVENT1》

Set the mode of controlling external equipment via the [EVENT1] output (relay 1).

```
SELECT EVENT1 0
0: Event 1: Start
```

Set Value	Function
0	The relay contact is controlled with the [EVENT1] set value.
1	The relay contact 1 [EVENT1] is used as a start signal of a time program.

▣ **NOTE** If the SELECT EVENT1 function is used, the corresponding EVENT parameter is disabled.

### ■ Setting the function of the EVENT2 output terminal 《SELECT EVENT2》

Set the mode of controlling external equipment via the [EVENT2] output (relay 2).

```
SELECT EVENT2 0
0: Event 1: Error
```

Set Value	Function
0	The relay contact is controlled with the [EVENT2] set value.
1	The relay contact 2 [EVENT2] is used as an error output signal.

▣ **NOTE** If the SELECT EVENT2 function is used, the corresponding EVENT parameter is disabled.

### ■ Setting the system parameter 《PUMP CONFIG (SYS)》

Input values according to the status of the system used.

```
PUMP CONFIG(SYS) 1
Input 1 or 4
```

Set Value	Function
1	The instrument is controlled independently or with external equipment
4	The instrument is used as a low-pressure gradient system

**NOTE** The system functions normally only with the above values. Values other than the above cannot be set.

Setting the set value to "4" (low-pressure gradient system) highlights [CONC] on the display allowing the user to set a concentration.

```
0.0000ml MAX 10.0
0.0MPa MIN 0.0
PUMP CONC RUN PURGE
```

### ■ Setting the system protection 《SYSTEM PROTECT》

When [P.MAX] is active, the flow rate is reduced in increments of a half rate while delivery is continued until the pressure falls below [P.MAX].

```
SYSTEM PROTECT 0
0:Clear 1:Set
```

Set Value	Function
0	Do not use system protection.
1	Use system protection.

**Hint** To clear a [P.MAX] error, press [CE]. The alarm stops and the flow rate returns to that before the error.

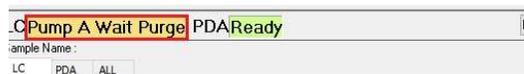
### ■ Displaying the status that prompts purging 《WAIT PURGE MODE》

When the instrument is powered on or generates an error, the status that prompts purging is displayed on the LabSolutions and SCL-40 screens so that analysis can be started in stable system condition.

```
WAIT PURGE MODE 0
0 : Ready 1 : Wait
```

Set Value	Function
0	Do not display the status that prompts purging on the LabSolutions/SCL-40 screens.
1	Display the status that prompts purging on the LabSolutions/SCL-40 screens.

 **Hint** When this setting is set to 1, the status is displayed on LabSolutions/SCL-40 as shown in the figure. Analysis is started after this status is canceled.



### ■ Selecting the type of external solenoid valve 《EXT.SV TYPE》

Select the type of flow switching valve (optional) connected to the [SV] connector on the back of the instrument.

```
EXT .SV TYPE 0
0 : - 1 : 11AL 2 : 11ALS
```

Set Value	Function
0	Do not use FCV.
1	Use FCV-11AL.
2	Use FCV-11ALS.

 **Hint** After changing EXT.SV TYPE, enter the serial number of the solenoid valve unit in EXT.SV SERIAL.

▶▶ **Reference** ["Inputting the serial number of the external flow path switching valve 《EXT.SV SERIAL》" P.54](#)

### ■ Inputting the serial number of the external flow path switching valve 《EXT.SV SERIAL》

Input the serial number of the flow path switching valve connected to the SV connector on the back of the instrument.

```
EXT .SV SERIAL
C1 2 3 4 5 6 7 8 9 0 1
```

### ■ Selecting the flow path of the solenoid valve unit 《EXT.SV CHANNEL》

Input correspondence between ports A to D of the low-pressure gradient kit and the valves of FCV-11AL/FCV-11ALS when the optional low-pressure gradient kit and FCV-11AL/FCV-11ALS are used together.

**For FCV-11AL**

Input "0" for a flow path that does not pass through FCV-11AL. Values 1 to 3 are automatically assigned to the other flow paths. Connect the flow paths that pass through FCV-11AL so that the relation  $A < B < C < D$  is satisfied.

```
EXT.SV CHANNEL
A:1 B:2 C:3 D:0
```

**For FCV-11ALS**

The user can input "0" or "1". For a port passing through FCV-11ALS, input "1".

Set Value	Port
0	The port does not pass through a flow path of FCV-11AL/FCV-11ALS.
1	The port is connected to flow path 1 of FCV-11AL/FCV-11ALS.
2	The port is connected to flow path 2 of FCV-11AL.
3	The port is connected to flow path 3 of FCV-11AL.

**Hint**

In the previous figure, port A of the low-pressure gradient kit is connected to flow path 1 of FCV-11AL, port B to flow path 2, and port C to flow path 3. The flow path of port D does not pass through the FCV-11AL.

**NOTE**

The values can be input only when the low-pressure gradient kit and FCV-11AL/FCV-11ALS are used together.

▶▶ Reference "Setting the system parameter 《PUMP CONFIG (SYS)》" P.53  
"Selecting the type of external solenoid valve 《EXT.SV TYPE》" P.54

### ■ Setting the unit of the displayed pressure 《PRESSURE UNIT》

Set the unit of the displayed pressure.

Set Value	Unit of Displayed Value
0	MPa
1	kgf/cm <sup>2</sup>
2	bar
3	psi

```
PRESSURE UNIT 0
0:MPa 1:kgf 2:bar 3:psi
```

$$1 \text{ kgf/cm}^2 = 0.098 \text{ MPa} = 0.98 \text{ bar} = 14.2 \text{ psi}$$

### ■ Inputting the tube volume 《INNER VOLUME》

Inputting a value in a low-pressure gradient system enables the system controller to calculate the system volume. Refer to the table to input an appropriate value according to the tubes used.

```
INNER VOLUME  0.0
Input 0.0 - 9999.9
```

Input "0" in any mode other than the low-pressure gradient mode.

#### For LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D

Tubing Between Solenoid Valve and Pump Inlet	Tubing Between Pump Outlet and Mixer Inlet	Set Value
Standard tube (OUT tube, 310 mm)	Tubing (ID 0.3 × 600)	200 μL
	Tubing (ID 0.3 × 300)	180 μL
Tube for buffer solution (OUT tube, 400 mm)	Tubing (ID 0.3 × 600)	355 μL
	Tubing (ID 0.3 × 300)	335 μL
Use the Mixer installation kit (228-65020-41, -43)	Tubing in Mixer installation kit	0 μL



#### Hint

- The values above are intended when using the mixer recognition device. When the mixer recognition device is not used, add the capacity depending on the mixer. The column oven automatically recognise the capacity of the mixer when using the mixer recognition device.
- The values above are intended for the recommended tubes. When using a tube not listed above, increase or decrease the capacity depending on the tube.

#### Example

- 1) Use the standard tube + Tubing (ID 0.3 x 600) + Mixer MR40 LPGE (without the mixer recognition device)  
→Set value: 240 (200 L (from the table above) + 40 μL (mixer capacity))
- 2) Using the tube for buffer solution + Tubing (ID 0.3 x 600) + Mixer MR40 LPGE (with the mixer recognition device)  
→Set value: 355 (from the table above) (The capacity of the mixer will be automatically recognised by the column oven)
- 3) Use the mixer installation kit (without the mixer recognition device)  
→Set value: 40 (0 μL (from the table above) + 40 μL (mixer capacity))

**For LC-40i**

Tubing Between Solenoid Valve and Pump Inlet	Tubing Between Pump Outlet and Mixer Inlet	Set Value
Standard tube (OUT tube, 310 mm)	Tubing (ID 0.25 × 600)	190 µL
Tube for buffer solution (OUT tube, 400 mm)	Tubing (ID 0.25 × 600)	345 µL

**Hint**

- The values above are intended when using the mixer recognition device. When the mixer recognition device is not used, add the capacity depending on the mixer. The column oven automatically recognise the capacity of the mixer when using the mixer recognition device.
- The length of tubing above is an Example. When using a tube not listed above, decrease the capacity depending on the tube. Refer to the calculation examples below as needed.

3

**Example**

- 1) Use the standard tube + Tubing (ID 0.25 x 600) + 0.4 mL PEEK Mixer LPGE (without the mixer recognition device)  
→Set value: 240 = 160 µL (volume of Standard tube) + 30 µL (volume of Tubing (ID 0.25 x 600)) + 400 µL (mixer capacity)
- 2) Using the tube for buffer solution + Tubing (ID 0.25 x 600) + 0.4 mL PEEK Mixer LPGE (with the mixer recognition device)  
→Set value: 345 (from the table above) (The capacity of the mixer will be automatically recognised by the column oven)
- 3) Use the standard tube + Tubing (ID 0.25 x 300) + 1.6 mL PEEK Mixer LPGE (without the mixer recognition device)  
→Set value: 1775 = 160 µL (volume of Standard tube) + 15 µL (volume of Tubing (ID 0.25 x 600)) + 1600 µL (mixer capacity)

### 3.5.5 [UTILITY] Setting Group

This setting group is relevant to the display monitor.

#### ■ Disables the key entry «KEY CLOSE»

Press [Enter] to disable key input.  
From this point, keypad input is disabled.

```
KEY CLOSE
Enter to Close
```

 **Hint** To release this function, press [Enter] while pressing [CE].

#### ■ Setting the brightness of display screen «BRIGHTNESS»

Sets the brightness of the display screen.  
The value range is 1 to 4, and 4 is the  
brightest.

```
BRIGHTNESS          4
Input 1 - 4
```

#### ■ Setting the operation of buzzer «BEEP MODE»

Sets the buzzer sound.

```
BEEP MODE          0
0:On 1:Alarm 2:Off
```

Set Value	Function
0	The key input sound, as well as the alarm sound to go off when an error occurs, are activated. (Default setting)
1	Only the alarm sound that goes off when an error occurs is activated.
2	All the buzzer sounds are deactivated.

#### ■ Setting the operation of buzzer volume «VOLUME»

Set the buzzer sound level. A larger setting  
value increases the sound level.

```
VOLUME          2
Input 1 - 3
```

### ■ Setting the time to turn off the operation panel automatically 《DISP OFF TIME》

Sets the time elapsed before the operation panel automatically turns to the sleep mode, when no operations are performed on the instrument.

```
DISP OFF TIME 1
Input 0 - 10min
```

The setting range is from 0 to 10 (min), in which the step can be set by minute. If 0 (min) is input, the operation panel remains on.

**NOTE** Setting "0" minutes causes the display screen to be always on. If the display screen is always on, some dots frequently lighting will deteriorate in brightness in a shorter time.

**HINT** The light does not go off while purging executed by pressing the [PURGE] key of the instrument.

### ■ Setting the direct keys 《DIRECT KEY MODE》

To prevent unintended operation, a confirmation screen can be displayed when a direct key ([PUMP], [RUN], or [PURGE]) is pressed.

```
DIRECT KEY MODE 0
0:Confirm 1:Direct
```

For example, setting this function to "0" (Confirm) and then pressing [PUMP] displays the confirmation screen shown in the figure. Pressing [Enter] starts the operation.

```
ENTER:PUMP ON
CE :CANCEL
```

**HINT** When the optional low-pressure gradient kit or reservoir switching valve is installed inside, pressing [PURGE] when starting purging does not display the confirmation screen. The confirmation screen, however, is displayed when purging is stopped.

### 3.5.6 [FILE] Operation Group

This group is relevant to analysis file operation.

#### ■ Specifying the file number 《FILE NUMBER》

The instrument allows the user to create and store a maximum of ten time programs. The program files can be selected with the parameter.

```
FILE NUMBER
Input 0-9
```

 **Hint** Select the file number from 0 to 9.

Input the file number with the numeric keypad and press [Enter].

#### ■ Specifying the file copy destination 《FILE COPY》

The program content of the currently selected file (indicated by the number of [FILE NUMBER] above) is copied to the file of a specified number.

```
FILE COPY
Input 0-9
```

Input a file number with the numeric keypad and press [Enter].

#### ■ Deleting a file 《FILE DELETE》

The time program of the currently selected file is deleted.

Press [Enter].

```
FILE DELETE
Enter to Delete
```

## 3.6 VP Functions Screen

The VP functions screen has four setting groups. Switch the groups with [ $\uparrow$ ] or [ $\downarrow$ ] and press [ $\rightarrow$ ] to enter the screen of the desired setting group. Press [CE] to return to the initial screen.

Setting Group Name	Description
PRODUCT INFO	The group is relevant to information of the instrument.
MAINTENANCE	The group is relevant to maintenance of the instrument.
VALIDATION	The group allows the user to check whether the instrument is operating correctly.
CALIBRATION	The group is for calibration of the instrument.

3

### 3.6.1 List of VP Functions

#### ■ Product information group [PRODUCT INFO]

Name	Function	Ref.
SERIAL NUMBER	Displays the serial number of the instrument.	P.63
S/W ID	Displays the S/W version number.	P.63

#### ■ Maintenance information group [MAINTENANCE]

Name	Function	Ref.
TOTAL OP TIME	Displays the total operation time of the instrument.	P.63
L SEAL USED	Displays or reset the total delivery amount of the currently used plunger seal and the delivery amount that requires replacement (for the left seal).	P.63
R SEAL USED	Displays or reset the total delivery amount of the currently used plunger seal and the delivery amount that requires replacement (for the right seal).	P.64
MOBILE PHASE*1	Displays the remaining amount of mobile phase and set an amount.	P.64
ALARM LEVEL	Specifies a threshold to cause an alarm of low mobile phase level.	P.64
PART REPLACEMENT	Input the part number of the replaced part when replacing the part.	P.65
MAINTENANCE LOG	Displays the maintenance log.	P.65
OPERATION LOG	Displays the log of password change, parameter reset, etc.	P.65
ERROR LOG	Displays the error log.	P.66
DGU OP TIME	Displays or reset the operation time of the degassing unit connected to the instrument.	P.66

\*1 Normally one solvent can be set for the mobile phase level monitoring function. Only in the low-pressure gradient mode, four solvents (A to D) can be set.

### ■ Validation support information group [VALIDATION]

Name	Function	Ref.
DATE	Displays or set the date.	P.67
TIME	Displays or set the time.	P.67
MEMORY CHECK	Checks ROM/RAM.	P.68
LEAK SENSOR CHECK	Checks operation of the leak sensor.	P.68
PULSE CHECK	Checks the pulse.	P.69
FLOW CHECK	Checks the flow rate.	P.70
PRESS LIMIT CHECK	Checks that the maximum and minimum pressure functions work correctly.	P.74

### ■ Calibration support information group [CALIBRATION]

Name	Function	Ref.
Input PASSWORD*1	Input a password.	P.75
OPERATION MODE	Selects an operation mode.	P.75
DATE FORMAT	Changes the displayed order of year, month and day.	P.76
INITIALIZE PARAM	Initializes parameters.	P.76
PARAMETER LOCK	To prohibit change of parameters.	P.77
PARTS MGMT TOOL	Sets the usage of the parts management tool.	P.77
PASSWORD SETTING	Changes the password.	P.78
CBM PARAMETER	Displays or set the parameters of the connected system controller.	P.79
LEAK THOLD	Sets the operation level of the leak sensor.	P.82
FLOW COMP FACTOR	Input the flow rate correction parameter (ALPHA).	P.83
PRESS COMP FACTOR	Input a pressure sensor sensitivity correction factor.	P.83
PLUNGER SEAL	Sets the time to replace the plunger seal.	P.83
P.MAX OVERRIDE	Sets override of the maximum pressure.	P.83
SV SELECT	Selects a mobile phase switching valve to be used in the compatible mode.	P.84
AUTO DIAGNOSTICS	Turns on/off Auto-Diagnostics.	P.84

\*1 In the calibration support group, an invalid password prevents the user from going further than [OPERATION MODE] even if the user presses [Enter].

### 3.6.2 Product Information Group (PRODUCT INFO)

The group is relevant to information of the instrument.

#### ■ Showing the serial number «SERIAL NUMBER»

Displays the serial number of the instrument.

```
SERIAL NUMBER
L22135500010
```

#### ■ Displaying the S/W version number «S/W ID»

The screen displays the S/W name (model name) and version.

```
LC-40D XR
Version:V1.00
```

3

### 3.6.3 Maintenance Information Group (MAINTENANCE)

The group is relevant to maintenance information of the instrument.

#### ■ Showing the total operation time «TOTAL OP TIME»

Displays the total cumulative operating time of the instrument.

```
TOTAL OP TIME
12 h
```

#### ■ Displaying the delivery amount of the left plunger seal «L SEAL USED»

The screen displays the total delivery amount of the currently used plunger seal and the delivery amount that requires replacement (unit: L).

```
L SEAL USED
15 / 60L
```

If the parts management tool (PARTS MGMT TOOL) is not used, press [del] after replacing the seal. The total delivery amount is reset to "0" and the reset date is recorded in the maintenance log.



#### Hint

- The plunger seal on the left when viewed from the front is shown as "L".
- When PARTS MGMT TOOL is active, the delivery amount cannot be reset on the operation panel. Reset it from PARTS MGMT TOOL. For the operation procedure, refer to the PARTS MGMT TOOL instruction manual.

### ■ Displaying the delivery amount of the right plunger seal 《R SEAL USED》

The screen displays the total delivery amount of the currently used plunger seal and the delivery amount that requires replacement (unit: L).

```
R SEAL USED
      15 / 60L
```

If the parts management tool (PARTS MGMT TOOL) is not used, press [del] after replacing the seal. The total delivery amount is reset to "0" and the reset date is recorded in the maintenance log.



#### Hint

- The plunger seal on the right when viewed from the front is shown as "R".
- When PARTS MGMT TOOL is active, the delivery amount cannot be reset on the operation panel. Reset it from PARTS MGMT TOOL. For the operation procedure, refer to the PARTS MGMT TOOL instruction manual.

### ■ Displaying and setting the remaining amount of mobile phase 《MOBILE PHASE》

The screen displays the remaining amount and set amount of the current mobile phase.

```
MOBILE PHASE
      1000 / 1000ml
```

When replacing the mobile phase, input the set amount of the mobile phase in the unit of mL and press [Enter].

```
MOBILE PHASE
      999 / 1000ml
```

The remaining amount is automatically calculated when solvent is delivered.

Normally only one solvent is supported. In the low-pressure gradient mode, four solvents (A to D) are supported.

A1, A2, B1, B2 etc. are shown if the low-pressure gradient kit and external mobile phase switching valve are used together.

```
MOBILE PHASE A1
      1000 / 1000ml
```

### ■ Setting a threshold to cause an alarm of low mobile phase level 《ALARM LEVEL》

The warning screen is displayed when the mobile phase level has fallen to the set percentage. Note that delivery continues.

```
ALARM LEVEL      20%
Input 1 - 99,0:Off
```

Input the set value with the numeric keypad and press [Enter]. Setting the value to 0 % disables the low mobile phase level alarm.

```
WARNING
MOBILE PHASE
```

### ■ Inputting a replacement part number 《PART REPLACEMENT》

When the parts management tool (PARTS MGMT TOOL) is not used, input the part number when replacing a general part.

The input part number is stored in the maintenance log.

 **Hint** When PARTS MGMT TOOL is active, the delivery amount cannot be reset on the operation panel. Reset it from PARTS MGMT TOOL.  
For the operation procedure, refer to the PARTS MGMT TOOL instruction manual.

▶▶ Reference "Displaying the maintenance log 《MAINTENANCE LOG》" P.65

```
PART REPLACEMENT
P/N: 228-48249-96
```

```
PART REPLACEMENT
SAVED
```

### ■ Displaying the maintenance log 《MAINTENANCE LOG》

This displays twenty records of previously replaced parts with the dates of their replacement. After press [→], press [↓] several times to display the replaced parts in order.

The figure shows an example that part number 228-48249-96 was replaced on April 1, 2019.

The table shows the messages displayed in the second row of a maintenance log.

Message	Description	Ref.
L SEAL REPLACED	The left plunger seal was replaced.	P.63
R SEAL REPLACED	The right plunger seal was replaced.	P.64
P/N: XXX-XXXXX-XX	The displayed part number was replaced.	P.65
DGU OP TIME: *****	The setting value (*****) was entered in DGU OP TIME.	P.66

```
>MAINTENANCE LOG
```

```
#1 19-04-01
P/N:228-48249-96
```

### ■ Displaying the operation log 《OPERATION LOG》

This displays ten records of previous modifications such as password change and parameter reset with the dates of the modifications. After press [→], press [↓] several times to display the operation log records in order.

The figure shows an example that the password was changed on April 1, 2019.

```
>OPERATION LOG
```

```
#1 19-04-01
CHANGE PASSWORD
```

The table shows the messages displayed in the second row of a maintenance log.

Message	Description	Ref.
INITIALIZE PARAM	The parameters were initialized.	P.76
PARAM LOCK ON	The parameter lock function was turned ON.	P.77
PARAM LOCK OFF	The parameter lock function was turned OFF.	
PARAM LOGIN	When the parameter lock function was ON, a user entered the password and moved on to the next screen.	
CHANGE PASSWORD	The password was changed.	P.78
USE PARTS MGMT	The PARTS MGMT TOOL was set to "Use".	P.77
NOT USE PARTS MGMT	The PARTS MGMT TOOL was set to "NotUse".	

### ■ Displaying the error log 《ERROR LOG》

This displays ten records of previous errors with the dates of the errors.

After press [→], press [↓] several times to display the error log records in order.

The figure shows an example that a maximum pressure error occurred on April 1, 2019.

For the messages displayed in [ERROR LOG], refer to the System Guide.

▶▶ Reference System Guide "5.4 Error Log List"




### ■ Displaying the operation time of the degassing unit 《DGU OP TIME》

The screen displays the operation time of the degassing unit connected to the instrument.

When the operation time is input, count of the operation time of the degassing unit starts from the input time. The input set value is stored in the maintenance log. If [999999 h] is set, the display shows "\*\*\*\*\*" and the operation time will not be counted.



- ▼ NOTE
- To activate this function, supply power from the instrument to the degassing unit and make sure that the pressure signal cable is connected correctly. If more than one pump is used, be sure to connect the power cable and pressure signal cable to the same pump. For how to connect, refer to the System Guide.
  - The shutdown function of SCL-40/CBM-40/CBM-40lite, or LC-Workstation can stop the degassing unit. For details, refer to the instruction manual of the system controller or LC-Workstation.
  - Approximate time to replace the vacuum pump of the degassing unit is 3 years or 8000 hours of operation time. Contact your Shimadzu representative if you need to replace the vacuum pump.

### 3.6.4 Validation Support Information Group (VALIDATION)

The group allows the user to check whether the equipment is operating correctly.

#### ■ Entering date «DATE»

This allows the user to view or input the date in this screen. The value is reset to the default "00-00-00" if the power switch on the back is turned off. The value is transmitted when the system controller is connected for control.  
To delete the input value, press [del].

```
DATE
YY-MM-DD  19-04-01
```

 **Hint** The figure is an example of April 1, 2019.

#### ■ Entering time «TIME»

This allows the user to view or input the time in this screen. The value returns to the initial value "00:00:00" when the power is turned off. The value is transmitted when the system controller is connected for control.  
To delete the input value, press [del].

```
TIME
HH:MM:SS  15:01:01
```

 **Hint** The figure is an example of 3:01:01 p.m.

### ■ Checking the memory 《MEMORY CHECK》

Runs the memory check on ROM and RAM.  
Pressing [Enter] starts the memory check.  
After the check, the result is displayed.

```
MEMORY CHECK
Enter to Start
```

```
MEMORY CHECK
ROM OK / RAM OK
```

### ■ Checking the leak sensor 《LEAK SENSOR CHECK》

Performs the operation test for the leak sensor.

- 1 Use a syringe filled with water to wet the sensor unit at the bottom of the leak sensor.

```
LEAK SENSOR CHECK
Soak and Enter
```

- 2 Wait about 10 seconds and then press [Enter].

If the sensor detects a leakage, [Good] will be shown.

If not, [No Good] will be shown.

```
LEAK SENSOR CHECK
Sensor Good
```

```
LEAK SENSOR CHECK
Sensor No Good
```

- 3 Press [CE].

The result display will be cleared.

If the result is [No Good], adjust the detection level with [LEAK THOLD] function in the Calibration Support Group.

▶▶ Reference "Setting the operation level of leak sensor 《LEAK THOLD》" P.82

■ **NOTE** After wetting and testing the leak sensor, wipe away the water on the tray completely. When wiping away the water, do not apply pressure to the leak sensor, the sensitivity decreases if the sensor unit touches the wall.

▶▶ Reference "4.16 Cleaning of the Leak Tray" P.161

## ■ Checking the pulse 《PULSE CHECK》

When checking operation, connect a resistance tube to the pump outlet to create 5 MPa to 10 MPa pressure at 1 mL/min during delivery.

**1** Press [Enter].

```
PULSE CHECK
Enter to Start
```

**2** Set the acceptance criterion (MPa) of pressure variation (pulse).

Input the set value with the numeric keypad and press [Enter]. Start delivery at 1 mL/min.

The value range is 0.05 to 1.00 MPa.

```
CRITERIA
0.20MPa
```

 **Hint** When setting 0.20 MPa as the acceptance criterion, input a value as shown in the figure.

The measurement starts after 1 minute during pumping. During measurement, the set flow rate (1 mL/min), measured pressure, pressure variation, and remaining time are displayed.

```
1.000 Wait...
1.99min left
```

```
1.000 7.0 0.08
0.99min left
```

After measurement, the panel displays the measured pressure variation with pass or fail, and then the results and the measurement date and time are stored in the memory of the instrument.

```
PULSATION 0.08 OK
Recorded
```

 **NOTE** Before measurement, make sure that the compressibility correction parameter of the solvent is correctly set.

▶▶ Reference "Setting the compressibility of solvent 《COMP》" P.43

3

### ■ Checking the flow rate 《FLOW CHECK》

When checking operation, connect a resistance tube to the pump outlet to create 5 MPa to 10 MPa pressure during delivery.

According to your measurement method, measure the flow rate by following the instructions below.

Set Value	Measurement Method
0	The flow rate is measured based on the time that was required to deliver the specified volume. (volumetric method)
1	The flow rate is measured based on the weight of water delivered in the specified time. (gravimetric method)
2	A flow meter is used for measurement

▼ **NOTE** Before measurement, make sure that the compressibility correction parameter of the solvent is correctly set.

▶▶ Reference "Setting the compressibility of solvent 《COMP》" P.43

To use the volumetric method

**1** Set the flow rate and start delivery.

**2** After confirming the delivery stabilizes, measure the time required for the solvent to accumulate to 5 mL in a measuring flask.

**3** In the [FLOW CHECK] screen, press [Enter].

```
FLOW CHECK
Enter to Start
```

**4** In the measurement method selection screen, input "0".

```
FLOW CHECK METHOD0
0:Vol 1:Wt 2:Flow
```

**5** Input the measured flow rate.  
The value can be set between 0.1 mL/min and 3.0 mL/min.

```
SET FLOW RATE
1.000ml
```

6

Set the acceptance criterion of the flow rate accuracy in "ML".

The value can be set between 0.001 mL and 1.000 mL.



**Hint** For example, if the set flow rate is 1 mL/min and the criterion is  $\pm 2\%$ , input 0.02 mL.

CRITERIA

0.020ml

7

Input the measurement time (seconds).

The flow rate accuracy (%) and pass/fail result are displayed.

COLLECTION TIME

300.0sec

ACCURACY +0.0% OK  
Recorded 1.000ml

3

To use the gravimetric method

1

Measure the weight (g) before delivery.

2

Set the flow rate and start delivery.

3

After confirming the delivery stabilizes, accumulate water in a measuring flask for a specific time.

4

Measure the weight (g) before delivery.

5

In the [FLOW CHECK] screen, press [Enter].

FLOW CHECK  
Enter to Start

6

In the measurement method selection screen, input "1".

FLOW CHECK METHOD1  
0:Vol 1:Wt 2:Flow

7

Input the measured flow rate.

The value can be set between 0.1 mL/min and 3.0 mL/min.

SET FLOW RATE

1.000ml

8

Set the acceptance criterion of the flow rate accuracy in mL.

The value can be set between 0.001 mL and 1.000 mL.



**Hint** For example, if the set flow rate is 1 mL/min and the criterion is  $\pm 2\%$ , input 0.02 mL.

CRITERIA

0.020ml

9

Input the weight (g) measured before delivery.

WEIGHT (BEFORE)

XX.XXXg

10

Input the measurement time (seconds).

MEASUREMENT TIME

300.0sec

11

Input the weight (g) measured after delivery.

WEIGHT (AFTER)

XX.XXXg

The flow rate accuracy (%) and pass/fail result are displayed.

ACCURACY +0.0% OK  
Recorded 1.000ml

To use a flow meter

1

Set the flow rate and start delivery.

2

After confirming the delivery stabilizes, measure the flow rate.

3

In the [FLOW CHECK] screen, press [Enter].

FLOW CHECK

Enter to Start

4

In the measurement method selection screen, input "2".

FLOW CHECK METHOD2

0:Vol 1:Wt 2:Flow

**5****Input the measured flow rate.**

The value can be set between 0.1 mL/min and 3.0 mL/min.

```
SET FLOW RATE
1 . 0 0 0 ml
```

**6****Set the acceptance criterion of the flow rate accuracy in mL.**

The value can be set between 0.001 mL and 1.000 mL.

```
CRITERIA
0 . 0 2 0 ml
```



**Hint** For example, if the set flow rate is 1 mL/min and the criterion is  $\pm 2\%$ , input 0.02 mL.

**7****Input the flow rate measured with a flow meter.**

The flow rate accuracy (%) and pass/fail result are displayed.

```
ACTUAL FLOW RATE
1 . 0 0 0 ml
```

```
ACCURACY +0 . 0 % OK
Recorded 1 . 0 0 0 ml
```

**3**

### ■ Checking operation of the maximum and minimum pressure functions 《PRESS LIMIT CHECK》

When checking operation, connect a resistance tube to the pump outlet to create 5 MPa to 10 MPa pressure at 1 mL/min during delivery.

1

Press [Enter].

```
PRESS LIMIT CHECK
Enter to Start
```

Start delivery at 1 mL/min. The pressure is monitored for 1 minute and the maximum pressure (P.MAX) and minimum pressure (P.MIN) are automatically set.

```
1.000 Monitoring
3.99min left
```

Then the flow rate is automatically set to 1.5 mL/min and 0.5 mL/min, and whether the P.MAX and P.MIN functions work correctly is checked.

```
1.500 Upper Limit
2.99min left
```

```
1.000 Monitoring
1.99min left
```

```
0.5000 Lower Limit
0.99min left
```

The result is displayed after checking is completed.

```
PRESSURE LIMIT OK
Recorded
```

### 3.6.5 Calibration Support Information Group (CALIBRATION)

The group is for calibration of the instrument.

**NOTE** The instrument is tuned before shipment. Do not modify values unnecessarily.

#### ■ Inputting the password «Input PASSWORD»

The password must be input by the system administrator.

Input the five-digit numbers by using the numeric keypad, and press [Enter].

Input PASSWORD  
\*\*\*\*\*

**Hint** Be sure to input the five numbers. The default password is [00000].  
When the password matches, the [OPERATION MODE] screen below appears on the screen.  
If the password does not match, the user cannot go further.

#### ■ Setting the operation mode «OPERATION MODE»

For LC-40D X3/LC-40D XS/LC-40D XR/LC-40D

Set the value according to the connected system controller.

Input the value by using the numeric keypad, and press [Enter].

OPERATION MODE 0  
0 : 40DXR 1 : 20ADXR

Set Value	System Controller			
	LC-40D X3	LC-40D XS	LC-40D XR	LC-40D
0	CBM-40/CBM-40lite			
	Identified and operated as LC-40D X3.	Identified and operated as LC-40D XS.	Identified and operated as LC-40D XR.	Identified and operated as LC-40D.
1*1	CBM-20A/CBM-20Alite			
	Identified and operated as LC-30AD.	Identified and operated as LC-20ADXR.	Identified and operated as LC-20ADXR.	Identified and operated as LC-20AD.

\*1 Select it when the system controller or workstation does not support LC-40D X3/LC-40D XS/LC-40D XR/LC-40D.

**For LC-40D XSi/LC-40i**

Set the value according to the connected system controller.

Input the value by using the numeric keypad, and press [Enter].

```
OPERATION MODE 0
0 : 40 1 : 20XR 2 : 40XS
```

For LC-40D XSi

```
OPERATION MODE 0
0 : 40i 1 : 20AD 2 : 40D
```

For LC-40i

Set Value	System Controller	
	LC-40D XSi	LC-40i
0	CBM-40/CBM-40lite	
	Identified and operated as LC-40D XSi.	Identified and operated as LC-40i.
1*1	CBM-20A/CBM-20Alite	
	Identified and operated as LC-20ADXR.	Identified and operated as LC-20AD.
2*1	CBM-40/CBM-40lite	
	Identified and operated as LC-40D XS.	Identified and operated as LC-40D.

\*1 Select it when the system controller or workstation does not support LC-40D XSi and LC-40i.

■ **Changing the displayed order of year, month and day 《DATE FORMAT》**

Change the displayed order of year, month and day.

Input the value by using the numeric keypad, and press [Enter].

```
DATE FORMAT 0
0 : YMD 1 : DMY 2 : MDY
```

Set value	Display
0	Year, month, and day (YMD)
1	Day, month, and year (DMY)
2	Month, day, and year (MDY)

■ **Initializing the parameters 《INITIALIZE PARAM》**

Initialize the parameters and the time programs.

Press [Enter] to return to the default values of the parameters and to delete the time programs.

After the parameter initialization completes, the instrument is automatically restarted.

```
INITIALIZE PARAM
Enter to Init
```

```
INITIALIZE PARAM
Completed
```

### ■ Setting the parameter lock 《PARAMETER LOCK》

This prevents users other than the administrator from changing parameters except the flow rate by prohibiting screen transition to the auxiliary functions screen and VP functions screen.

```
PARAMETER LOCK 0
0:Off 1:On
```

If [1] (On) is set, a password input screen is displayed when the user enters the setting screen. If the user modifies the setting or inputs the password to enter the setting screen, the operation is recorded in the operation log.

▶▶ Reference "Displaying the operation log 《OPERATION LOG》" P.65

### ■ Setting the usage of the parts management tool 《PARTS MGMT TOOL》

Sets the usage of the parts management tool.

```
PARTS MGMT TOOL 1
0:NotUse 1:Use
```

For details on the parts management tool (PARTS MGMT TOOL), refer to the PARTS MGMT TOOL instruction manual.

Set value	Description
0	Do not use PARTS MGMT TOOL.
1	Use PARTS MGMT TOOL.

When the setting is changed, the change is recorded in the operation log.

▶▶ Reference "Displaying the operation log 《OPERATION LOG》" P.65

■ Changing the password 《PASSWORD SETTING》

Enables to change the password.

1

Press [Enter].

The input screen is displayed.



PASSWORD SETTING  
Enter to Change

2

Input the five-digit number by using the numeric keypad, and press [Enter].



Input PASSWORD  
█

3

To confirm, input the same password that was input in step 2 again.

When the input is completed and the password is changed, the message "PASSWORD CHANGED" is displayed. Then, the password change is recorded in the operation log.

If the password input is not correct, the message "PASSWORD WRONG" is displayed. At this stage, the password has not been changed yet.



Input Again  
█



Input Again  
PASSWORD CHANGED



Input Again  
PASSWORD WRONG

4

Press [Enter] to return to the title screen.

## ■ Showing/setting CBM parameter 《CBM PARAMETER》

This allows the user to view or set the parameters of SCL-40/CBM-40/CBM-40lite that controls the instrument.



Press [→] to enter the CBM parameter setting screen.

Press [↓] or [↑] several times to select the desired item.

Pressing [←] at an item in the screen returns the display to the screen as shown in the figure.

 **Hint** If SCL-40/CBM-40/CBM-40lite is not connected (it is not set the link address), pressing [→] does not bring the user to the CBM parameter setting screen. When using CBM-40lite, set [CONTROLLER LINK] to "0" (Int).

▶▶ **Reference** "Setting the link address 《LINK ADDRESS》" P.50  
"Setting the link destination of the system controller 《CONTROLLER LINK》" P.52

3

### List of CBM Parameters

Display	Description
SERIAL NUMBER	Displays the serial No. of CBM.
S/W ID	Displays the program version No. of CBM.
INTERFACE	Sets the transmitting protocol to data processing unit.
ETHERNET SPEED	Sets the transmitting speed of Ethernet.*1
USE GATEWAY	Sets usage of default gateway or DHCP server.*1
IP ADDRESS	Sets IP address of CBM.*1
SUBNET MASK	Sets subnet mask.*1
DEFAULT GATEWAY	Sets default gateway.*1, *2
TRS MODE	Select the communication distribution when connecting to an LC workstation or a Chromatopac.

\*1 Available only to show, when not allowed to change on SCL-40/CBM-40/CBM-40lite.

\*2 Not available when [USE GATEWAY] is set to "Do not use Default Gateway".

 **NOTE** Each parameter is activated after the system controller is restarted.

▶▶ **Reference** Refer to SCL-40/CBM-40/CBM-40lite instruction manual for details of each parameter.

### Showing the serial number 《SERIAL NUMBER》

Displays the serial number of the system controller which controls the instrument.



**Showing the S/W version number 《S/W ID》**

Displays the S/W name (the same name as the model name) and version of CBM which controls the instrument.

```
CBM-40
FW V1.00
```

**Setting the transmitting protocol to data processing unit 《INTERFACE》**

Sets the transmitting protocol between the data processing unit and the system controller which controls the instrument.

```
INTERFACE 2
0:OPT 1:RS 2:ETH
```

Enter the value using the numeric keypad and press [Enter].

Set Value	Transmitting Protocol
0	To connect with optical cable.
1	To connect with serial transmission. (RS-232C)
2	To connect with Ethernet.

**Setting the transmitting speed of Ethernet 《ETHERNET SPEED》**

Sets transmitting speed of the system controller Ethernet which controls the instrument.

```
ETHERNET SPEED 0
Input 0,1-4
```

Enter the value using the numeric keypad and press [Enter].

Set Value	Transmitting Speed
0	Auto Detect
1	10 Mbps, Half Duplex
2	10 Mbps, Full Duplex
3	100 Mbps, Half Duplex
4	100 Mbps, Full Duplex

**Setting the usage of default gateway or DHCP server 《USE GATEWAY》**

Sets usage of default gateway or DHCP server of the system controller which controls the instrument.

```
USE GATEWAY 0
0:NO 1:GW 2:DHCP
```

Enter the value using the numeric keypad and press [Enter].

Set Value	Description
0	Do not use Default Gateway.
1	Use Default Gateway.
2	Automatic acquisition of IP address from DHCP server.

**Setting IP address 《IP ADDRESS》**

Sets IP address of the controller which controls the instrument.

Enter the value using the numeric keypad and press [Enter].

```
IP ADDRESS
192 . 168 . 12 . 50
```

**Setting the subnet mask 《SUBNET MASK》**

Sets subnet mask of the controller which controls the instrument.

Enter the value using the numeric keypad and press [Enter].

```
SUBNET MASK
255 . 255 . 255 . 0
```

**Setting the default gateway 《DEFAULT GATEWAY》**

Sets the default gateway of the controller which controls the instrument.

Enter the value using the numeric keypad and press [Enter].

```
DEFAULT GATEWAY
192 . 168 . 12 . 50
```

**Setting the transmission mode 《TRS MODE》**

Select the communication distribution when the controller is connected to an LC workstation.

Enter the value using the numeric keypad and press [Enter].

```
TRS MODE
Input 0 . 1 - 19
```

Set Value	Description
0	Connects in manual setting at the system controller.
2	Can not be used.
3	Connects to LCsolution/LabSolutions.

**NOTE** Do not set values other than the set value above. Otherwise the instrument will not work properly.

### ■ Setting the operation level of leak sensor 《LEAK THOLD》

Enables to set the threshold value for the leak sensor.

When an error occurs in the leak sensor check, set the value again.

```
LEAK THOLD      175
Actual level 100
```

**NOTE** Calibration of the leak sensor must be performed by the system administrator. The leak sensor detects liquid drops when the mobile phase leaks from the plunger seal or tubes. When the sensor output value exceeds the predetermined "threshold," the sensor issues an error and stops pumping.

1

**Dip the sensor unit at the bottom of the leak sensor into water.**

Upon detection of water, the leak sensor value (Actual Level) in the screen increases.

2

**Read the maximum value of the leak sensor value (Actual Level).**

Example) The maximum value here is "160".

3

**Wipe off the water near the leak sensor.**

The leak sensor value (Actual Value) will decrease.

**NOTE** When wiping away the water, do not apply pressure to the sensor unit of the leak sensor. The sensitivity decreases if the sensor unit touches the instrument wall surface.

4

**Calculate the threshold of the leak sensor based on the value read in step 2.**

Formula to calculate the leak sensor threshold:

Threshold = (Max. value-100)×0.7+100

Example) The value obtained here is "142".

5

**Press [Enter], input the value obtained in step 4, and press [Enter].**

The new "threshold" is stored.

```
LEAK THOLD      142
Actual level 100
```

### ■ Setting the flow rate correction parameter (ALPHA) 《FLOW COMP FACTOR》

This allows the user to set the flow rate correction parameter.

```
FLOW COMP FACTOR
5.00
```

- Correct the flow rate if it is incorrect.
- To increase the flow rate, input the value obtained by adding the increment (%) to the current value.
- To reduce the flow rate, input the value obtained by subtracting the decrement from the current value.

For example, the measured flow rate is 1.45 % less than the set flow rate and the current flow rate correction parameter is 5.00, calculate  $5.00 + 1.45 = 6.45$  and input the result to increase the actual flow rate by approximately 1.45 %.

### ■ Setting the pressure sensor sensitivity correction factor 《PRESS COMP FACTOR》

This allows the user to set the pressure sensor sensitivity correction factor.

```
PRESS COMP FACTOR
1:10.76 5:63.06
```

Reset the value when the pressure sensor is replaced. Of the numbers on the data label of the pressure sensor, input PRS-1[XX.XX] in [1:] and PRS-5[XX.XX] in [5:].

### ■ Setting the time to replace the plunger seal 《PLUNGER SEAL》

This allows the user to set the time to replace the plunger seal (unit: L).

```
PLUNGER SEAL
Alert Lvl 60L
```

- ▶▶ Reference "Displaying the delivery amount of the left plunger seal 《L SEAL USED》" P.63  
"Displaying the delivery amount of the right plunger seal 《R SEAL USED》" P.64

### ■ Selecting how to set the maximum pressure 《P.MAX OVERRIDE》 (LC-40D XS/LC-40D XSi/LC-40D XR only)

This allows the user to set the maximum pressure with keys on the pump even if [OPERATION MODE] is set to "1" and the instrument is controlled with the system controller.

```
P. MAX OVERRIDE 0
0:Off 1:On
```

If [OPERATION MODE] is set to "0", the set value will be "0".

- ▶▶ Reference "Setting the operation mode 《OPERATION MODE》" P.75

Set Value	Setting Method
0	To set the value with the system controller.
1	To set the value on the pump.

### ■ Selecting the flow path switching valve 《SV SELECT》

This allows the user to select the valve to use when [OPERATION MODE] is set to "1" (compatible mode) and the instrument is controlled with the system controller.

```
SV SELECT 0
0: Int 1: Ext
```

 **Hint** In the compatible mode, only the internal flow path switching valve, low-pressure gradient kit, or FCV-11AL/FCV-11ALS is available. Users need to choose which valve to use.

Set Value	Setting Method
0	The internal flow path switching valve or low-pressure gradient kit is used.
1	FCV-11AL/FCV-11ALS is used.

▶▶ Reference "Setting the operation mode 《OPERATION MODE》" P.75

### ■ Turning on/off Auto-Diagnostics 《AUTO DIAGNOSTICS》

This allows the user to turn on/off Auto-Diagnostics.

```
AUTO DIAGNOSTICS 1
0: Off 1: On
```

Set Value	Setting Method
0	Auto-Diagnostics is off.
1	Auto-Diagnostics is on.

▶▶ Reference "Displays of Condition 《CONDITION》" P.33

## 3.7 Creating Time Program

The instrument can run a time program with a flow rate and other parameters. A created time program is saved in a file. Check for file numbers in use before creating a time program.

See "Specifying the file number «FILE NUMBER» " P.60 of the auxiliary function to view or specify file numbers.

### 3.7.1 Time Program Command List

The commands for the time program are listed below.

Command	Description	Setting Range	Remark	Ref.
FLOW	Sets flow rate (Available only in constant flow solvent delivery mode)	0 to 10.0000 mL/min (other than LC-40i)	Minimum unit: 0.0001 mL/min	P.28
		0 to 5.0000 mL/min (only for LC-40i)		
PRESS	Sets delivery pressure. (Available only in constant pressure solvent delivery mode. This can be set only for LC-40D XR/LC-40D/LC-40i.)	(LC-40D XR) 1.0 to 60.0 MPa 10 to 612 kgf/cm <sup>2</sup> 10 to 600 bar 142 to 8706 psi	Minimum units: 0.1 MPa 1 kgf/cm <sup>2</sup> 1 bar 1 psi	P.29
		(LC-40D) 1.0 to 30.0 MPa 10 to 306 kgf/cm <sup>2</sup> 10 to 300 bar 142 to 4353 psi	Minimum units: 0.1 MPa 1 kgf/cm <sup>2</sup> 1 bar 1 psi	
		(LC-40i, Aqueous solvents) 1.0 to 30.0 MPa 10 to 306 kgf/cm <sup>2</sup> 10 to 300 bar 142 to 4353 psi	Minimum units: 0.1 MPa 1 kgf/cm <sup>2</sup> 1 bar 1 psi	
		(LC-40i, Organic solvents) 1.0 to 30.0 MPa 10 to 224 kgf/cm <sup>2</sup> 10 to 220 bar 142 to 3186 psi		
BCONC	Specifies concentration of mobile phase B Only active when [PUMP CONFIG(SYS)] = 4* <sup>1</sup>	0 to 100 %	Minimum unit: 0.1 %	*2
CCONC	Specifies concentration of mobile phase C Only active when [PUMP CONFIG(SYS)] = 4* <sup>1</sup>	0 to 100 %* <sup>2</sup>	Minimum unit: 0.1 %	

Command	Description	Setting Range	Remark	Ref.
DCONC	Specifies concentration of mobile phase D Only active when [PUMP CONFIG(SYS)] = 4* <sup>1</sup>	0 to 100 %* <sup>2</sup>	Minimum unit: 0.1 %	
INT.SV	Opens or closes the solenoid valve of the low-pressure gradient unit or internal reservoir switching valve (optional)	1, 2, 3, 4	-	P.43
EXT.SV	Opens or closes the solenoid valve of FCV-11AL/FCV-11ALS (optional)	0, 1, 2, 3, 12, 13, 23, 123	Each numeric character represents the channels 1, 2, and 3 of FCV-11AL/FCV-11ALS. Input a setting value of the valves to be switched to side B.	P.45
EVENT	Sets ON/OFF of the event output (relay contact) on the back of the instrument	0, 1, 2, 12	0: EVENT1 and EVENT2 are set to OFF. 1: EVENT1 is set to ON. 2: EVENT2 is set to ON. 12: EVENT1 and EVENT2 are set to ON.	P.45
LOOP	Repeats program	0 to 255 * 0 means 256 times.	-	P.92
STOP	Stops program	N/A	-	P.92
GOTO	Switches to other programs (up to 10 files)	0 to 9	-	P.93

\*1 "Setting the system parameter «PUMP CONFIG (SYS)» " P.53

\*2 The total of the settings for [BCONC], [CCONC], [DCONC] may not exceed 100 %.

That is: [BCONC] + [CCONC] + [DCONC] ≤ 100.

The concentration of mobile phase A will be the value subtracted from the total value of the other concentrations from 100 (%),

For example: Concentration A = 100 - ([BCONC] + [CCONC] + [DCONC])

▶▶ Reference "3.7.4 Creating a Low-Pressure Gradient Program" P.90

## 3.7.2 Time Program Setting Screen

To create a time program, access the edit screen as described below.

**1**

Press [CE].

The initial screen is displayed.

**2****Press [→] twice.**

The auxiliary functions screen [FUNCTION] is displayed.

```
>PARAMETER
CONTROL
```

**3**

**Press [↓] several times until [EDIT] is displayed in the screen, move the cursor to [EDIT], and press [→].**

The time program editing screen is displayed. The figure shows an example of a time program that has ten steps already created and 310 steps left available.

```
USED      LEFT
10 / 310
```

Display	Description
USED	The number of created steps in the selected file
LEFT	The number of steps left available

**4**

**Press [Enter] again to edit steps of the time program.**

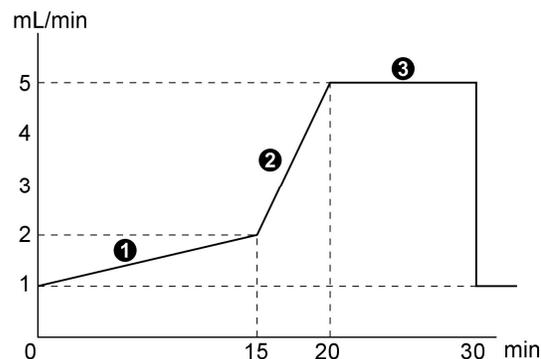
```
TIME      FUNC      VALUE
0.01 - 999.99min
```

Displays	Description
TIME	Time (minute) that elapsed from the start of the step
FUNC	Command name
VALUE	Set value

**3**

### 3.7.3 Creating a Time Program

The table below shows an example of a time program that changes the flow rate as shown in the figure (initial flow rate: 1 mL/min).



Step	TIME (minute) Setting	FUNC Command Option	VALUE(mL/min) Input a Command Value
①	15.00	FLOW	2.0000
②	20.00	FLOW	5.0000
③	30.00	STOP	-

1

Displays the time program setting screen.

▶▶ Reference "3.7.2 Time Program Setting Screen" P.86

```
USED  LEFT
0 / 320
```

2

Press [Enter].

The time (minute) setting screen is displayed.

To set step 1

```
TIME  FUNC  VALUE
0.01 - 999.99 min
```

3

Press [1], [5], and [Enter].

```
15.00>FLOW
SELECT COMMAND
```

4

Press [Enter].

The [FLOW] command is selected, which enables the user to input the flow rate.

```
15.00>FLOW
0.0 - 10.0000 ml
```

5

Press [2] and [Enter].

The flow rate is set to 2 mL/min and editing step 1 is completed.

```
15.00 FLOW 2.0
1 / 319
```

To set step 2

- 6** Press [2], [0], and [Enter] to set the time.

```
20.00>FLOW
SELECT COMMAND
```

- 7** Press [Enter].

The [FLOW] command is selected, which enables the user to input the flow rate.

- 8** Press [5] and [Enter] to set the flow rate.

```
20.00 FLOW      5.0
 2 / 318
```

To set step 3

- 9** Press [3], [0], and [Enter].

```
30.00>FLOW
SELECT COMMAND
```

- 10** Press [↓] several times until [STOP] is displayed in the command selection screen.

```
30.00>STOP
SELECT COMMAND
```

- 11** Press [Enter].

```
30.00 STOP
 3 / 317
```

- 12** Press [CE] to save the time program. Then the initial screen is displayed.

```
1.0000ml  MAX 10.0
 0.0MPa   MIN  0.0
PUMP  CONC  RUN  PURGE
```

 **Hint** When inputting multiple steps, the user does not need to input the data in order of time because they are automatically sorted.

3

### 3.7.4 Creating a Low-Pressure Gradient Program

Setting the concentrations of solvents B, C, and D at individual time points in a time program can change the concentrations of solvents A, B, C, and D with time.

The concentration of solvent A in this case will be as below.

Solvent A (%) = 100 (%) - Solvent B (B CONC) (%) - Solvent C (C CONC) (%) - Solvent D (D CONC) (%)

Note that the solvent B (B CONC), solvent C (C CONC), and solvent D (D CONC) parameters can be set in the range from 0 % to 100 % with the minimum unit of 0.1 %.

#### ■ Example of time program setting

1

Displays the time program setting screen.

```
USED   LEFT
0 / 320
```

▶▶ Reference "3.7 Creating Time Program" P.85

2

Press [Enter] and input the time with the numeric keypad.

3

Press [↓] several times until [B CONC] is displayed in the setting screen.

```
20.00>B CONC
SELECT COMMAND
```



**Hint** Press [↓] several times in the same manner to display [C CONC] and [D CONC].

4

Move the cursor to [B CONC] and press [Enter].

```
20.00>B CONC
0.0 - 100.0%
```

The [B CONC] command is selected, which enables the user to set the solvent B concentration.

5

Input the concentration with the numeric keypad and press [Enter].

### 3.7.5 Deleting a Step

To delete a step, display it and press [del].

See the following example of deleting the first step of the program created in "3.7.3 Creating a Time Program" P.88.

1

**In the same manner as creating the program, display the desired step.**

```
15.00 FLOW      2.0
 1 / 317
```



**Hint** To display the second or subsequent lines, press [↓] several times until the desired step is displayed.

2

**Press [del].**

The first step of the program is deleted and the second step is displayed.

```
20.00 FLOW      5.0
 1 / 318
```

3

### 3.7.6 Starting and Stopping a Time Program

#### ■ Starting a Time Program

To start a time program after setting it, perform the following.

Press [RUN] to start the program.

[RUN] on the display is highlighted.

```
1.0000ml  MAX 10.0
 0.0MPa   MIN  0.0
PUMP  CONC  RUN  PURGE
```

#### ■ Stopping a Time Program

There are two ways to stop the program.

- Forcibly stopping a program being executed

Press [RUN] to stop the program.

[RUN] on the display stops being highlighted and the program stops.

- Stopping a program with the [STOP] command

▶▶ Reference "Setting a [STOP] command for a time program «STOP»" P.92

### 3.7.7 Commands Used for Time Programs Only

This section explains about the commands that can be set for time programs only.

#### ■ Setting a loop count for a time program «LOOP»

A [LOOP] command can repeat a program the specified number of times.

```
30.00 LOOP 3
0 - 255
```

Settings shown in the table repeat steps ① and ② three times at intervals of 30 minutes.

Step	TIME (Minute)	FUNC	VALUE (mL/min)
①	15.00	FLOW	2.0000
②	20.00	FLOW	5.0000
③	30.00	LOOP	3

- ▼ NOTE
- After [LOOP] is repeated the specified number of times, the program automatically stops. The way the program stops differs depending on whether there is a [GOTO] command after the [LOOP] command.  
When there is a [GOTO] command, the value at the end of LOOP is retained until the time point of a [GOTO] command and then the program stops before the [GOTO] command is executed.  
When there is not a [GOTO] command, the program stops at the end of [LOOP].
  - Steps other than a [GOTO] command that are set after the [LOOP] command are ignored.
  - The [LOOP] command can be set to a maximum of 255. Note that if it is set to "0", LOOP is executed 256 times.

#### ■ Setting a [STOP] command for a time program «STOP»

This allows the user to set the time to stop a time program. Input the time in the last step of a time program and press [↓] several times until [STOP] is displayed.

Press [Enter] to set a [STOP] command.

```
30.00>STOP
SELECT COMMAND
```

- ▼ NOTE In the following cases, do not set a [STOP] command at the end of the program.
- ① When the time program is executed continuously
  - ② When the program files are linked through a [GOTO] command

▶▶ Reference "Setting switchover to the next file «GOTO» " P.93

### ■ Setting switchover to the next file 《GOTO》

A [GOTO] command switches the processing from the current file to the next specified file.

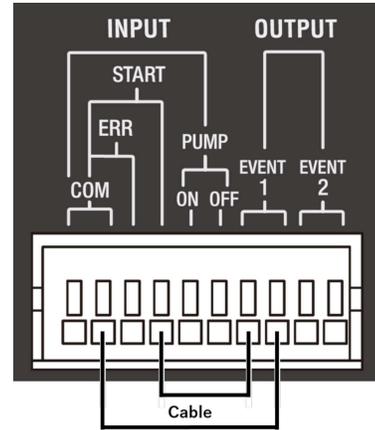
```
30.00 GOTO      2
Set File Num: 0-9
```

After the processing is switched to the destination file, the instrument waits in the initial screen of the destination file. To re-run the program stopping after execution of a [GOTO] command, perform the following steps 1 to 6.

1

Insert the event cables into the "external I/O terminals" as shown in the figure.

▶▶ Reference "3.10.2 Connection of Remote Cable" P.100



3

2

Add the next step to the time program of the file from which the processing is switched.

- ① Input the time that is a little earlier than that of the [GOTO] command.
- ② Display [EVENT].
- ③ Set the value to "0".

```
29.90 EVENT    0
0,1,2 or 12
```

3

Press [CE] to finish creating the time program.

4

Select the file number to be started next.

▶▶ Reference "Specifying the file number 《FILE NUMBER》" P.60

```
FILE NUMBER
Input 0 - 9
```

5

Set the EVENT output terminal of the destination file selected in step 4 to "1".

▶▶ Reference "Setting the EVENT1 output terminal 《EVENT1》" P.45

```
0.01 EVENT    1
0,1,2 or 12
```

- 6** Select the preceding file number again.

## 3.8 Delivery in the Low-Pressure Gradient Mode

### 3.8.1 Set Value

- 1** Input "4" in the [PUMP CONFIG(SYS)] of [SYSTEM] setting group.

```
PUMP CONFIG(SYS) 4
Input 1 or 4
```

▶▶ Reference "Setting the system parameter «PUMP CONFIG (SYS)» " P.53

- 2** Set the [P.MAX] and [P.MIN] of [PARAMETER] setting group.

▶▶ Reference "Setting the maximum pressure limit during pumping «P.MAX» " P.41  
"Setting the minimum pressure during delivery «P.MIN» " P.42

### 3.8.2 Preparation for Delivery

- 1** Press [Enter] once on the initial screen.

- 2** Input a flow rate as the [FLOW] set value with the numeric keypad.

```
2.0000ml MAX 10.0
0.0MPa MIN 0.0
```

### 3 Set solvent concentrations.

- 1 Press [CONC].  
The concentration setting screen is displayed.

```
A : 100 . 0 %   B :   0 . 0 %
C :   0 . 0 %   D :   0 . 0 %
```

- 2 Input the solvent B concentration (%) and press [Enter].

- 3 Input the solvent C and D concentrations (%).  
The concentration of solvent A in this case will be as below.

---


$$\text{Solvent A concentration (\%)} = 100 (\%) - \text{Solvent B concentration (\%)} - \text{Solvent C concentration (\%)} - \text{Solvent D concentration (\%)}$$


---

For example, when setting the solvent A to D concentrations to 25%, input values as shown in the figure.

```
A :  25 . 0 %   B :  25 . 0 %
C :  25 . 0 %   D :  25 . 0 %
```

### 4 Set the compressibility.

- 1 Displays [COMP] of [PARAMETER] setting group.

```
>COMP
```

- 2 Press [→].  
The compressibility setting screen is displayed.  
Press [↓] several times to display the [COMP B], [COMP C], and [COMP D] setting screens.

```
COMP A           0 . 45
Input 0 . 00 - 3 . 00
```

- 3 Set the compressibilities of solvents A to D.  
When using FCV-11AL/FCV-11ALS together, the setting screen is displayed as shown in the figure.

```
COMP A1          0 . 45
Input 0 . 00 - 3 . 00
```

 **Hint** Of the flow paths connected to port A of the low-pressure gradient valve, the one connected to side A (left side) of FCV-11AL/FCV-11ALS is A1 and the other connected to side B (right side) is A2.

## 5 Purge flow paths.

- 1 Open the drain valve.
- 2 Press [PURGE].  
The flow path selection screen is displayed.



PURGE LINE  
1-4:A-D 0:Ini.Conc

- 3 Select the flow path to purge with the numeric keypad and press [Enter].  
[PUMP] on the display is highlighted and purging starts.

Set Value	Description
0	Solvent is purged at the concentration set on the concentration setting screen.
1	Solvent A is purged.
2	Solvent B is purged.
3	Solvent C is purged.
4	Solvent D is purged.

If FCV-11AL/FCV-11ALS and the low-pressure gradient valve are used together, the setting screen will be as shown in the figure.



PURGE LINE 0:Ini  
1-4:A1-D1 5-8:A2-

Set Value	Description
0	Solvent is purged at the concentration set on the concentration setting screen.
1	Solvent A1 is purged.
2	Solvent B1 is purged.
3	Solvent C1 is purged.
4	Solvent D1 is purged.
5	Solvent A2 is purged.
6	Solvent B2 is purged.
7	Solvent C2 is purged.
8	Solvent D2 is purged.



**Hint** Of the flow paths connected to port A of the low-pressure gradient valve, the one connected to side A of FCV-11AL/FCV-11ALS is A1 and the other connected to side B is A2.

## 6 Close the drain valve and start delivery.

## 3.9 Connection with the System Controller or Workstation

### 3.9.1 Setting the Instrument

To control the instrument from SCL-40/CBM-40/CBM-40lite, set the parameters as follows:

Setting Parameter	Set Value	Remark
LOCAL MODE	0: Remote	▶▶ Reference "Selecting the local/remote mode 《LOCAL MODE》 " P.50
LINK ADDRESS	Link address	▶▶ Reference "Setting the link address 《LINK ADDRESS》 " P.50
CONTROLLER LINK	0: Int 1: Ext	▶▶ Reference "Setting the link destination of the system controller 《CONTROLLER LINK》 " P.52
OPERATION MODE	(LC-40D X3) 0: 40D X3*1 1: 30AD*2 (LC-40D XSi) 0: 40D XSi*3 1: 20ADXR*4 2: 40D XS*5 (LC-40D XS) 0: 40D XS*5 1: 20ADXR*4 (LC-40D XR) 0: 40D XR*6 1: 20ADXR*4 (LC-40D) 0: 40D*7 1: 20AD*8 (LC-40i) 0 : 40i*9 1 : 20AD*8 2 : 40D*7	*1 Identified and operated as LC-40D X3. *2 Identified and operated as LC-30AD. *3 Identified and operated as LC-40D XSi. *4 Identified and operated as LC-20ADXR. *5 Identified and operated as LC-40D XS. *6 Identified and operated as LC-40D XR. *7 Identified and operated as LC-40D. *8 Identified and operated as LC-20AD. *9 Identified and operated as LC-40i.  ▶▶ Reference "Setting the operation mode 《OPERATION MODE》 " P.75

3

### 3.9.2 Basic Parameters

A max. of 4 pump units can be connected to SCL-40/CBM-40/CBM-40lite. SCL-40/CBM-40/CBM-40lite can set flow rate (pressure), maximum pressure limit, minimum pressure limit, solenoid valves, pumping ON/OFF, time program, etc., and can control binary and ternary high-pressure gradient analysis depending on the system configuration. Also, by combining the SIL-40 series autosampler, the auto purging function is available. For details, refer to the SCL-40/CBM-40/CBM-40lite Instruction Manual.

### 3.9.3 Notes on Operation

#### ■ LC-40D XS/LC-40D XSi/LC-40D XR

If LC-40D XS/LC-40D XSi/LC-40D XR is used with [OPERATION MODE] set to "1" (20ADXR), it operates in the LC-20ADXR compatible mode with the following restriction.

- 1) The maximum delivery pressure is 66.0 MPa.

The limit can be raised up to 105.0 MPa for LC-40D XS/LC-40D XSi, and 70.0 MPa for LC-40D XR, on the pump using the [P.MAX OVERRIDE] function.

▶▶ Reference "Selecting how to set the maximum pressure 《P.MAX OVERRIDE》 (LC-40D XS/LC-40D XSi/LC-40D XR only)" P.83

#### ■ LC-40i

- The LC-40i may be difficult to remove air bubbles during purging or liquid delivery. If necessary, please execute manually purge with a syringe.  
For more information on manual purging, refer to Nexera System Guide.
- If LC-40i is used with [OPERATION MODE] set to "1" (20AD) or "2" (40D), it operates in the LC-20AD/LC-40D compatible mode with the following restriction.

- 1) The maximum delivery volume is 5.0 mL/min. If a value which is out of specification is set from LabSolutions or the system controller, the entered setting value will be ignored, and the maximum delivery volume setting will not be changed.

- 2) For the upper limit of the delivery pressure follows the specification of the LC-40i. If a value which is out of specification is set from LabSolutions or the system controller, the entered setting value will be ignored, and the maximum delivery volume setting will not be changed.

- 3) The low-pressure gradient operating mode is as follows depending on the compatible mode setting.

For LC-20AD compatible mode : The low-pressure gradient operation mode can be set only on the unit. It cannot be set from LabSolutions or the system controller.

For LC-40D compatible mode : The low-pressure gradient operating mode operates with the value of the compatibility setting which is automatically calculated based on the value set by LabSolutions or the system controller.

Example) Setting 4-cycle mode from LabSolutions or the system controller → LC-40i operates in the 8-cycle mode.

## 3.10 Connection to External Input/Output Terminals

The external input/output terminals are connected to an event output device or other external devices with a provided event cable.

Details of the terminal and wiring are described as follows.

### ! WARNING



Instruction

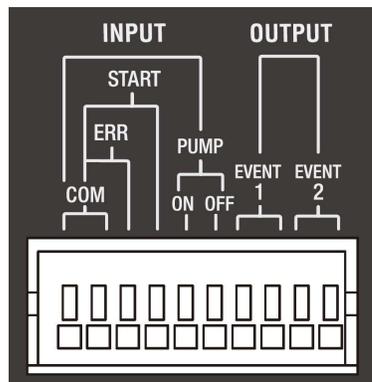
**Before connecting the cable, turn OFF the power and unplug the instrument. Use only the specified cable.**

**Connect as specified.**

Otherwise, fire, electric shock, or malfunction may occur.

3

### 3.10.1 External Input/Output Terminals



Signals	Description	Remark
EVENT1	Relay contact outputs. They can be turned on/off with a program or the set values of the [EVENT] auxiliary function.	The rated values of the relay contacts are 30 V DC and 1 A.
EVENT2		
PUMP ON	The pump is started with an external contact signal.	The signals and the COMMON terminal are short-circuited through contacts of external equipment and thus operation is controlled. The short-circuit time (tc) should satisfy the following. 0.5 sec < tc < 10 sec
PUMP OFF	The pump is stopped with an external contact signal.	
START	A time program of the instrument is started with an external contact signal. If a start signal is received while a time program is in progress, a time program starts from 0 minutes.	
ERR	Sets the instrument to the error detection status by the external error signal.	
COM	Common terminal for [PUMP ON], [PUMP OFF], [START] and [ERR].	

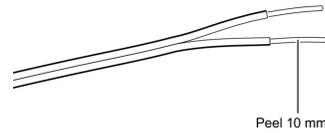
### 3.10.2 Connection of Remote Cable

1

**Peel about 10 mm from the cable end.**



**Hint** This preparation is not necessary for the supplied event cable.



2

**If the cable core is a single wire, insert it as is into the terminal hole.**

If the cable core is a twisted wire, twist the end tightly and insert it into the terminal hole while holding down the button of the terminal with a flathead screwdriver. When pulling out the cable, hold down the button of the terminal as well.

**NOTE** The instrument is provided with one remote cable set (228-28253-91). To connect the cable to the terminal for 3 circuits or more, additionally prepare a cable or use a cable as follows:

- Cable with single wire:  $\varnothing 0.4$  to  $\varnothing 1.2$  (AWG26 to 16)
- Cable with stranded wire:  $0.3 \text{ mm}^2$  to  $1.25 \text{ mm}^2$  (AWG22 to 16), diameter of single wire of  $\varnothing 0.18$  or thicker

To prevent disconnection, the cable with stranded wire is recommended.

**NOTE** When using the [EVENT1] or [EVENT2] signal, set [EVENT1] or [EVENT2] and [SELECT EVENT1] or [SELECT EVENT2].

- ▶▶ Reference "Setting the EVENT1 output terminal «EVENT1»" P.45  
 "Setting the EVENT2 output terminal «EVENT2»" P.45  
 "Setting the function of the EVENT1 output terminal «SELECT EVENT1»" P.52  
 "Setting the function of the EVENT2 output terminal «SELECT EVENT2»" P.52

# 4 Maintenance

## 4.1 Periodic Inspection and Maintenance

It is necessary to perform periodic inspections of this instrument to ensure its safe use. It is possible to have these periodic inspections performed by Shimadzu service personnel on a contractual basis.

For information regarding the maintenance inspection contract, contact your Shimadzu representative.

### WARNING



Instruction

Be sure to power OFF the instrument and pull out the plug from the power supply before inspection/maintenance unless otherwise instructed.

Fire, electric shock or malfunction may occur.

### CAUTION



Instruction

For parts replacement, use parts and tools listed in "1.2 Component Parts" and "5.2 Maintenance Parts".

If any other parts or tools are used, part damage, injury, and malfunction may occur.



Prohibition

Never remove the cover.

This may cause injury or a malfunction of the device.

Contact your Shimadzu representative if the main cover must be removed.

### 4.1.1 Prior to Inspection and Maintenance

- Replace the mobile phase in the flow lines with water.
- Wipe away any dirt from the front panel and the main cover.
- Remove the right panel cover and filter holder before starting the work. Release the tubes bound at the front right from the tube holder to prevent them from interfering with the work.

Return them after completing the work.

▶▶ Reference "4.2 Removing the Right Panel Cover and the Filter Holder" P.104

## 4.1.2 List of Periodic Inspection and Maintenance

▼ **NOTE** The maintenance and replacement periods listed in this table are presented only as guidelines. These are not guarantee periods. These will vary depending on usage conditions.

Inspection/Maintenance Item	Replacement Periods	Remark	Ref.				
Replacement of Plunger Seal	1 year	<ul style="list-style-type: none"> <li>Sealing efficiency decreases when seals are worn.</li> <li>As a guideline, seals should be replaced after delivery of the respective volumes listed below. (VP fuction, [L(R)SEAL USED], shows the total delivered volume.)</li> </ul> (LC-40D X3/LC-40D XS/LC-40D XSi) <table border="1"> <thead> <tr> <th>Pumping Pressure</th> <th>Total Delivery</th> </tr> </thead> <tbody> <tr> <td>80 MPa (816 kgf/cm<sup>2</sup>)</td> <td>30 L</td> </tr> </tbody> </table>	Pumping Pressure	Total Delivery	80 MPa (816 kgf/cm <sup>2</sup> )	30 L	P.118 P.125
		Pumping Pressure	Total Delivery				
		80 MPa (816 kgf/cm <sup>2</sup> )	30 L				
		Repeating high-pressure (above 100 MPa) and low-pressure (below 10 MPa) pumping could shorten the service life of seals.					
(LC-40D XR)							
<table border="1"> <thead> <tr> <th>Pumping Pressure</th> <th>Total Delivery</th> </tr> </thead> <tbody> <tr> <td>30 MPa (306 kgf/cm<sup>2</sup>)</td> <td>60 L</td> </tr> <tr> <td>60 MPa (612 kgf/cm<sup>2</sup>)</td> <td>30 L</td> </tr> </tbody> </table>	Pumping Pressure	Total Delivery	30 MPa (306 kgf/cm <sup>2</sup> )	60 L	60 MPa (612 kgf/cm <sup>2</sup> )	30 L	
Pumping Pressure	Total Delivery						
30 MPa (306 kgf/cm <sup>2</sup> )	60 L						
60 MPa (612 kgf/cm <sup>2</sup> )	30 L						
Repeating high-pressure (above 60 MPa) and low-pressure (below 10 MPa) pumping could shorten the service life of seals.							
(LC-40D/LC-40i)							
<table border="1"> <thead> <tr> <th>Pumping Pressure</th> <th>Total Delivery</th> </tr> </thead> <tbody> <tr> <td>10 MPa (102 kgf/cm<sup>2</sup>)</td> <td>90 L</td> </tr> <tr> <td>30 MPa (306 kgf/cm<sup>2</sup>)</td> <td>30 L</td> </tr> </tbody> </table>	Pumping Pressure	Total Delivery	10 MPa (102 kgf/cm <sup>2</sup> )	90 L	30 MPa (306 kgf/cm <sup>2</sup> )	30 L	
Pumping Pressure	Total Delivery						
10 MPa (102 kgf/cm <sup>2</sup> )	90 L						
30 MPa (306 kgf/cm <sup>2</sup> )	30 L						
Inspection (Replacement) of Plunger	1 year	Replace the plunger seal and the diaphragm when the plunger is replaced.	P.137				
Inspection (Replacement) of Diaphragm	1 year	-					

Inspection/Maintenance Item	Replacement Periods	Remark	Ref.
Inspection (Replacement) of Outlet Check Valve	1 year	-	P.150
Inspection (Replacement) of Inlet Check Valve	1 year	-	P.150
Inspection (Replacement) of Line Filter	2 Years	Replace when particulates in mobile phase clog the filter.	P.152 P.154
Inspection (Replacement) of Suction Filter	2 Years	Replace when particulates in mobile phase clog the filter.	P.157
Replacement of Drain Valve	3 Years	Replace when there is a fluid leak from the drain valve.	P.158
Replacement of Air Filter (for Right Panel)	1 year	-	P.159
Replacement of Air Filter (for FAN)	1 year	Contact your Shimadzu representative.	-
Pump ASSY lubrication	3 Years	Contact your Shimadzu representative.	-
Replacement of Fuse	3 Years	Contact your Shimadzu representative.	-
Cleaning of the Automatic Rinsing Kit	1 year	-	P.162
Replacement of Pump Head	(2 Years)	Pumping mobile phase mixtures containing acids such as trifluoroacetic acid or formic acid can cause leakage due to internal damage in the pump head. In such cases, replace the pump head every two years, as a general guideline. (Pump heads do not need to be replaced if only mobile phases without added acid are pumped.)	-

### 4.1.3 Check after Inspection and Maintenance

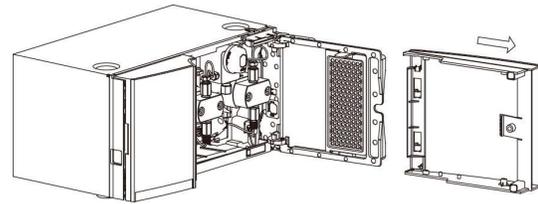
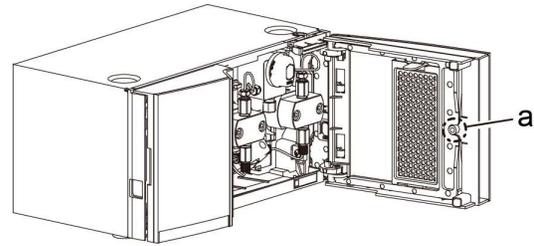
After inspection and maintenance, check any leakage during pumping.

## 4.2 Removing the Right Panel Cover and the Filter Holder

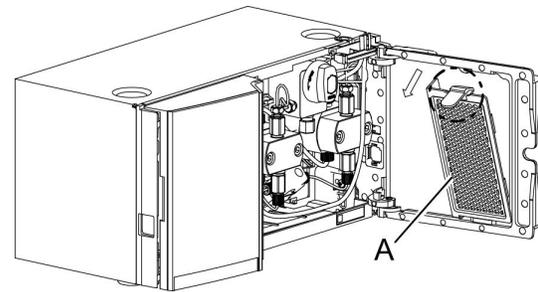
**1** Open the right panel.

**2** Remove the right panel cover.

While lightly pressing the cylinder-shaped projection (a) inside the right panel cover, slide the cover to the front.



**3** While pressing the knob at the top of the filter holder (A), remove it toward the front.



## 4.3 Attaching/Removing the Pump Heads

This section will explain how to attach and remove the right-side pump head.

### Necessary tools

Part Name	Quantity	Part No.
Wrench (8 mm and 10 mm)	2	086-03002
Allen wrench (M5)	1	086-03805
Syringe	1	046-00038-01
Syringe needle	1	228-18216-91
Wrench, 40l (Only for LC-40i)	1	228-79981

### ■ Removing the pump heads

**1** Perform either of the following to prevent the mobile phase solvent from flowing out of the suction tube or pump head when removing the tubes around the pump.

- Place the reservoir bottle at a position lower than the pump inlet.
- Empty the reservoir bottle and suction tube of the mobile phase solvent, loosen the bushing of the suction filter, and remove it from the pump inlet.

**2** Press [CE] to display the initial screen.

```
0.0000ml  MAX 10.0
0.0MPa    MIN 0.0
PUMP CONC RUN PURGE
```

**3** Press [→] twice.  
The FUNCTION group is displayed.

```
>PARAMETER
CONTROL
```

**4** Press [↓] once, move the cursor to [CONTROL], and press [→].

```
PARAMETER
>CONTROL
```

**5** Press [Enter].  
The cursor blinks at the input position.

```
PLUNGER SET
0:Stop 1:L 2:R 3:M
```

4

6

Press [2] and [Enter]. (To replace the left plunger seal, press [1] and [Enter].)

[PUMP] on the display is highlighted and after a while stops being highlighted. The right plunger is now at the backmost position.

▶▶ Reference "Setting the plunger stop position «PLUNGER SET» " P.49

```
PLUNGER SET      2
0:Stop 1:L 2:R 3:M
```

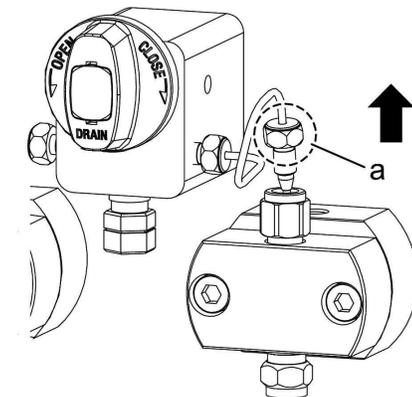
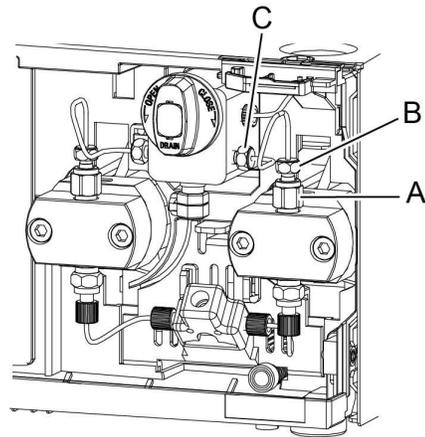
In the conditions, remove the right pump head. When attaching the right pump head, perform steps 2 to 6 as well.

7

Follow the instructions below to remove the tubing.

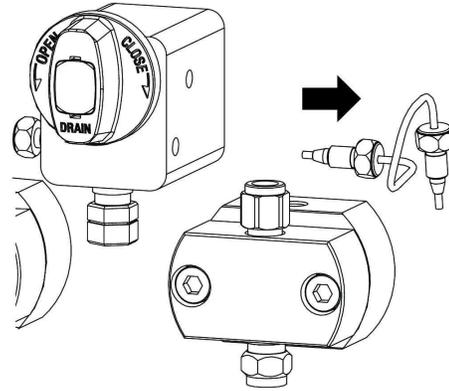
(LC-40D X3/LC-40D XS)

- 1 While holding the check valve OUT (A) with a 10-mm wrench, loosen the check valve OUT side male nut (B) of the SUS pipe R with an 8-mm wrench.
- 2 Loosen the pressure sensor side male nut (C) of the SUS pipe R with an 8-mm wrench.
- 3 Hold the check valve OUT side male nut ("a" in the figure) of the SUS pipe R and then slightly lift and pull out the SUS pipe R.



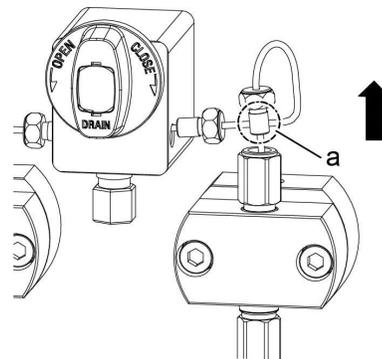
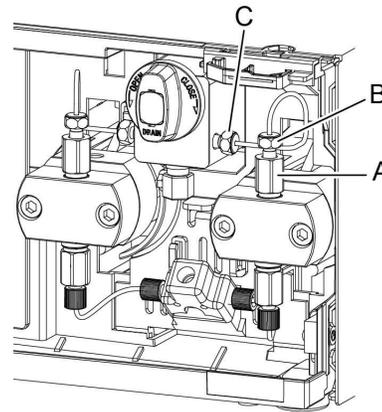
- 4 Pull the SUS pipe R to the right to remove it.

 **Hint** Though the orientation is opposite to the right one (SUS pipe R), remove the left tube (SUS pipe L) in the same procedure.



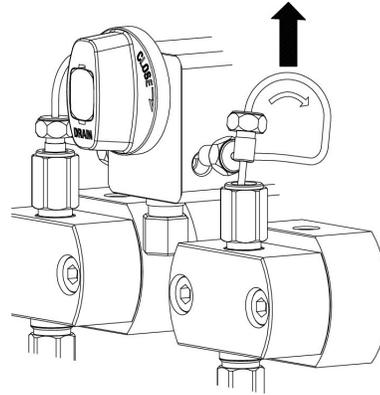
(LC-40D XR/LC-40D)

- 1 While holding the check valve OUT (A) with a 10-mm wrench, loosen the check valve OUT side male nut (B) of the SUS pipe R with an 8-mm wrench.
- 2 Loosen the pressure sensor side male nut (C) of the SUS pipe R with an 8-mm wrench.
- 3 Hold the check valve OUT side male nut ("a" in the figure) of the SUS pipe R and then slightly lift and pull out the SUS pipe R.



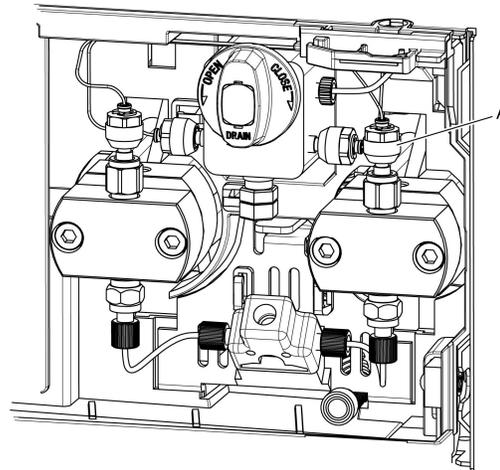
- 4 Slightly lean backwards the SUS pipe R to pull it out upward.

 **Hint** Though the orientation is opposite to the right one (SUS pipe R), remove the left tube (SUS pipe L) in the same procedure.

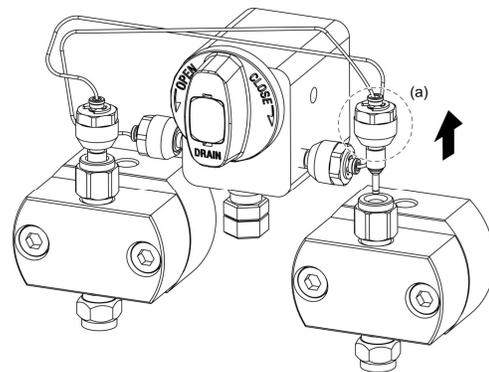


(LC-40D XSi)

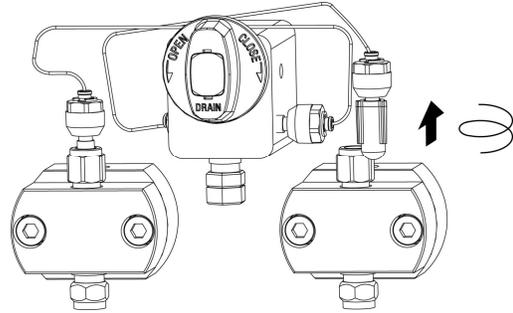
- 1 Loosen the the check valve OUT side male nut (A) of the PEEK lined SS tube R with an 10-mm wrench.



- 2 Hold the male nut ("a" in the figure) of the PEEK lined SS tube R and then slightly lift the PEEK lined SS tube R.



- 3 Attach the cap to the tip of the male nut of the PEEK lined SS tube by screwing with hands.

**Hint**

- This cap is included in the accessories.
- Though the orientation is opposite to the right one (PEEK lined SS tube R), remove the left tube (PEEK lined SS tube L) and attach the cap by screwing with hands in the same procedure.

### CAUTION



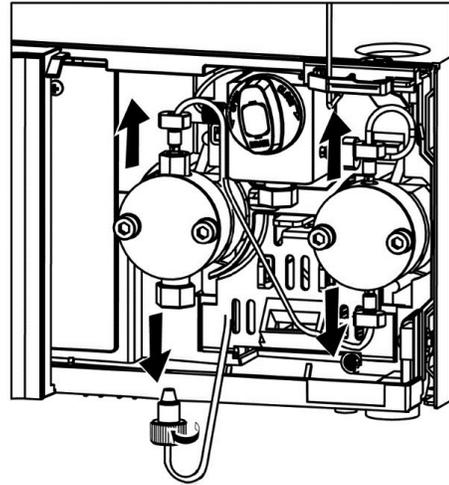
Instruction

When removing the PEEK lined SS tube, be sure to attach a cap to protect the tip.

Replace the piping if the end of the PEEK lined SS tube is damaged, causing leakage or clogging.

(LC-40i)

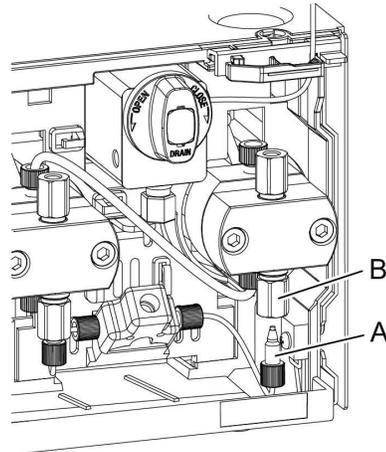
- 1 Remove the PEEK tubes and suction tubing connected to the top and bottom of the right and left pump heads and the pressure sensor.



- NOTE**
- Loosen and remove the bush on the check valve IN side by hand.
  - Loosen and remove the male nut on the PEEK tube with the 40l wrench.
  - To remove the PEEK tube at the top of the left pump head, fix the check valve OUT with a 10 mm wrench not to loosen check valve OUT, and loosen the male nut of the PEEK tube with the 40l wrench.

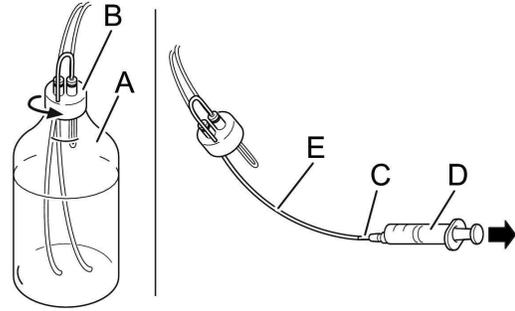
8

(For LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D) Loosen the male nut PEEK (A) of the inlet tube by hand and remove it from the check valve IN (B).



**9** If the seal rinsing kit is attached, remove the cap (B) of the seal rinsing kit from the rinse solution bottle (A).

**10** Attach the syringe needle (C) to the end of the outlet FEP tubing (E) (upward U-shape), and use the syringe (D) to suction out the rinse fluid from the rinse flow line.



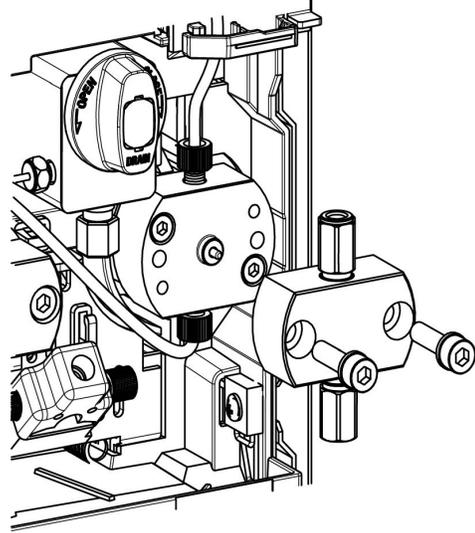
**11** Place the removed cap (B) and rinse solution bottle on the reservoir tray on the top of the instrument.

12

**Follow the instructions below to remove the pump head.**

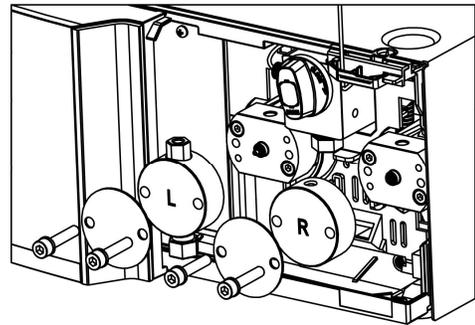
(LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D)

Gradually loosen the 2 hexagonal socket screws using an Allen wrench (M5) by alternating between the left and right screw, and remove the pump head.



(LC-40i)

Gradually loosen the 2 hexagonal socket screws using an Allen wrench (M5) by alternating between the left and right screws, and remove the pump heads and head plates.

**⚠ CAUTION**

Instruction

**Gently pull the pump head horizontally along the plunger.**

The plunger may be damaged if the pump head is forcefully removed.

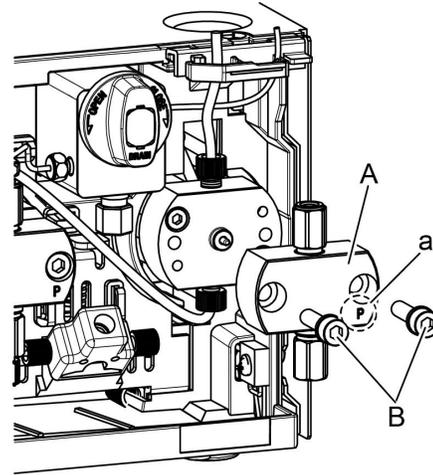
## ■ Attaching the pump head

**1** Set the plunger position by following steps 2 to 6 in "Removing the pump heads" P.105.

**2** Follow the instructions below to attach the pump head.

(LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D)

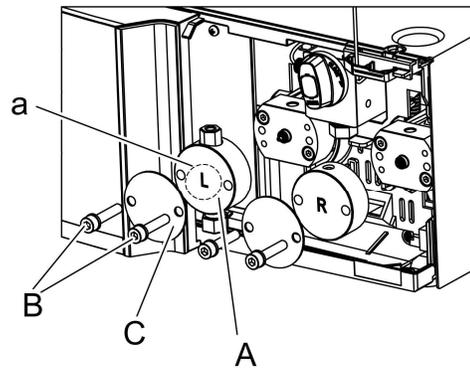
Hold the pump head with the mark (a) coming at the bottom right, tighten the 2 hexagonal socket screws (B) with an Allen wrench (M5) by tightening the right and left screws alternately, and attach the pump head (A).



4

(LC-40i)

Hold the pump head so that the vertical direction of mark (a) is correct, place the head plate (C) on top of it, and align the holes with the holes of the pump head (A). Then, tighten the 2 hexagonal socket screws (B) with an Allen wrench (M5) to attach the pump head (A) and head plate (C).



### ⚠ CAUTION



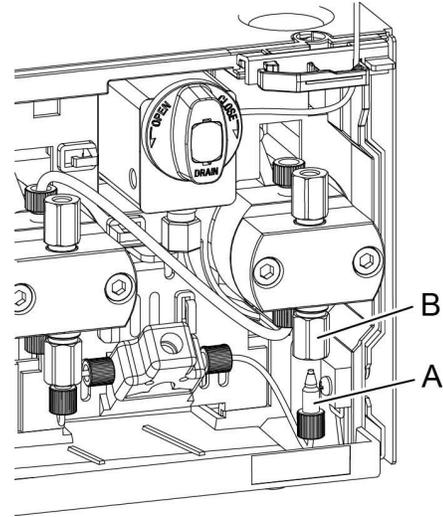
Instruction

Gently inset the pump head horizontally along the plunger.  
The plunger may be damaged if the pump head is forcefully inserted.

▣ NOTE Tighten the left and right hexagonal socket screws 90 degrees at a time, and then firmly tighten using the long side of the Allen wrench.

3

(LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D) Tighten the male nut PEEK (A) of the inlet tube to the inlet check valve (B) by hand.

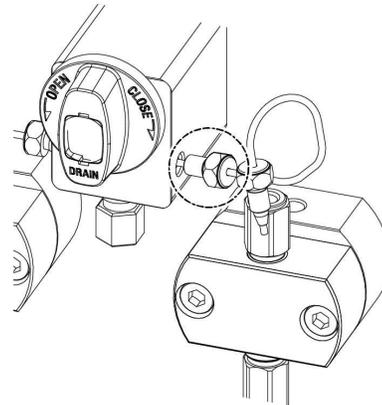


4

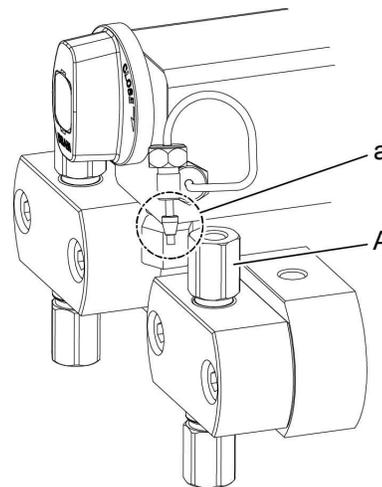
Follow the instructions below to attach the tubing.

(LC-40D X3/LC-40D XS/LC-40D XR/LC-40D)

- 1 Insert the end of the SUS pipe R into the hole of the pressure sensor.

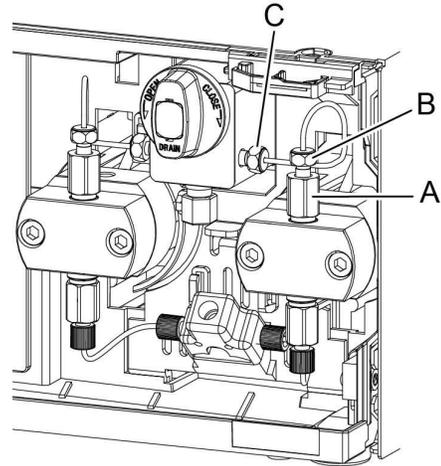


- 2 Hold the check valve side end of the SUS pipe R ("a" in the figure) and then insert the male nut into the check valve OUT (A).



- 3 While holding the check valve OUT (A) with a 10-mm wrench, tighten the SUS pipe R male nut on the check valve OUT side with an 8-mm wrench (B).
- 4 Tighten the pressure sensor side male nut (C) of the SUS pipe R with an 8-mm wrench.

 **Hint** Though the orientation is opposite to the right one (SUS pipe R), attach the left tube (SUS pipe L) in the same procedure.



(LC-40D XSi)

- 1 Loosen the cap attached to the tip of PEEK lined SS tube R by hand and remove it.
- 2 Hold the male nut of PEEK lined SS tube R ("a" in the figure) and insert it straight into the check valve OUT from above.

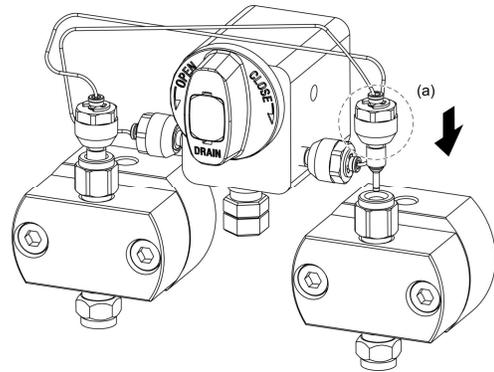
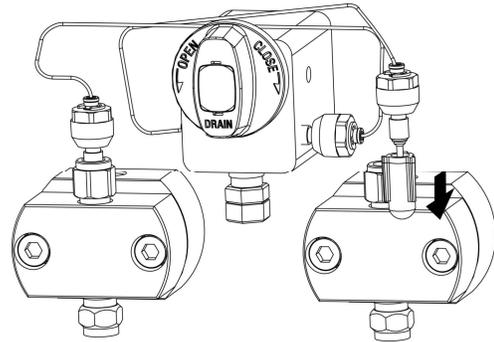
### CAUTION



Instruction

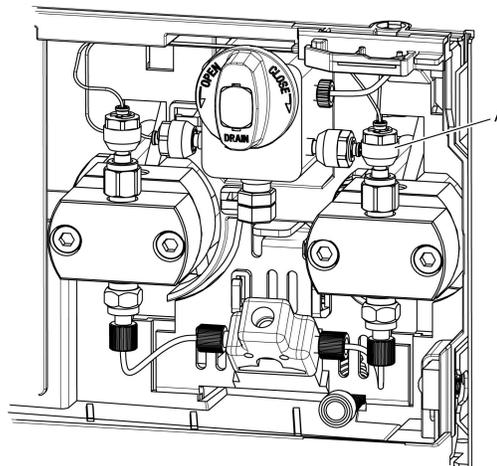
When attaching the PEEK lined SS tube, make sure that the end of the PEEK lined SS tube does NOT touch other parts such as the threaded part of the check valve OUT.

Replace the piping if the end of the PEEK lined SS tube is damaged, causing leakage or clogging.



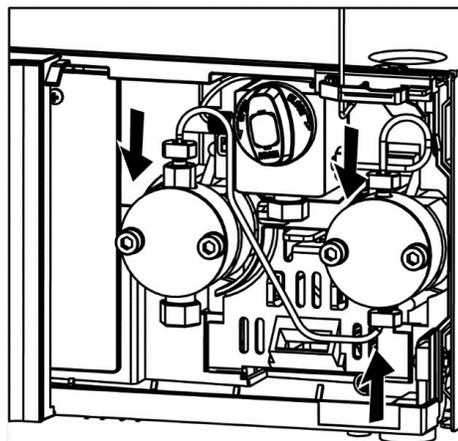
- 3 Tighten the male nut (A) of the PEEK lined SS tube R with an 10-mm wrench until it clicks twice.

 **Hint** Though the orientation is opposite to the right one (PEEK lined SS tube R), attach the left tube (PEEK lined SS tube L) in the same procedure.



(LC-40i)

- 1 Attach the PEEK tubes to the top and bottom of the right and left pump heads and to the pressure sensor, and tighten them with the 40I wrench.



-  **NOTE**
- When tightening the male nut, tighten it by hand until it is secured, then tighten it further with the 40I wrench by about 120° (about 180° for a new male nut).
  - To attach the PEEK tube at the top of the left pump head, tighten the male nut while holding the check valve OUT with a 10 mm wrench.
  - When attaching the PEEK tube, hold down the PEEK tube not to rotate with the mail nut.

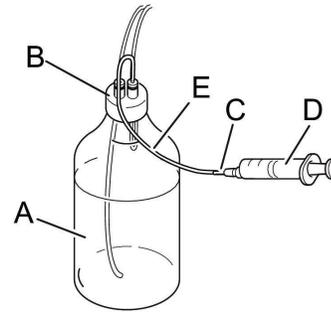
- 2 Attach the bush of the suction tubing to the check valve IN.

-  **NOTE** When attaching the suction tubing, turn the fitting while pressing the tubing into the check valve IN.

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

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

**7** Return the rinsing kit to the reservoir tray.



## 4.4 Replacing the Plunger Seal of LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR

A plunger seal and backup ring are attached inside the left and right pump heads. The following section will explain the method for replacing the plunger seal and backup ring on the right side (when viewed from the front).

### Necessary tools

Part Name	Quantity	Part No.
wrench (8 mm and 10 mm)	2	086-03002
Allen wrench (M5)	1	086-03805
Seal Installer/Remover	1	228-62458-41

### Necessary parts

Part Name	Part Type	Part No.
Plunger Seal (UHP) (supplied with backup ring)	Consumable part	228-52711-93
CAP	Component part	228-79093 (LC-40D XSi)

### 4.4.1 Replacing the Plunger Seal and Backup Ring

**1** Remove the pump head, pipe, and inlet tube by following the instructions in "Removing the pump heads" P.105.

**2** Perform the following steps to replace the plunger seal and backup ring. The plunger seal and the backup ring are installed inside the pump head. Use the provided seal installer/remover to remove them.

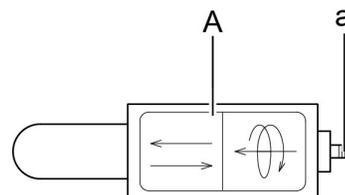
#### **CAUTION**



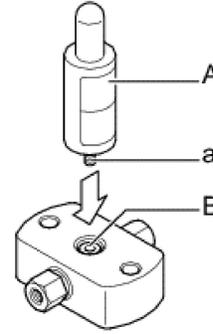
Prohibition

Do NOT drop the seal installer/remover when using it.  
Seal installer/remover may be damaged.

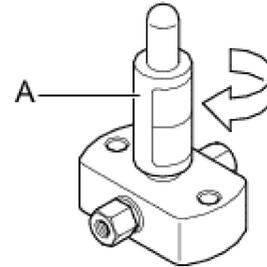
- 1 Wipe off the threaded tip on the metal part (a) of the seal installer/remover (A) with a wiping paper soaked in 2-propanol.



- 2 With the metal part (a) of the seal installer/remover (A) facing downward, insert the seal installer/remover (A) vertically into the backup ring (B).

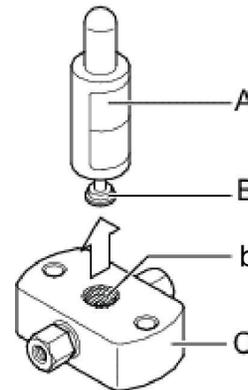


- 3 Turn the seal installer/remover (A) 180 degrees to 360 degrees clockwise.

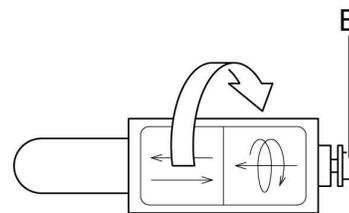


- 4 Pull out the seal installer/remover (A) upward. The backup ring (B) will come off from the plunger seal hole (b) of the pump head (C).

**NOTE** If the backup ring is still stuck, return to step 3 and turn the seal installer/remover 180 degrees more, then retry this step.



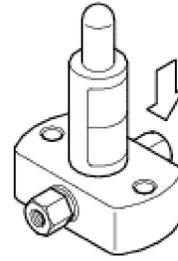
- 5 Grip the backup ring (B) with two fingers and turn the seal installer/remover counterclockwise, then remove the backup ring from the seal installer/remover.



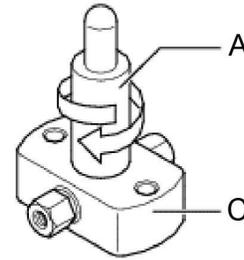
- 6 Wipe off the threaded tip on the metal part of the seal installer/remover with a wiping paper soaked in 2-propanol.

4

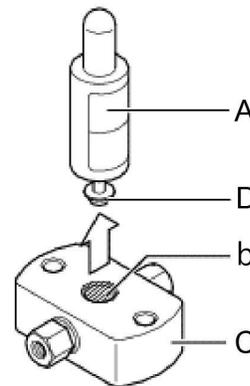
- 7 With the metal part of the seal installer/remover facing downward, place the seal installer/remover vertically above the plunger seal and push it slightly into the seal.



- 8 Turn the seal installer/remover (A) clockwise until it comes into contact with the pump head (C).

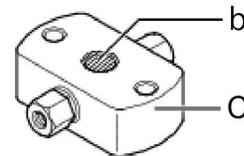


- 9 Pull out the seal installer/remover (A) upward. The plunger seal (D) will come off from the plunger seal hole (b) of the pump head (C).



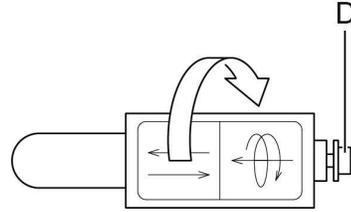
- 10 Place the pump head into a clean beaker containing 2-propanol, and clean it for 10 minutes using an ultrasonic bath.

- 11 Use a piece of wiping paper soaked in 2-propanol to wipe the plunger attachment portion (b) inside the pump head (C).



- NOTE**
- If seal material adheres to the plunger attachment portion of the pump head, the airtightness cannot be maintained.
  - If any scratches are found on the plunger attachment portion of the pump head, replace the pump head.

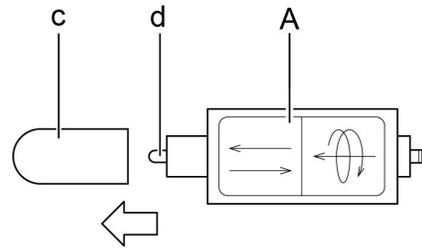
- 12 Grip the plunger seal (D) with two fingers and turn the seal installer/remover counterclockwise, then remove the plunger seal from the seal installer/remover.



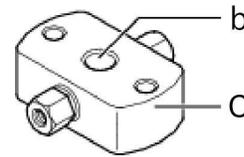
- 13 Wipe off the threaded tip on the metal part of the seal installer/remover with a wiping paper soaked in 2-propanol.

- 14 Remove the cap (c) from the seal installer/remover (A).

- 15 Wipe off the white protrusion (d) and the surrounding area of the seal installer/remover (A) with a wiping paper soaked in 2-propanol.



- 16 Put some drops of 2-propanol in the plunger seal hole (b) of the pump head (C) while paying attention to spillage of 2-propanol.

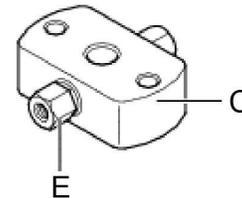


### ⚠ CAUTION



Prohibition

Before putting in 2-propanol, screw the check valves (E) into the pump head (C) so that 2-propanol does not leak from the holes for the check valve.



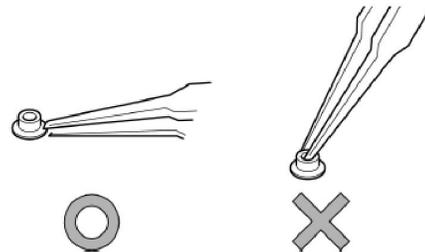
- 17 Soak a new plunger seal and a new backup ring in 2-propanol in a clean beaker.

### ⚠ CAUTION

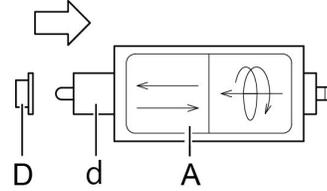


Prohibition

When gripping the plunger seal with tweezers, do NOT touch the internal hole surface. Also, to prevent damage, do NOT grip the plunger seal and the backup ring tightly with tweezers.



- 18 Take the new plunger seal (D) out of the beaker and put it on the white protrusion (d) of the seal installer/remover (A).



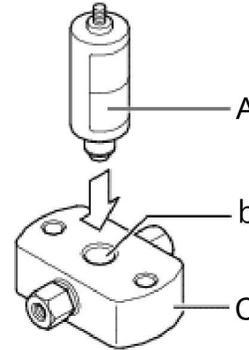
### ⚠ CAUTION



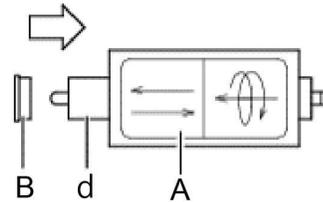
Instruction

Be sure that the plunger seal is moistened with 2-propanol when putting it on the seal installer/remover.

- 19 Insert the seal installer/remover (A) vertically all the way into the plunger seal hole (b) of the pump head (B) and slowly pull out the seal installer/remover upward. The plunger seal will be installed in the pump head.



- 20 Take the new backup ring (B) out of the beaker and, with the smaller diameter side facing the seal installer/remover (A), put the backup ring on the white protrusion (d).

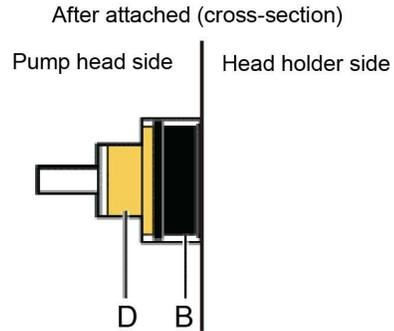


**CAUTION**

Instruction

**Be sure to attach the backup ring with the correct orientation.**

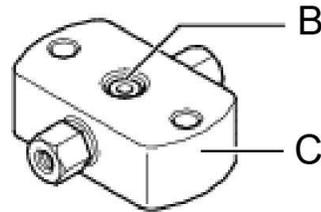
When the backup ring (B) is attached correctly to the pump head, the larger diameter side comes into contact with the plunger seal (D).



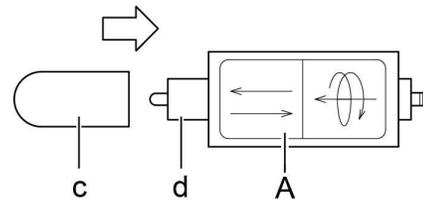
Instruction

**Be sure that the backup ring is moistened with 2-propanol when putting it on the seal installer/remover.**

- 21 Insert the seal installer/remover vertically all the way into the plunger seal and slowly pull out the seal installer/remover upward. The new backup ring (B) will be installed into the pump head (C).



- 22 Put the cap (c) on the white protrusion (d) of the seal installer/remover.

**3**

**Attach the pump head, SUS pipe, and inlet tube by following the instructions in "Attaching the pump head" P.113.**

## 4.4.2 Resetting the Delivery Amount

- 1 Display the [MAINTENANCE] information group of the VP function.

▶▶ Reference "3.3 Types of Screens" P.31



- 2 Press [↓] several times until [R SEAL USED] is displayed.

- 3 Press [del].

The delivery amount of the plunger seal before replacement is reset and the reset date is recorded in the maintenance log.



▶▶ Reference "Displaying the delivery amount of the right plunger seal «R SEAL USED» " P.64

**NOTE** When PARTS MGMT TOOL is active, the delivery amount cannot be reset on the operation panel. Reset it from PARTS MGMT TOOL.

**Hint** To replace the left plunger seal, display [L SEAL USED] and press [del].

## 4.4.3 Check after Replacement

After replacing the plunger seal, check the following:

- Is the pumping (pressure) stable?
- Is fluid leaking from the gap between the pump head and the head holder?
- Is fluid leaking from the rinse flow line?

**NOTE** If the above occurs even after replacing the plunger seal, it is possible that there are scratches on the surface of the plunger. If there are scratches on the plunger, replace it with a new plunger.

▶▶ Reference "4.6 Replacing the Plunger Seal of LC-40i" P.130

## 4.5 Replacing the Plunger Seal of LC-40D

Plunger seals are attached inside the left and right pump heads. The following section will explain the method for replacing the plunger seal on the right side (when viewed from the front).

### Necessary tools

Part Name	Quantity	Part No.
Wrench (8 mm and 10 mm)	2	086-03002
Allen wrench (M5)	1	086-03805
Seal Installer/Remover	1	228-62458-41

### Necessary parts

Part Name	Part Type	Part No.
Plunger Seal GFP ID2	Consumable part	228-35146

### 4.5.1 Replacing the Plunger Seal

4

1

Remove the pump head, SUS pipe, and inlet tube by following the instructions in ["Removing the pump heads" P.105](#).

2

Perform the following steps to replace the plunger seal.

The plunger seal is installed inside the pump head. Use the provided seal installer/remover to remove them.

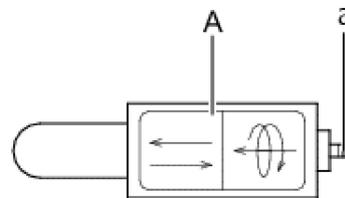
### CAUTION



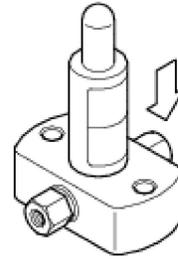
Prohibition

Do NOT drop the seal installer/remover when using it.  
Seal installer/remover may be damaged.

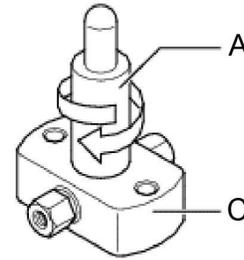
- 1 Wipe off the threaded tip on the metal part (a) of the seal installer/remover (A) with a wiping paper soaked in 2-propanol.



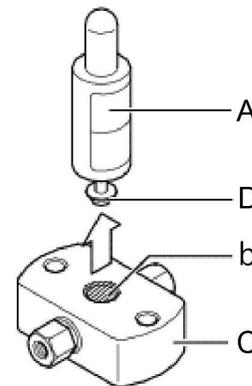
- 2 With the metal part of the seal installer/remover facing downward, place the seal installer/remover vertically above the plunger seal and push it slightly into the seal.



- 3 Turn the seal installer/remover (A) clockwise until it comes into contact with the pump head (C).

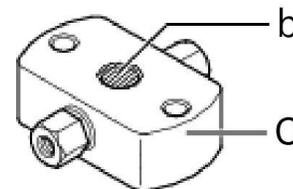


- 4 Pull out the seal installer/remover (A) upward. The plunger seal (D) will come off from the plunger seal hole (b) of the pump head (C).



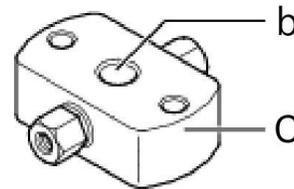
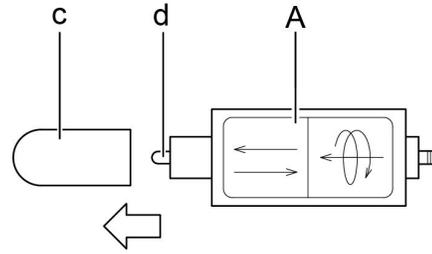
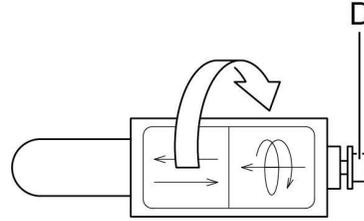
- 5 Place the pump head into a clean beaker containing 2-propanol, and clean it for 10 minutes using an ultrasonic bath.

- 6 Use a piece of wiping paper soaked in 2-propanol to wipe the plunger attachment portion (b) inside the pump head (C).



- NOTE
- If seal material adheres to the plunger attachment portion of the pump head, the airtightness cannot be maintained.
  - If any scratches are found on the plunger attachment portion of the pump head, replace the pump head.

- 7 Grip the plunger seal (D) with two fingers and turn the seal installer/remover counterclockwise, then remove the plunger seal from the seal installer/remover.
- 8 Wipe off the threaded tip on the metal part of the seal installer/remover with a wiping paper soaked in 2-propanol.
- 9 Remove the cap (C) from the seal installer/remover (A).
- 10 Wipe off the white protrusion (d) and the surrounding area of the seal installer/remover (A) with a wiping paper soaked in 2-propanol.
- 11 Put some drops of 2-propanol in the plunger seal hole (b) of the pump head (C) while paying attention to spillage of 2-propanol.

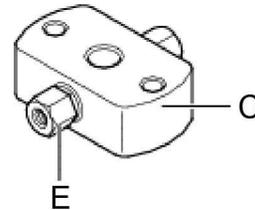


### ⚠ CAUTION



Instruction

Before putting in 2-propanol, screw the check valves (A) into the pump head (C) so that 2-propanol does not leak from the holes for the check valve.



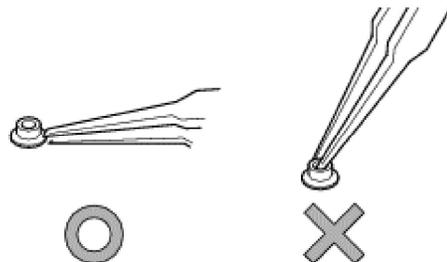
- 12 Soak a new plunger seal in 2-propanol in a clean beaker.

### ⚠ CAUTION

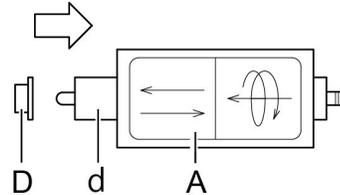


Prohibition

When gripping the plunger seal with tweezers, do NOT touch the internal hole surface. Also, to prevent damage, do NOT grip the plunger seal and the backup ring tightly with tweezers.



- 13 Take the new plunger seal (D) out of the beaker and put it on the white protrusion (d) of the seal installer/remover (A).



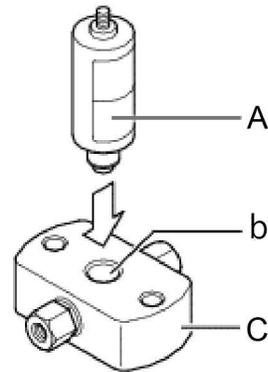
### CAUTION



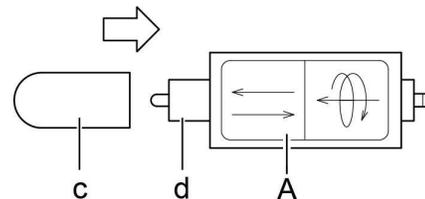
Instruction

Be sure that the plunger seal is moistened with 2-propanol when putting it on the seal installer/remover.

- 14 Insert the seal installer/remover (A) vertically all the way into the plunger seal hole (b) of the pump head (C) and slowly pull out the seal installer/remover upward. The plunger seal will be installed in the pump head.



- 15 Put the cap (c) on the white protrusion (d) of the seal installer/remover (A).



3

Attach the pump head, SUS pipe, and inlet tube by following the instructions in "Attaching the pump head" P.113.

## 4.5.2 Resetting the Delivery Amount

1

Display the [MAINTENANCE] information group of the VP function.

▶▶ Reference "3.3 Types of Screens" P.31



2

Press [↓] several times until [R SEAL USED] is displayed.

3

Press [del].

The delivery amount of the plunger seal before replacement is reset and the reset date is recorded in the maintenance log.

▶▶ Reference "Displaying the delivery amount of the right plunger seal «R SEAL USED» " P.64




**NOTE** When PARTS MGMT TOOL is active, the delivery amount cannot be reset on the operation panel. Reset it from PARTS MGMT TOOL.



**Hint** To replace the left plunger seal, display [L SEAL USED] and press [del].

4

## 4.5.3 Checking After Replacement

Check the following after replacing the plunger seal.

- Is the pumping (pressure) stable?
- Is fluid leaking from the gap between the pump head and the head holder?
- Is fluid leaking from the rinse flow line?



**NOTE** If the above occurs even after replacing the plunger seal, it is possible that there are scratches on the surface of the plunger. If there are scratches on the plunger, replace it with a new plunger.

▶▶ Reference "4.7.2 Cleaning and Inspection (Replacement) of the Plunger and the Diaphragm" P.140

## 4.6 Replacing the Plunger Seal of LC-40i

### Necessary tools

Part Name	Quantity	Part No.
Wrench (8 mm and 10 mm)	1	086-03002
Wrench, 40l	1	228-79981
Allen wrench (M5)	1	086-03805
Seal Installer/Remover	1	228-70835-41

### Necessary parts

Part Name	Part Type	Part No.
Plunger Seal	Consumable part	228-78510

### 4.6.1 Replacing the Plunger Seal

A plunger seal is attached inside the left and right pump heads. The following section will explain the method for replacing the plunger seal on the left side (when viewed from the front).

1

Remove the pump head and tubing by following the instructions in **"Removing the pump heads"** P.105.

2

Perform the following steps to replace the plunger seal.

The plunger seal and the backup ring are installed inside the pump head. Use the provided seal installer/remover to remove them. Work on a hard surface when replacing the plunger seal.

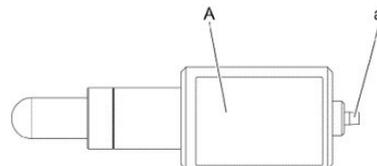
### ⚠ CAUTION



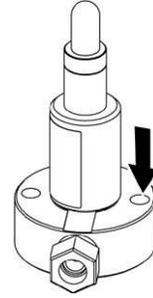
Instruction

Do NOT drop the seal installer/remover when using it. Otherwise, seal installer/remover may be damaged.

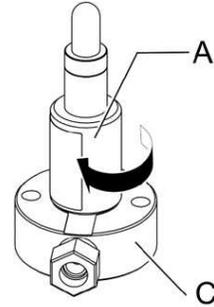
- 1 Wipe off the threaded tip on the metal part (a) of the seal installer/remover (A) with a wiping paper soaked in 2-propanol.



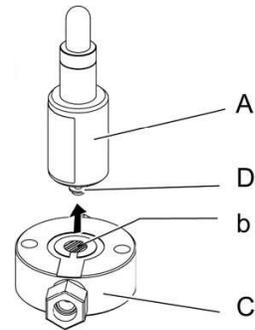
- 2 With the metal part of the seal installer/remover facing downward, place the seal installer/remover vertically above the plunger seal and push it slightly into the seal.



- 3 Turn the seal installer/remover (A) clockwise until it comes into contact with the pump head (C).



- 4 Pull out the seal installer/remover (A) upward. The plunger seal (D) will come off from the plunger seal hole (b) of the pump head (C).



- 5 Remove the O-ring left on the plunger seal hole (b) with tweezers.

### **CAUTION**



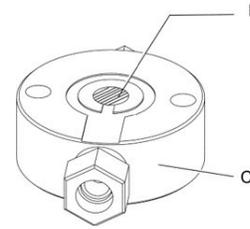
Prohibition

When removing the O-ring, be careful not to make any scratches on the plunger seal hole.

Any scratches on the part may cause a delivery failure.

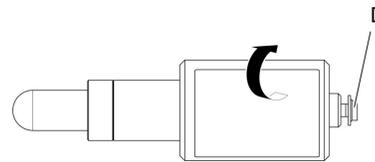
- 6 Place the pump head into a clean beaker containing 2-propanol, and clean it for 10 minutes using an ultrasonic bath.

- 7 Use a piece of wiping paper soaked in 2-propanol to wipe the plunger attachment portion (b) inside the pump head (C).



- NOTE
- If seal material adheres to the plunger attachment portion of the pump head, the airtightness cannot be maintained.
  - If any scratches are found on the plunger attachment portion of the pump head, replace the pump head.

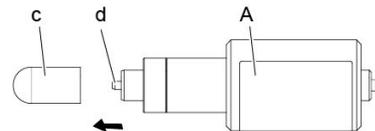
- 8 Grip the plunger seal (D) with two fingers and turn the seal installer/remover counterclockwise, then remove the plunger seal from the seal installer/remover.



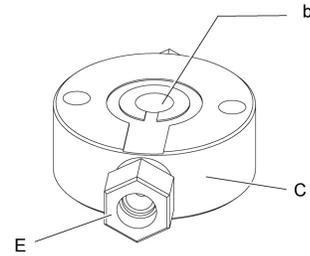
- 9 Wipe off the threaded tip on the metal part of the seal installer/remover with a wiping paper soaked in 2-propanol.

- 10 Remove the cap (c) from the seal installer/remover (A).

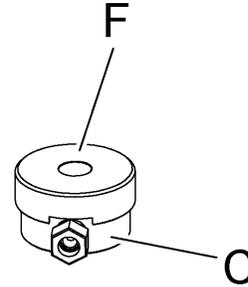
- 11 Wipe off the white protrusion (d) and the surrounding area of the seal installer/remover (A) with a wiping paper soaked in 2-propanol.



- 12 Screw the check valve (E) into the pump head (C) and Put some drops of 2-propanol in the plunger seal hole (b) of the pump head (C) while paying attention to spillage of 2-propanol.



- 13 Place the seal guide (F) over the pump head (C).



- 14 Soak a new plunger seal in 2-propanol in a clean beaker.

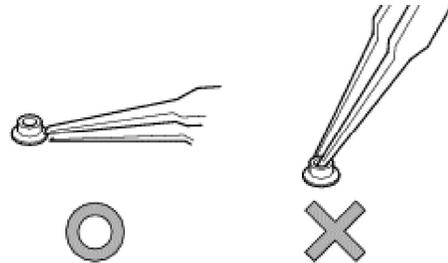
4

### ⚠ CAUTION

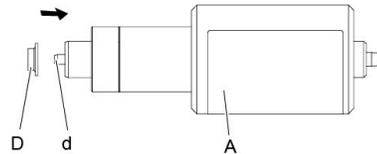


Prohibition

When gripping the plunger seal with tweezers, do NOT touch the internal hole surface or O-ring. Also, to prevent damage, do NOT grip the plunger seal tightly with tweezers. Any scratches may cause liquid leakage.



- 15 Take the new plunger seal (D) out of the beaker and put it on the white protrusion (d) of the seal installer/remover (A).



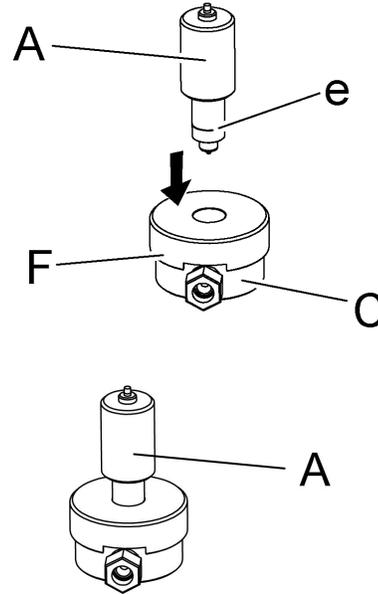
### ⚠ CAUTION



Instruction

Be sure that the plunger seal is moistened with 2-propanol when putting it on the seal installer/remover.

- 16 Slowly insert the seal installer/remover (A) into the hole of the seal guide (F) until resistance is felt.
- 17 Fix the pump head (C) by hand and gently shake the seal guide (F) to align the hole of the seal guide with the hole in the center of the pump head.
- 18 Confirm that the line of the seal installer/remover is hidden with the seal guide.



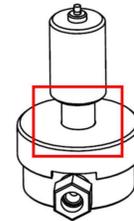
**CAUTION**



Instruction

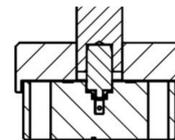
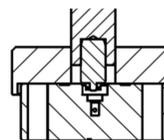
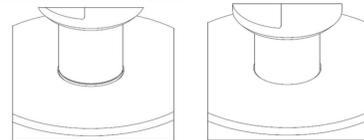
Be sure to confirm that the line of the seal installer/remover is hidden with the seal guide.

Forcibly inserting the part while the line is still visible may lead to a delivery failure.



NG

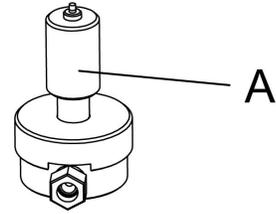
OK



The seal is in the upper left.

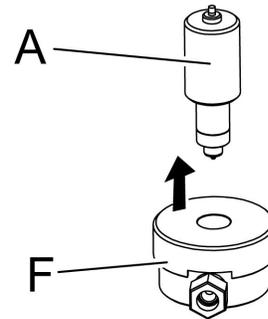
The seal is in the correct position.

- 19 Press in the seal installer/remover (A) with both hands.

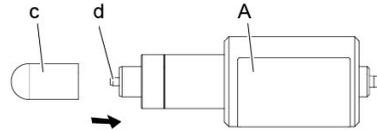


 **Hint** Use both hands and push strongly in the seal installer/remover.

- 20 Slowly pull the seal installer/remover (A) and the seal guide (F) upward in that order.



- 21 Put the cap (c) on the white protrusion (d) of the seal installer/remover (A).



## 4.6.2 Resetting the Delivery Amount

- 1 Display the [MAINTENANCE] information group of the VP function.

▶▶ Reference "3.3 Types of Screens" P.31



- 2 Press [↓] several times until [L SEAL USED] is displayed.

- 3 Press [del].

The delivery amount of the plunger seal before replacement is reset and the reset date is recorded in the maintenance log.



▶▶ Reference "Displaying the delivery amount of the right plunger seal «R SEAL USED» " P.64

**NOTE** When PARTS MGMT TOOL is active, the delivery amount cannot be reset on the operation panel. Reset it from PARTS MGMT TOOL.

**Hint** To replace the right plunger seal, display [R SEAL USED] and press [del].

## 4.6.3 Checking After Replacement

Check the following after replacing the plunger seal.

- Is the pumping (pressure) stable?
- Is fluid leaking from the gap between the pump head and the head holder?
- Is fluid leaking from the rinse flow line?

**NOTE** If the above occurs even after replacing the plunger seal, it is possible that there are scratches on the surface of the plunger. If there are scratches on the plunger, replace it with a new plunger.

▶▶ Reference "4.7.2 Cleaning and Inspection (Replacement) of the Plunger and the Diaphragm" P.140

## 4.7 Cleaning/Inspecting (Replacing) the Plunger and Diaphragm

A plunger and a diaphragm are attached to the left and right pump body. The following section will explain the method for cleaning/inspecting (replacing) the plunger and the diaphragm on the right side (when viewed from the front).

When replacing the plunger, be sure to also replace the plunger seal and the diaphragm.

### Necessary tools

Part Name	Quantity	Part No.
Wrench (8 mm and 10 mm)	2	086-03002
Wrench, 40l (For LC-40i only)	1	228-79981
Allen wrench M4	1	086-03804
Allen wrench M5	1	086-03805
Box driver	1	228-28767-91
Diaphragm jig	1	228-54852
Plunger press plate	1	228-70388

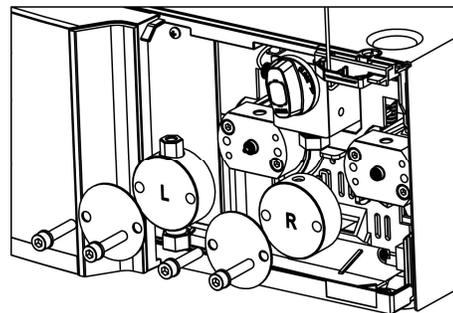
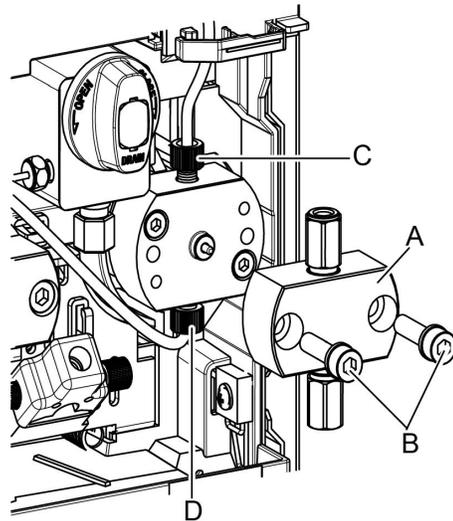
### Necessary parts

Target model	Part Name	Part Type	Part No.	Remark
LC-40D X3 LC-40D XS LC-40D XSi LC-40D XR	Plunger Holder Assy	Consumable part	228-52069-44	Supplied with a diaphragm
LC-40D LC-40i			228-35281-97	

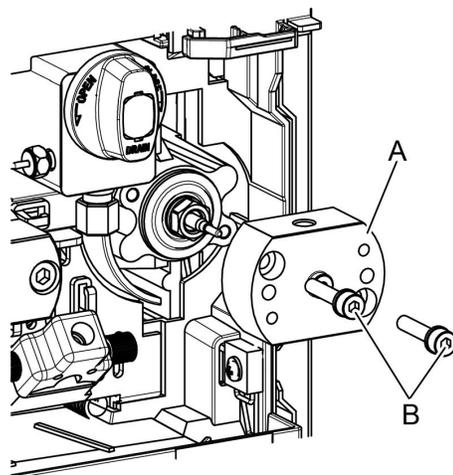
## 4.7.1 Removing the Pump Head and the Head Holder

**1** Remove the pump head and pipe by following the instructions in "Removing the pump heads" P.105.

**2** Loosen the head holder top and bottom fittings (C and D), and remove the rinse tube.



**3** Gradually loosen the 2 hexagonal socket screws (B) of the head holder (A) using an Allen wrench (M4) by alternating between the left and right screw.



4

Remove the head holder.

**CAUTION**

Instruction

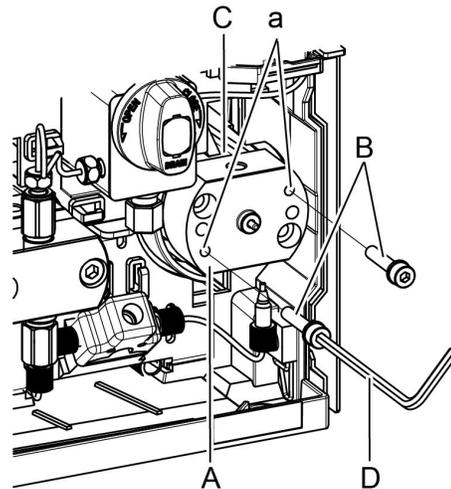
**Gently pull the head holder horizontally along the plunger.**

If the head holder is not removed carefully, the plunger may become damaged.

**■ In the case the head holder is difficult to remove**

Insert into the head holder M4 bolt hole (a) the 2 hexagonal socket screws (B) that were removed, and tighten the left and right sides gradually using an Allen wrench (M4) (D).

The head holder (A) can be loosened by pushing the pump body (C) using the 2 hexagonal socket screws (B).



4

## 4.7.2 Cleaning and Inspection (Replacement) of the Plunger and the Diaphragm

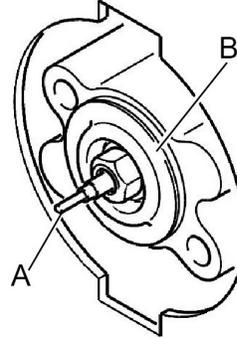
NOTE When replacing the plunger, be sure to replace the plunger seal and the diaphragms.

1

Perform the following steps to clean or inspect (replace) the plunger and diaphragm.

- Using a wiping paper soaked with 2-propanol to remove any portion of the seal or dirt attached to the plunger (A).

NOTE If seal material adheres to the surface, the airtightness cannot be maintained.



- Check that there are no visible scratches on the plunger (A) or the diaphragm (B).
  - If scratches are found through visual inspection, replace with a new plunger. Proceed to the next step 3.
  - If no scratches are found through visual inspection, proceed to step 2.

### CAUTION



Prohibition

Do NOT allow foreign particles or crystals into the head holder.

Foreign particles from the mobile phase solution or crystals from the buffer solution getting into the head holder may cause scratches on the surface of the plunger.

- 3 Insert the box driver (B) into the plunger holder (A), then rotate counter-clockwise to remove it.

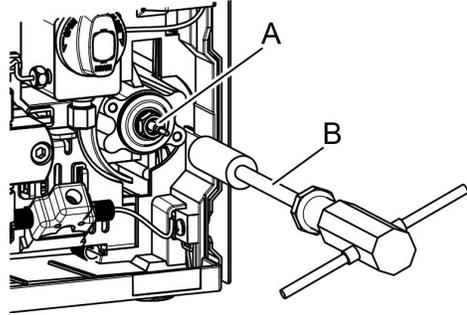
### CAUTION



Instruction

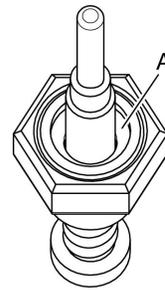
**Gently insert the box driver into the plunger.**

The plunger may become damaged if the box driver is forcefully inserted.



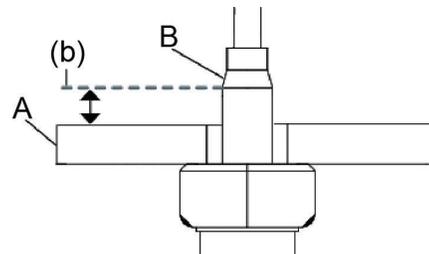
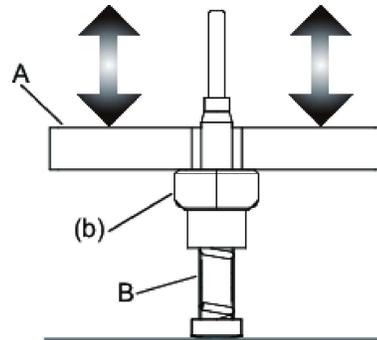
- 4 (For LC-40D/LC-40i) Place a few drops of water on the O-ring (A) of a new plunger holder and get it wet.

**NOTE** Pay attention NOT to damage the O-ring by the tip of the syringe.



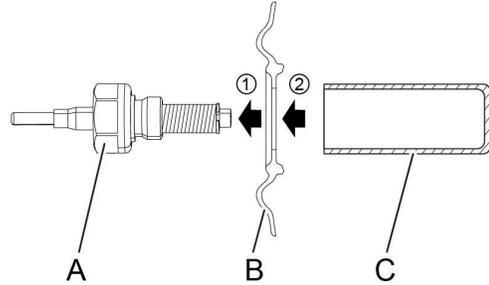
- 5 (For LC-40D/LC-40i) Slide up and down the bush (b) on the plunger holder (B) approximately 10 times, using a plunger press plate (A). Please continue it till the bush moves smoothly.

**NOTE** Push down the plunger press plate (A) to lower than the bevel (b) of the plunger holder (B). Please wipe out the residual water behind the bushing when the operation completed.

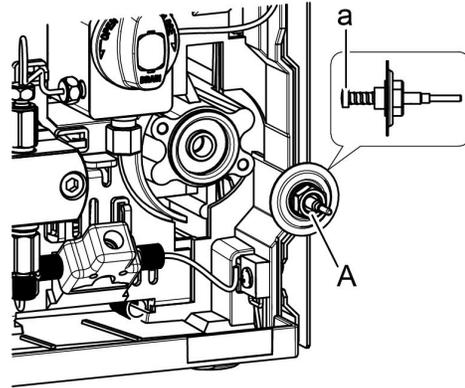


- 6 Attach a new diaphragm (B) to the new plunger holder (A) using the diaphragm jig (C).

**NOTE** Confirm the direction of the diaphragm when attaching.



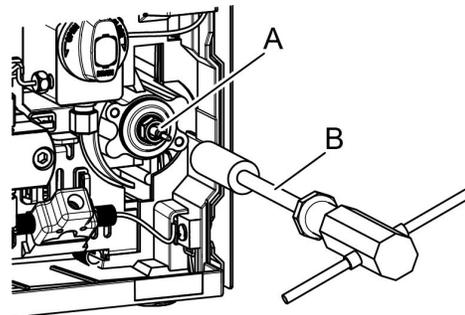
- 7 After applying the grease (black: approximately 5 mm square size) provided with the plunger holder ASSY to the rear end surface of the plunger (a), insert the plunger holder (A) to which the diaphragm was attached in Procedure 6 into the pump body.



**NOTE**

- Be careful not to get any grease on the diaphragm or the body.
- Attach the diaphragm so that it will not become detached from the plunger holder. If the diaphragm becomes detached, wipe away any grease and perform from Procedure 6 again.

- 8 Tighten the plunger holder (A) using the box driver (B).
- 9 Pinch the end of the plunger with your two fingers, move it up, down, right, left, clockwise, and counterclockwise five times each so that the grease applied to the rear end of the plunger holder can spread evenly. Then wipe off the plunger surface with wiper paper soaked in 2-propanol to clean it.



**2**

In the [PLUNGER SET] screen of the control setting group, press [2] and [Enter]. (To replace the left plunger, press [1] and [Enter].)

[PUMP] on the display is highlighted and after a while stops being highlighted. The right plunger is now at the backmost position.

▶▶ Reference "Setting the plunger stop position «PLUNGER SET» " P.49

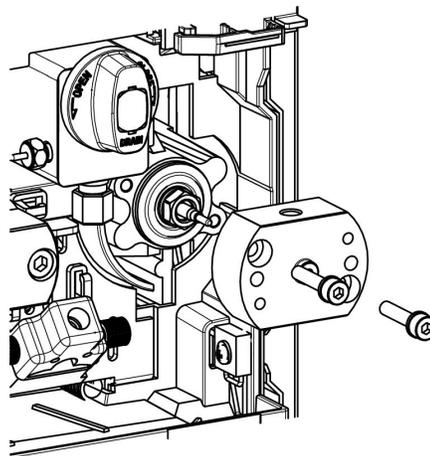
- 3** Attach the head holder to the pump body.

**CAUTION**



Instruction

Slowly push in the head holder along the plunger.  
Pushing in the head holder forcibly may break the plunger.



- 4** Attach the 2 hexagonal socket screws to the head holder and tighten them with an Allen wrench.

**NOTE** Tighten the right and left hexagon socket screws alternately in 90° increments. Finally hold the longer part of the hex wrench and tighten them securely.

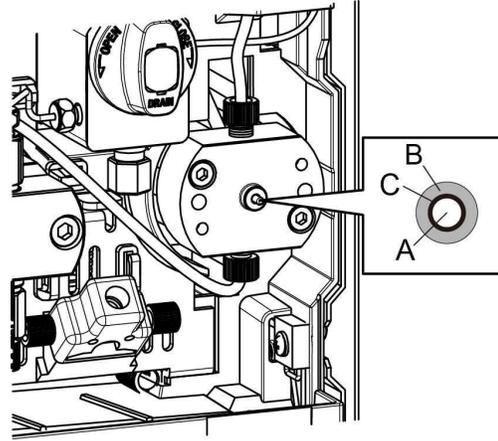
- 5** Attach rinse tubes to the top and bottom of the head holder.

- 6** In the [PLUNGER SET] screen, press [1] and [Enter].  
(To replace the left plunger, press [2] and [Enter].)

[PUMP] on the display is highlighted and after a while stops being highlighted. The right plunger is now at the frontmost position.

▶▶ Reference "Setting the plunger stop position «PLUNGER SET» " P.49

- 7** Pinch the end of the plunger that is projecting from the head holder with your fingers and adjust its position to make the gap (C) around the plunger (A) inside the hole of the projection (B) of the head holder even. While keeping the plunger in place, wipe off the plunger surface with clean wiper paper soaked in 2-propanol.



**CAUTION**



Instruction

Move the plunger gently. Moving the plunger too abruptly could scratch the plunger surface or cause it to break off.

- 8** In the [PLUNGER SET] screen, press [2] and [Enter]. (To attach the left plunger seal, backup ring and pump head, press [1] and [Enter].) [PUMP] on the display is highlighted and after a while stops being highlighted. The right plunger is now at the backmost position.

▶▶ Reference "Setting the plunger stop position «PLUNGER SET» " P.49

- 9** Attach the pump head and pipe, and set the seal rinsing kit back in place by following the instructions in "[Attaching the pump head](#)" P.113.

## 4.8 Rinsing the Check Valve

This section will explain how to pump 2-propanol to rinse the check valve.

### Necessary tools

Part Name	Quantity	Part No.
Wrench (8 mm and 10 mm)	2	086-03002

### Necessary parts

Part Name	Part Type	Part No.	Quantity
RESISTANCE TUBE, COIL FOR CLEANING	Replacement part	228-57908-41	1

1

Replace the solvent in the reservoir bottle with 2-propanol.

### CAUTION



Prohibition

After using buffer solution as the mobile phase, do NOT replace with an organic solvent such as 2-propanol without first replacing with water.

When using a buffer solution in the reservoir bottle, replace with distilled water or purified water, and after pumping at least 20 mL into the instrument, replace with new 2-propanol. If the buffer solution is directly replaced with 2-propanol, crystals will be precipitated, which can cause damage to the plunger seal or cause problems with the check valve.

▶▶ Reference System Guide "Precautions When Replacing the Mobile Phase"

4

2

Loosen the male nuts (A and C) on the column inlet and outlet with an 8-mm wrench and then remove the column (B) from the flow path.

3

Attach the male nut (A and C) of the column inlet and outlet that was removed to the resistor tube (D), and tighten it with an 8 mm wrench.

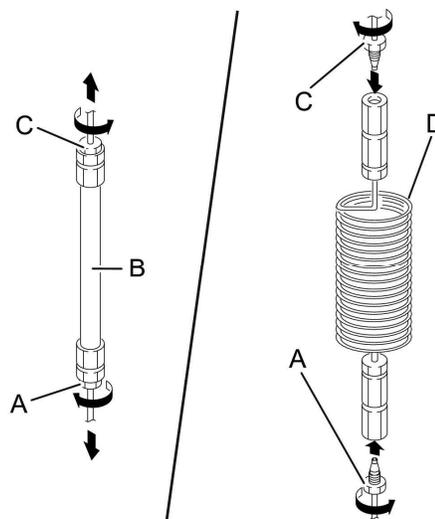
4

Press [CE] to display the initial screen.

5

Press [Enter] once.

The cursor blinks at the [FLOW] input position.

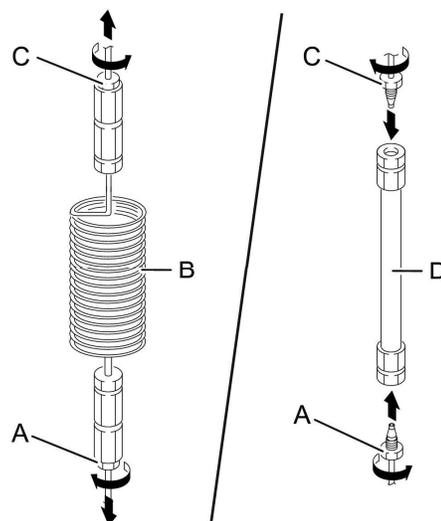


- 6** Press [2], [.] , [0] and [Enter].  
[FLOW] is set to "2.0000" and confirmed.

- 7** Press [PUMP].  
[PUMP] on the display is highlighted and delivery of 2-propanol starts at 2 mL/min.  
Continue delivery at least 1 hour.

- 8** Loosen the male nut (A and C) of the resistor tube inlet and outlet with an 8 mm wrench, and remove the resistor tube (B) from the flow line.

- 9** Attach the removed male nut (A and C) of the resistor tube inlet and outlet to the column (D) with an 8 mm wrench and tighten it with the 8 mm wrench.



- 10** Replace the solvent in reservoir bottle with the original mobile phase.  
▶▶ Reference System Guide "Precautions When Replacing the Mobile Phase"

- 11** Insert the suction filter into reservoir bottle.

## 4.9 Performing an Ultrasonic Cleaning of the Check Valve

### 4.9.1 LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D

Check valves are attached to the left and right pump heads. The following section will explain the method for performing an ultrasonic cleaning of the check valves on the right side (when viewed from the front).

#### Necessary tools

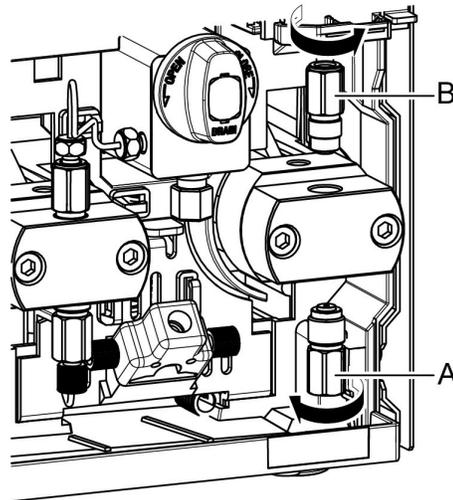
Part Name	Quantity	Part No.
Wrench (8 mm and 10 mm)	2	086-03002

1

Remove the pipe and inlet tube by following the instructions in "Removing the pump heads" P.105.

2

Use a 10 mm wrench to remove the inlet check valve (A) and the outlet check valve (B).



4

### ⚠ CAUTION



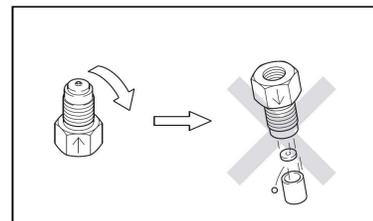
Prohibition

Never disassemble the check valve.  
Performance cannot be guaranteed if disassembled.



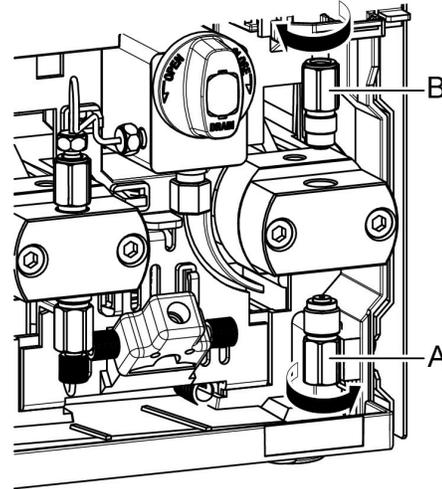
Prohibition

(For LC-40D X3/LC-40D XS/LC-40D XSi)  
Do NOT turn the inlet check valve (A)  
upside down.  
If you do, the internal parts will fall out.



- 3** Immerse the inlet check valve (A) and outlet check valve (B) into 2-propanol, and clean for 5 minutes using an ultrasonic bath.

- 4** Rotate the inlet check valve (A) and the outlet check valve (B) clockwise to attach them to the pump head, and after tightening by hand, use a 10 mm wrench to tighten them as follows.



- Inlet check valve
  - LC-40D X3/LC-40D XS/LC-40D XSi:  
Hand tightening and 120° with wrench
  - LC-40D XR/LC-40D:  
Hand tightening and 90° with wrench
- Outlet check valve
  - LC-40D X3/LC-40D XS/LC-40D XSi:  
Hand tightening and 60 to 90° with wrench
  - LC-40D XR/LC-40D:  
Hand tightening and 90° with wrench

- 5** Attach the pipe, and inlet tube by following the instructions in **"Attaching the pump head" P.113**.

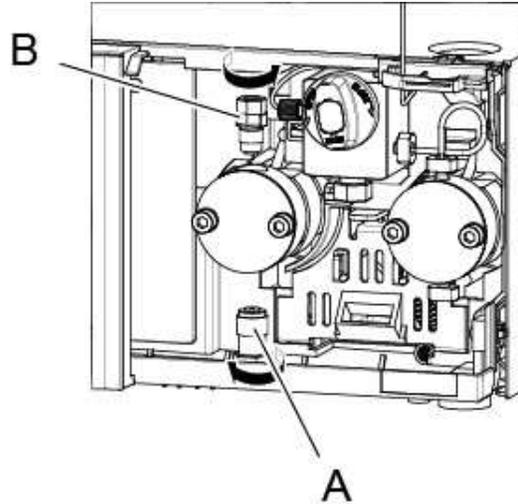
#### 4.9.2 LC-40i

##### Necessary tools

Part Name	Quantity	Part No.
Wrench (8 mm and 10 mm)	1	086-03002
Wrench (13 mm and 17 mm)	1	086-03047-10
Wrench, 40l	1	228-79981

- 1** Remove the pipe by following the instructions in **"Removing the pump heads" P.105**.

- 2** Use a 10 mm or 17 mm wrench to remove the inlet check valve (A) and the outlet check valve (B).



**CAUTION**

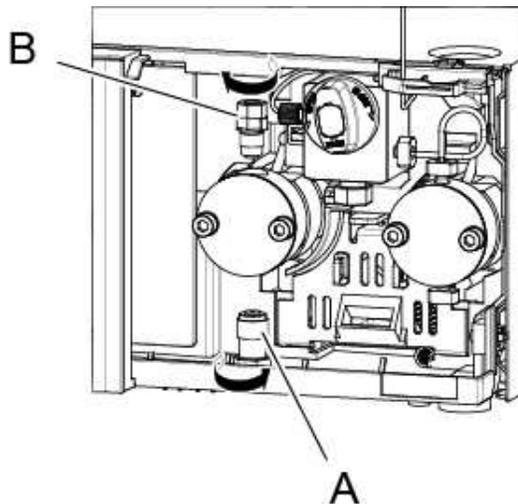


Prohibition

Never disassemble the check valve.  
Performance cannot be guaranteed if disassembled.

- 3** Immerse the inlet check valve (A) and outlet check valve (B) into 2-propanol, and clean for 5 minutes using an ultrasonic bath.

- 4** Attach the inlet check valve (A) and outlet check valve (B) to the pump head, and after tightening by hand, tighten them by 60° to 90° with a wrench.



- 5** Attach the pipe by following the instructions in "Attaching the pump head" P.113.

## 4.10 Inspecting (Replacing) the Check Valve

For LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D, check valves are attached to the left and right pump heads. The following section will explain the method for inspecting (replacing) the check valves on the right side (when viewed from the front).

### Necessary tools (for LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D)

Part Name	Quantity	Part No.
Wrench (8 mm and 10 mm)	2	086-03002

### Necessary tools (for LC-40i)

Part Name	Quantity	Part No.
Wrench (8 mm and 10 mm)	1	086-03002
Wrench (13 mm and 17 mm)	1	086-03047-10
Wrench, 40l	1	228-79981

### Necessary parts

Target Model	Part Name	Part Type	Part No.
LC-40D X3 LC-40D XS	Inlet check valve ASSY	Consumable parts	228-52964-42
LC-40D XR LC-40D			228-48249-96
LC-40D XSi			228-52964-44
LC-40D XR LC-40D	Inlet check valve ASSY, 2 pieces		228-48249-97
LC-40i	Inlet check valve ASSY		228-61830-41
LC-40D X3 LC-40D XS	Outlet Check Valve ASSY		228-53334-96
LC-40D XR LC-40D			228-45705-43
LC-40D XSi			228-53334-99
LC-40i			228-32798-91

**1**

### Check the pumping stability.

▶▶ Reference "Checking the pulse 《PULSE CHECK》" P.69

If the result of the system check is "Pass", it is considered normal.

If the result of the system check is "Fail", perform "4.8 Rinsing the Check Valve" P.145 or "4.9 Performing an Ultrasonic Cleaning of the Check Valve" P.147, and then check the pumping stability again. If the pumping (pressure) is still unstable, proceed to the following procedure to remove the check valve and replace it with a new one.

- 2** Remove the check valve and install a new one by following the instructions in "4.9 Performing an Ultrasonic Cleaning of the Check Valve" P.147.
- 3** Attach the pipe by following the instructions in "Attaching the pump head" P.113.
- 4** Turn the drain valve counterclockwise to open it.
- 5** Press [Enter] once.  
The cursor blinks at the [FLOW] input position.
- 6** Press [2], [. ], [0], and [Enter].  
[FLOW] is set to "2.0000" and confirmed.
- 7** Press [PUMP].  
[PUMP] on the display is highlighted and the solvent flows out of the drain tube.  
There is no problem with the valve if the solvent continues to flow out.

## 4.11 Inspecting the Line Filter/Frit (for LC-40i)

### Necessary tools (for LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D)

Part Name	Quantity	Part No.
Wrench (8 mm and 10 mm)	2	086-03002

### Necessary tools (for LC-40i)

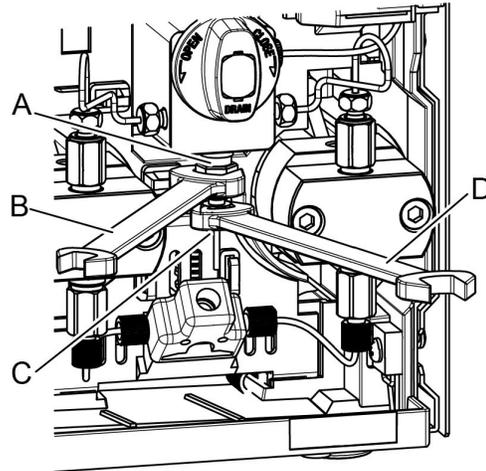
Part Name	Quantity	Part No.
Wrench (13 mm and 17 mm)	1	086-03047-10
Wrench, 40l	1	228-79981

1

### Follow the instructions below to remove the pump outlet tube.

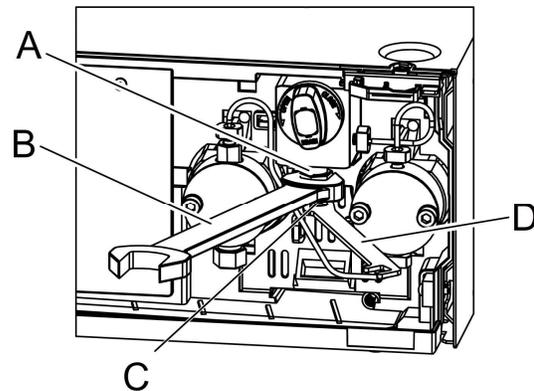
(LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D)

Fix the line filter (A) with a 10 mm wrench (B) and loosen the male nut (C) of the pump outlet tube with an 8 mm wrench (D) to remove it.



(LC-40i)

Fix the line filter (A) with a 13 mm wrench (B) and loosen the male nut (C) of the pump outlet tube with a 40l wrench (D) to remove it.



2

### Pour water into a reservoir bottle and set the flow rate to 1 mL/min.

**3****In a no load state, pump water at a rate of 1 mL/min.**

- If the pressure is 0.3 MPa or less, it is considered normal.
- If the pressure is more than 0.3 MPa, replace the line filter.

- ▼ **NOTE** Do NOT use the PEEK frit (Part No. 228-48607-91) or the PAT frit (Part No. 228-32744, discontinued) for LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR because they may be damaged during high pressure pumping.
- Rinsing method when a ghost peak is generated (for other than LC-40i)  
When a mobile phase such as trifluoroacetic acid is used, a ghost peak may be generated from the line filter. In this case, perform the following procedure to rinse the line filter.
    - 1) Deliver 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 10 mL/min for about 30 minutes. (Pumping pressure: 1 MPa to 5 MPa)
  - Note for ion chromatography  
Normally for ion chromatography, PEEK resin tubing is used; however, with LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR, pumping at a high pressure may cause PEEK resin tubing to be damaged. Do NOT use LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR for ion chromatography.

**4**

## 4.12 Replacing the Line Filter/Frit (for LC-40i)

### Necessary tools (for LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D)

Part Name	Quantity	Part No.
Wrench (8 mm and 10 mm)	2	086-03002

### Necessary tools (for LC-40i)

Part Name	Quantity	Part No.
Wrench (13 mm and 17 mm)	1	086-03047-10
Wrench, 40l	1	228-79981

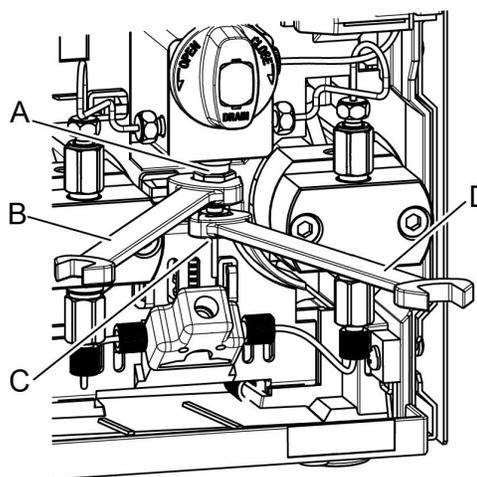
### Necessary parts

Target Model	Part Name	Part Type	Part No.
LC-40D X3 LC-40D XS	Line Filter	Consumable part	228-57501-92
LC-40D XSi			228-70796-42
LC-40D XR LC-40D			228-35871-96
LC-40i	Frit		228-48607-91

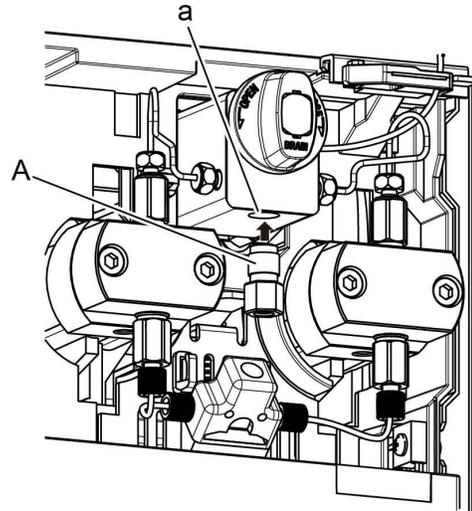
### 4.12.1 LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D

1

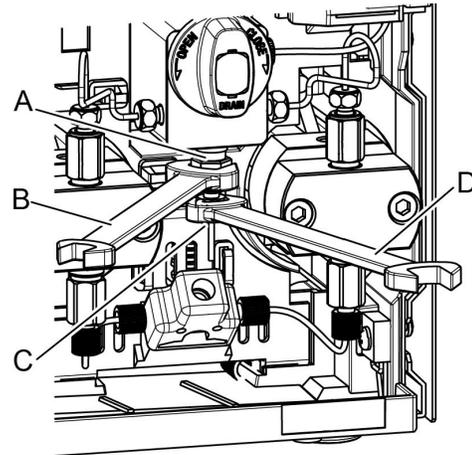
Fix the line filter (A) with a 10 mm wrench (B) and loosen the male nut (C) of the pump outlet tube with an 8 mm wrench (D) to remove it.



- 2** Loosen the line filter (A) with 10 mm wrench to remove it.
- 3** Use a cotton swab, etc., to wipe away any dirt from the line filter port (a).
- 4** Attach the new line filter (A) to the line filter port (a) by hand, and tighten it 45° using a 10 mm wrench.



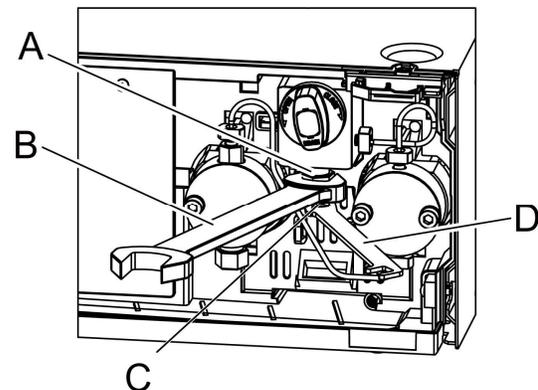
- 5** Attach the male nut (C) of the pump outlet tube to the line filter (A) by hand.
- 6** Fix the line filter (A) with a 10 mm wrench (B) and tighten the male nut (C) of the pump outlet tube with an 8 mm wrench (D).



4

## 4.12.2 LC-40i

- 1** While holding the line filter (A) with a 13 mm wrench (B), loosen the male nut (C) of the pump outlet tube with the 40l wrench (D) to remove it.



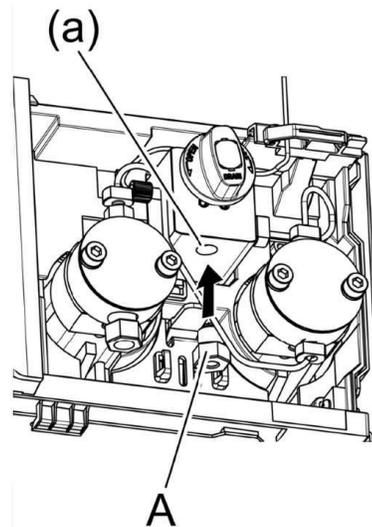
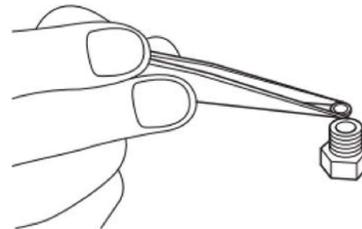
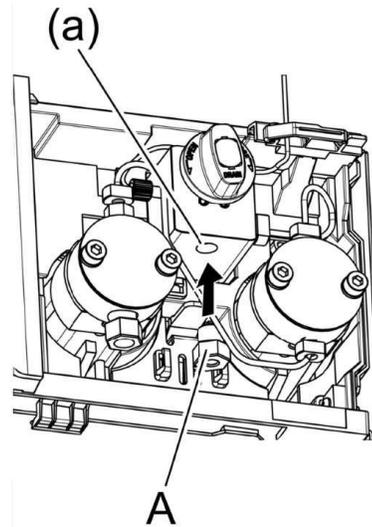
**2** Loosen the line filter (A) with a 13 mm wrench to remove it, and remove the frit with tweezers.

**3** Use a cotton swab, etc., to wipe away any dirt from the line filter port (a).

**4** Moisten a new frit with 2-propanol.

**5** Place the frit moistened with 2-propanol with tweezers on the housing of the line filter.

**6** Screw in the line filter (A) to the line filter port (a) by hand until it is secured, and tighten it by 60° to 90° with a 13 mm wrench.



7

Tighten the male nut of the PEEK tube by hand until it is secured, and further tighten it by about 120° (about 180° for a new ferrule) with the 40I wrench.

### ⚠ CAUTION



Prohibition

Do NOT tighten the line filter with excessive force.

Doing so may damage the screw part of the line filter or the frit.



Prohibition

Do NOT tighten the male nut with excessive force.

Doing so may damage the screw part of the male nut or significantly deform the ferrule and cause liquid leakage.

## 4.13 Cleaning/Replacing the Suction Filter

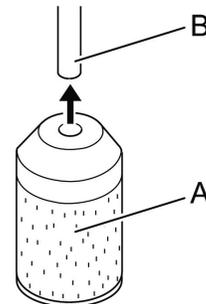
4

### Necessary Parts

Target Model	Part Name	Part Type	Part No.	Quantity
LC-40D X3 LC-40D XS LC-40D XR LC-40D	Filter Element	Consumable part	228-45707-91	1
LC-40D XSi LC-40i			228-25079-91	

1

Pull the suction filter (A) from the suction tubing (B).



- 2** Place the suction filter into a clean container with 2-propanol, and clean it for 5 minutes using an ultrasonic bath.

### CAUTION



Prohibition

After using the buffer solution as the mobile phase, do NOT replace with an organic solvent such as 2-propanol without first replacing with water.

When using a buffer solution, replace it with distilled water or purified water, and after pumping at least 20 mL into the instrument, replace it with new 2-propanol. If the buffer solution is directly replaced with 2-propanol, crystals will be precipitated, which can cause damage to the plunger seal or cause problems with the check valve.

▶▶ Reference System Guide "Precautions When Replacing the Mobile Phase"

- 3** Insert the suction tubing (A) into the suction filter (B).
- 4** Replace the solvent in reservoir bottle A with water, and place the suction tubing back into the bottle.
- 5** Press [CE] to display the initial screen.
- 6** Deliver water at 1 mL/min for 10 minutes.
- 7** Check for air bubbles inside the suction tubing.  
Replace the suction filter if air bubbles are present.

## 4.14 Replacing the Drain Valve

### Necessary tools

Part Name	Quantity	Part No.
Phillips screwdriver	1	-

### Necessary parts

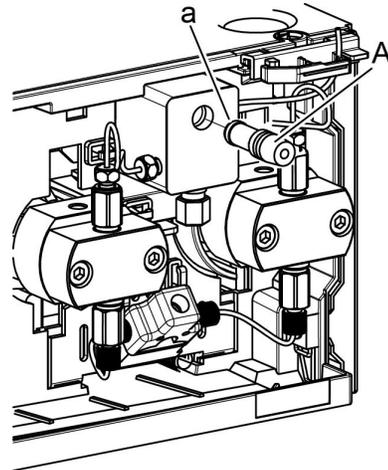
Applicable Model	Part Name	Part Type	Part No.
LC-40D X3 LC-40D XS LC-40D XR	DRAIN VALVE ASSY	Replacement part	228-51229-93
LC-40D XSi			228-51229-94
LC-40D			228-45574-95
LC-40i			228-70751-41

- 1 Rotate the drain valve ASSY counter-clockwise at least 3 complete rotations and pull it off straight.

NOTE Check that there is nothing wrong with the hole.

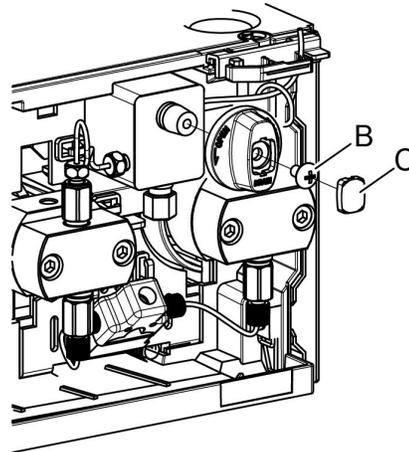
- 2 Wet the seal portion (a) of the new drain valve ASSY (A) with 2-propanol, etc., and insert it into the hole.

NOTE If the drain valve ASSY is forcefully inserted or is not inserted straight, the seal portion may become deformed, resulting in leakage.



- 3 Tighten the drain valve ASSY clockwise.

- 4 After tightening the drain valve ASSY, attach the knob using the screw (B) so that it is vertical, and then attach the cap (C).



## 4.15 Replacing the Air Filter (Right Panel)

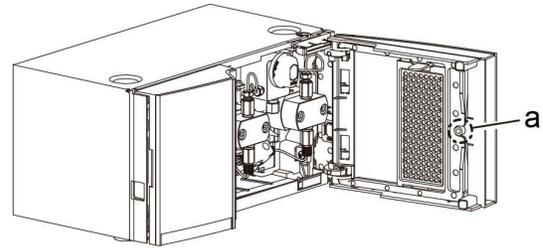
This section explains about replacement on the air filter of the right panel.

**Necessary parts**

Applicable Model	Part Name	Part Type	Part No.
LC-40D X3 LC-40D XS LC-40D XSi LC-40D XR LC-40D LC-40i	Air Filter Element, Non Woven, for Right Panel	Consumable part	228-53924-06

**1**

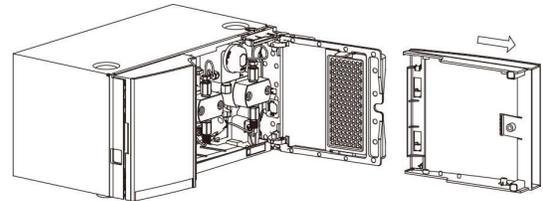
**Open the right panel.**



**2**

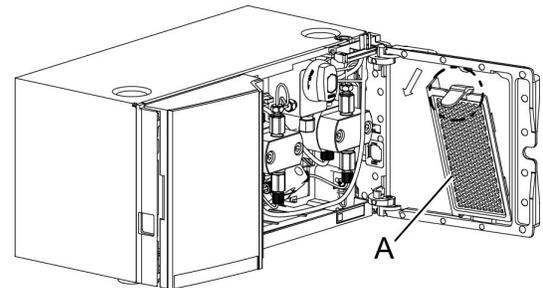
**Remove the right panel cover.**

While lightly pressing the cylinder-shaped projection (a) inside the right panel cover, slide the cover to the front.



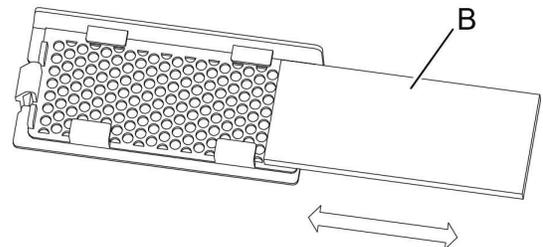
**3**

**While pressing the knob at the top of the filter holder (A), remove it toward the front.**



**4**

**Slide the air filter (B) to attach/remove it.**



## 4.16 Cleaning of the Leak Tray

▼ **NOTE** If a leak occurred, wipe off the leak in the leak tray completely as below. Leak of mobile phase solution used as buffer solution may dry and crystallize, clogging the leak tray. If the leak tray is contaminated by such crystallized buffer solution, wipe off the leak tray with wiper paper soaked in water in the same manner as below.

**1**

**Wipe off leak around the leak sensor or on the leak tray completely with wiper paper.**

▼ **NOTE**

- Do not bend or pull the leak sensor.
- If there is contamination such as crystallized buffer solution, wipe it off with wiper paper soaked in water.

## 4.17 Cleaning the Exterior

If the exterior of the instrument is dirty, clean it with a dry soft cloth or tissue paper. If it is very dirty, clean it as below.

**1**

**Clean with a cloth soaked in diluted neutral detergent and wrung tightly.**

**2**

**Wipe off detergent with a cloth soaked in water and wrung tightly and then wipe off water with a dry cloth.**

▼ **NOTE** Do not leave the exterior wet and do not use alcohol or thinner for cleaning. Doing so may cause rust or discoloration.

**4**

## 4.18 Cleaning of the Automatic Rinsing Kit

### Necessary parts

Part Name	Part Type	Part No.	Quantity
WASHING PUMP SEAL KIT	Replacement part	228-56201-41	1
WASHING PUMP SEAL KIT (LC-40i only)		228-56201-43	

**NOTE** If the 10% 2-propanol water in the rinse solution bottle is dirty, replace with new solution. If getting significantly dirty, 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.
  - ▶▶ Reference System Guide 2.9 "Replacing the Rinse Solution in the Solvent Delivery Pump Automatic Seal Rinsing Kit"
- 5** Replace the rinse tube if the inside is dirty.

# 5 Technical Information

## 5.1 Specifications

### 5.1.1 LC-40D X3/LC-40D XS/LC-40D XSi Specifications

Item	Specification		
	LC-40D X3	LC-40D XS/LC-40D XSi	
Pump Type	Micro-volume double plunger pump (approx. 10 µL/stroke)		
Pumping Methods	Constant flow pumping and constant pressure pumping		
Allowable Maximum Pressure	130 MPa	105 MPa	
Constant Flow Pumping	Flow Rate Setting Range	0.0001 to 10.0000 mL/min	
	Maximum Delivery Pressure	130 MPa (0.0001 to 3.0000 mL/min) 80 MPa (5.0000 mL/min) 22 MPa (10.0000 mL/min)	105 MPa (0.0001 to 3.0000 mL/min) 80 MPa (5.0000mL/min) 22 MPa (10.0000mL/min)
	Flow Rate Accuracy	±1 % (1 mL/min when water is pumped at 80 MPa, with water and room temperature constant between 20 to 30 °C)	
	Flow Rate Precision	Larger value of either 0.06 % RSD or 0.02 min SD	
Pressure Display Accuracy	Larger value of either ±2 % or ±2.4 MPa		
Suction Filter	10 µm		
Line Filter	5 µm		
Time Program	Commands for flow rate, pressure, [LOOP] (for program repetition), 320 steps (total of 10 program files)		

\*1 When water is pumped at 10 to 40 MPa, with water and room temperature constant between 20 to 30 °C.

\*2 When water is pumped at 40 to 60 MPa, with water and room temperature constant between 20 to 30 °C.

## 5.1.2 LC-40D XR/LC-40D/LC-40i Specifications

Item		Specification			
		LC-40D XR	LC-40D	LC-40i	
Pump Type		Micro-volume parallel-type double plunger pump (approx. 10 $\mu$ L/stroke)		Micro-volume serial-type double plunger pump (approx. 10 $\mu$ L/stroke)	
Pumping Methods		Constant flow pumping and constant pressure pumping			
Allowable Maximum Pressure		70 MPa	44 MPa	30 MPa	
Constant Flow Pumping	Flow Rate Setting Range	0.0001 to 10.0000 mL/min		0.0001 to 5.0000 mL/min	
	Maximum Delivery Pressure	70 MPa (0.0001 to 3.0000 mL/min) 44 MPa (3.0001 to 5.0000 mL/min) 22 MPa (5.0001 to 10.0000 mL/min)	44 MPa (0.0001 to 5.0000 mL/min) 22 MPa (5.0001 to 10.0000 mL/min)	(For aqueous solvent mobile phase) 30 MPa (0.0001 to 4.0000 mL/min) 15 MPa (4.0001 to 5.0000 mL/min)	(For organic solvent mobile phase) 22 MPa (0.0001 to 4.0000 mL/min) 15 MPa (4.0001 to 5.0000 mL/min)
	Flow Rate Accuracy	Larger value of either $\pm 1$ % or $\pm 2$ $\mu$ L/min (0.01 to 3 mL/min) Larger value of either $\pm 2$ % or $\pm 2$ $\mu$ L/min (0.01 to 3 mL/min)	Larger value of either $\pm 1$ % or $\pm 2$ $\mu$ L/min (0.01 to 2 mL/min) $\pm 2$ % (2 to 5 mL/min)	Larger value of either $\pm 2$ % or $\pm 2$ $\mu$ L/min (1 mL/min, 7MPa, water, and room temperature is 20~30°C and constant.)	
	Flow Rate Precision	No more than the large value calculated with either 0.06 % RSD or 0.02 min SD			
Constant Pressure Pumping	Pressure Setting Range	1.0 to 60 MPa (in steps of 0.1 MPa)	1.0 to 40 MPa (in steps of 0.1 MPa)	(For aqueous solvent mobile phase) 1.0 to 28 MPa (in steps of 0.1 MPa)	(For organic solvent mobile phase) 1.0 to 20 MPa (in steps of 0.1 MPa)
	Pressure Accuracy	Larger value of either $\pm 10$ % or 1.5 MPa	Larger value of either $\pm 10$ % or 1.0 MPa		
Pressure Display Accuracy		Larger value of either $\pm 2$ % or $\pm 1.0$ MPa	Larger value of either $\pm 2$ % or $\pm 0.5$ MPa		
Suction Filter		10 $\mu$ m		15 $\mu$ m	
Line Filter		5 $\mu$ m		2 $\mu$ m	

Item	Specification		
	LC-40D XR	LC-40D	LC-40i
Time Program	Commands for flow rate, pressure, [EVENT], [LOOP] (for program repetition), 320 steps (total of 10 program files)		

### 5.1.3 High-Pressure Gradient System

#### ■ High-pressure gradient system controlled by system controller (SCL-40/CBM-40/CBM-40lite)

Item	Specification			
	LC-40D X3/LC-40D XS/ LC-40D XSi	LC-40D XR	LC-40D	LC-40i
Number of Solvents Mixed	2 or 3			
Gradient Profile	Step, linear and exponential functions (Only when controlled by LC workstation) possible at multiple levels			
Maximum Program Steps	400 steps (total of 20 program files)			
Program Duration	0.01 to 9999.90 minutes (in steps of 0.01 minutes)			
Range of Set Concentrations	0 % to 100 % (in steps of 0.1 %)			
Concentration Accuracy*1	±0.5 % (1 mL/min, 80 MPa)	±0.5 % (0.05 to 3 mL/min, 1 to 40 MPa)	±0.5 % (0.2 to 2 mL/min) ±1.0 % (2 to 5 mL/min)	±1.0 % (0.2 to 2 mL/min) ±2.0 % (2 to 5 mL/min)
Flow Rate Possible	0.0001 to 10 mL/min			0.0001 to 5.0 mL/min

\*1 For binary gradient with water/caffeine solution

## 5.1.4 Low-Pressure Gradient System

### ■ Low-pressure gradient system controlled by system controller (SCL-40/CBM-40/CBM-40lite)

Item	Specification	
	LC-40D X3/LC-40D XS/LC-40D XSi/ LC-40D XR/LC-40D	LC-40i
Number of Solvents Mixed	Max. 4	
Gradient Profile	Step, linear and exponential functions (Only when controlled by LC workstation) possible at multiple levels	
Maximum Program Steps	400 steps (total of 20 program files)	
Program Duration	0.01 to 9999.90 minutes (in steps of 0.01 minutes)	
Range of Set Concentrations	0 % to 100 % (in steps of 0.1 %)	
Concentration Accuracy	±0.5 % (1 mL/min, 10 MPa) (for binary gradient with water/caffeine solution)	±1.0 % (1 mL/min, 10 MPa) (for binary gradient with water/caffeine solution)
Flow Rate Possible	0.0001 to 10 mL/min	0.0001 to 5 mL/min

### ■ Low-pressure gradient system controlled by pump unit (LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D/LC-40i)

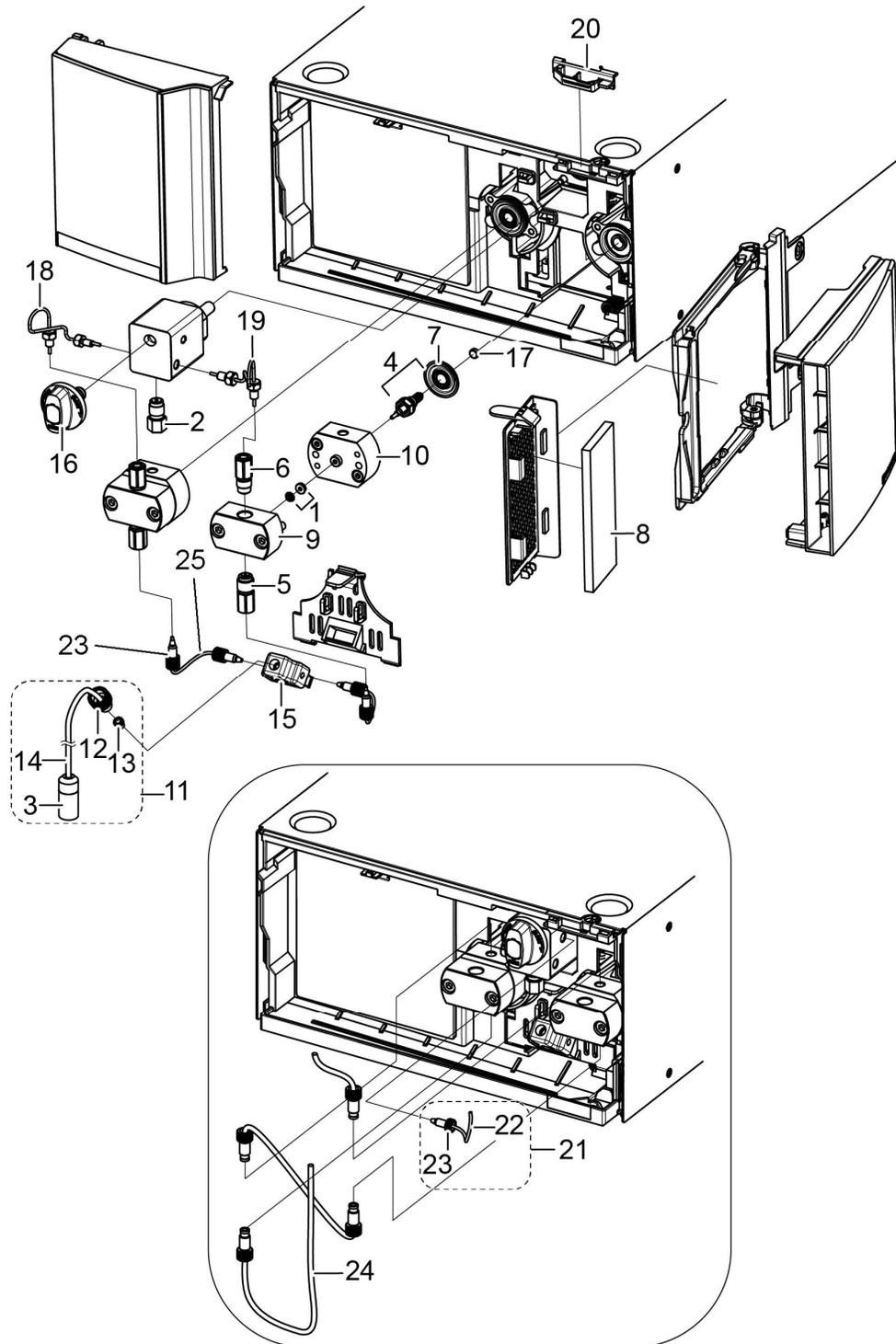
Item	Specification	
	LC-40D X3/LC-40D XS/LC-40D XSi/ LC-40D XR/LC-40D	LC-40i
Number of Solvents Mixed	Max. 4	
Gradient Profile	Step and linear are possible at multiple levels	
Maximum Program Steps	320 steps (total of 10 program files)	
Program Duration	0.01 to 9999.90 minutes (in 0.01 minutes steps)	
Range of Set Concentrations	0 % to 100 % (in steps of 0.1 %)	
Concentration Accuracy	±0.5 % (1 mL/min, 10 MPa) (for binary gradient with water/caffeine solution)	±1.0 % (1 mL/min, 10 MPa) (for binary gradient with water/caffeine solution)
Flow Rate Possible	0.0001 to 10 mL/min	0.0001 to 5 mL/min

## 5.1.5 Other Specifications

Item	Specification					
	LC-40D X3	LC-40D XS	LC-40D XSi	LC-40D XR	LC-40D	LC-40i
Liquid-Contacting Part Materials	SUS316L, PEEK, ruby, sapphire, HastelloyC, PE		Titanium, Titanium alloy, nickel alloy, PEEK, ruby, sapphire, Hastelloy C, PE	SUS316L, PEEK, ruby, sapphire, Hastelloy C, PE	SUS316L, PEEK, ruby, sapphire, Hastelloy C, PTFE	PEEK, perfluoroelastomer, ruby, sapphire, PTFE
Operating Temperature Range	4 °C to 35 °C					
Humidity Range	20 % to 85 %					
Available pH Range	1 to 14					
Dimensions	W260 mm ´ H140 mm ´ D500 mm (Excluding protruding parts)					
Mass	12kg			10 kg		
Power Supply	Power Supply Voltage (indicated on the instrument)	100 V AC to 240 V AC * Mains supply voltage fluctuations are not to exceed 10 % of the nominal supply voltage.				
	Power Consumption	150 VA				
	Frequency	50/60 Hz				
	Rated Breaking Capacity	50 A * Connect the instrument to a power outlet that is equipped with a circuit breaker that shuts off the current at the described value or less.				
Installation Environment (IEC)	Installation Category II, Pollution Degree 2, Altitude 2000 m max. Install indoors.					
Plunger Rinsing Line	Automatic rinsing kit as standard equipment				Optional	
Pressure Limiter Operations	Upper/lower limits can be set					
Error Display	Exist (Error display and stop at the time of malfunction)					

## 5.2 Maintenance Parts

### 5.2.1 Maintenance Parts for LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR/LC-40D



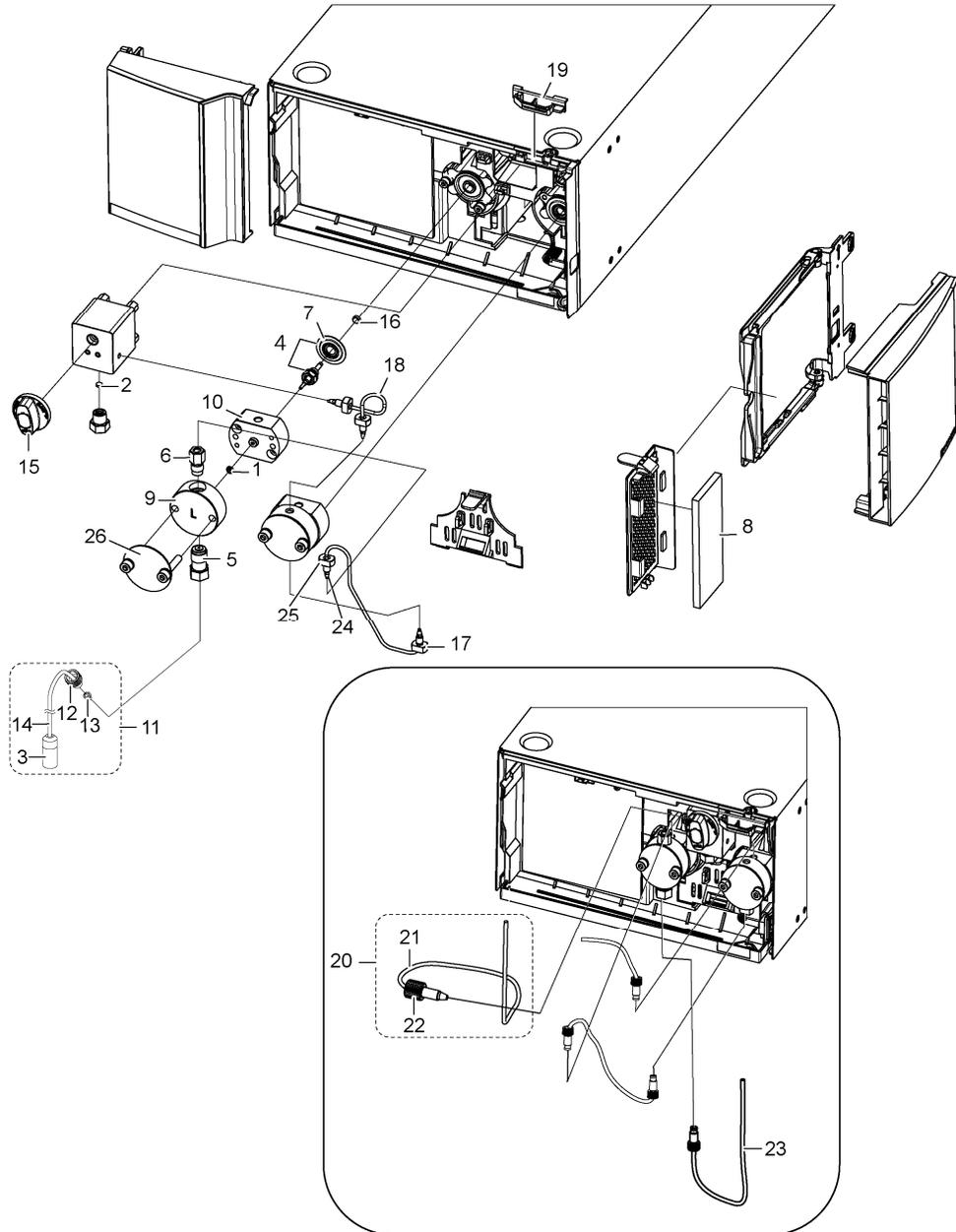
### ■ Consumable Parts

No.	Part Name	Part No.	Remarks
1	PLUNGER SEAL	228-52711-93	Seal for pump head, with backup ring, for LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR
		228-35146	Seal for pump head, for LC-40D
2	Line Filter ASSY	228-57501-92	LC-40D X3/LC-40D XS
		228-35871-96	LC-40D XR/LC-40D
		228-70796-42	LC-40D XSi
3	Suction filter (Filter body only)	228-45707-91	LC-40D X3/LC-40D XS/LC-40D XR/LC-40D
		228-25079-91	LC-40D XSi
4	Plunger Holder ASSY	228-52069-44	For LC-40D X3/LC-40D XS/LC-40D XSi/LC-40D XR, with diaphragm
		228-35281-97	For LC-40D, with diaphragm
5	Inlet Check Valve ASSY	228-52964-42	LC-40D X3/LC-40D XS
		228-52964-44	LC-40D XSi
		228-48249-96	LC-40D XR/LC-40D
	Inlet Check Valve ASSY, 2 pieces	228-48249-97	LC-40D XR/LC-40D
6	Outlet Check Valve ASSY	228-53334-96	LC-40D X3/LC-40D XS
		228-53334-99	LC-40D XSi
		228-45705-43	LC-40D XR/LC-40D
7	DIAPHRAGM 2PCS	228-55272-41	
8	AIR FILTER FOR RIGHT PANEL	228-53924-06	Filter only

## ■ Replacement Parts

No.	Part Name	Part No.	Remarks
9	PUMP HEAD	228-55230-45	For LC-40D X3/LC-40D XS/ LC-40D XR
		228-55230-48	For LC-40D XSi
		228-34541-01	For LC-40D
10	HEAD HOLDER,2030	228-38022-01	For LC-40D X3/LC-40D XS/ LC-40D XR/LC-40D
		228-70701	For LC-40D XSi
11	Suction Filter ASSY	228-45708-91	For LC-40D X3/LC-40D XS/ LC-40D XR/LC-40D
		228-39181-94	For LC-40D XSi
12	PEEK Bush Fitting 3	228-39084	For suction filter
13	FERRULE,3.0F-T	228-12493	For suction filter
14	FEP TUBE 3.0 (O.D.)×1.5(I.D.)	670-10321-05	For suction filter
15	INLET BLOCK PEEK	228-47518	Pump inlet
16	DRAIN VALVE ASSY	228-51229-93	For LC-40D X3/LC-40D XS/ LC-40D XR
		228-51339-94	For LC-40D XSi
		228-45574-95	For LC-40D
17	THRUST	228-34469	
18	SUS PIPE L	228-70472-01	For the left pump head of LC-40D X3/LC-40D XS
		228-70026-01	For the left pump head of LC-40D XR/LC-40D
	PEEK lined SS tube L	228-70807-41	For the left pump head of LC-40D XSi
19	SUS PIPE R	228-70472-02	For the right pump head of LC-40D X3/LC-40D XS
		228-70026-02	For the right pump head of LC-40D XR/LC-40D
	PEEK lined SS tube R	228-70807-42	For the right pump head of LC-40D XSi
20	TUBE HOLDER	228-70044	
21	DRAIN TUBE ASSY	228-25495-93	
22	ETFE TUBE 1.6 (O.D.)×1.0(I.D.)	228-18495-03	For the drain tube
23	MALE NUT 1.6 PEEK	228-35403	For plumbing between the inlet block and the check valve and the drain tube
24	FEP TUBE 3.0 (O.D.)×1.5(I.D.)	670-10321-05	
25	ETFE TUBE 1.6 (O.D.)×0.8(I.D.)	228-18495-01	For use between the inlet block and the check valve

### 5.2.2 Maintenance Parts for LC-40i



### ■ Consumable Parts

No.	Part Name	Part No.	Remarks
1	PLUNGER SEAL, O-RING	228-78510	Seal for pump head, for LC-40i
2	Frit (for line filter)	228-48607-91	Frit for line filter, for LC-40i
3	Suction filter (Filter body only)	228-25079-91	For LC-40i (Common to LC-40D XSi)
4	Plunger Holder ASSY	228-35281-97	For LC-40i, with diaphragm
5	Inlet Check Valve ASSY	228-61830-41	For LC-40i
6	Outlet Check Valve ASSY	228-32798-91	For LC-40i
7	DIAPHRAGM 2PCS	228-55272-41	
8	AIR FILTER FOR RIGHT PANEL	228-53924-06	Filter only

### ■ Replacement Parts

No.	Part Name	Part No.	Remarks
9	PUMP HEAD	228-78525-02	Left pump head for LC-40i
		228-78526-02	Right pump head for LC-40i
10	HEAD HOLDER	228-38022-01	For LC-40i (Common with LC-40D X3/LC-40D XS/LC-40D XR/LC-40D)
11	Suction Filter ASSY	228-39181-41	For LC-40i
12	PEEK Bush Fitting 3	228-39084	For suction filter
13	FERRULE,3.0F-T	228-12493	For suction filter
14	FEP TUBE 3.0 (O.D.)×1.5(I.D.)	670-10321-05	For suction filter
15	DRAIN VALVE ASSY	228-70751-41	For LC-40i
16	THRUST	228-34469	
17	PEEK TUBE ASSY, 1-2	228-78533-41	For connecting the left and right pump heads of LC-40i Only tube, Bended (w/o male nuts and ferrules)
18	PEEK TUBE ASSY, 2	228-78533-42	For connecting the right pump head and the pressure sensor of LC-40i Only tube, Bended (w/o male nuts and ferrules)
19	TUBE HOLDER	228-70044	
20	DRAIN TUBE ASSY	228-25495-93	
21	ETFE TUBE 1.6 (O.D.)×1.0(I.D.)	228-18495-03	
22	MALE NUT 1.6MN PEEK	228-35403	
23	FEP TUBE 3.0 (O.D.)×2.0(I.D.)	670-10321-03	
24	MALE NUT 1.6MN-2 PEEK	228-33213	For PEEK tube ASSY
25	FERRULE 1.6F PEEK	228-33513-91	For PEEK tube ASSY (3PCs)
26	PUMP HEAD PLATE	228-78527	

### 5.2.3 Maintenance Kit

A set of consumable parts is provided as Maintenance Kit

#### ■ Maintenance Kit for LC-40D X3/LC-40D XS (Parts No. 228-53265-45)

Part Name	Part No.	Quantity	Remarks
PLUNGER SEAL,BACKUP RING UHP	228-52711-93	2	With backup ring
Line Filter ASSY	228-57501-92	1	
Suction Filter ASSY	228-45708-91	1	
Plunger Holder ASSY	228-52069-44	2	With diaphragm
Inlet Check Valve ASSY	228-52964-42	2	
Outlet Check Valve ASSY	228-53334-96	2	
Air Filter for Right Panel	228-53924-06	1	

#### ■ Maintenance Kit for LC-40D XR (Parts No. 228-45593-49)

Part Name	Part No.	Quantity	Remarks
PLUNGER SEAL,BACKUP RING UHP	228-52711-93	2	With backup ring
Line Filter ASSY	228-35871-96	1	
Suction Filter ASSY	228-45708-91	1	
Plunger ASSY	228-52069-44	2	With diaphragm
FERRULE 1.6F 316L	228-16000-10	2	
MALE NUT 1.6MN	228-16001	2	
SUS316LTP 0.3	228-50579-91	1	0.3 mm (I.D.) × 2 m. With ferrules and male nuts (2 pieces).
Inlet Check Valve ASSY	228-48249-96	2	
Outlet Check Valve ASSY	228-45705-43	2	

### ■ Maintenance Kit for LC-40D (Parts No. 228-45593-50)

Part Name	Part No.	Quantity	Remarks
Plunger Seal, 42455	228-35146	2	
Line Filter ASSY	228-35871-96	1	
Suction Filter ASSY	228-45708-91	1	
Plunger Holder ASSY	228-35281-97	2	With diaphragm
FERRULE 1.6F 316L	228-16000-10	2	
MALE NUT 1.6MN	228-16001	2	
SUS316LTP 0.3	228-50579-91	1	0.3 mm (I.D.) × 2 m. With ferrules and male nuts (2 pieces).
Inlet Check Valve ASSY	228-48249-96	2	
Outlet Check Valve ASSY	228-45705-43	2	

### ■ Maintenance Kit for LC-40D XSi (Parts No. 228-53265-47)

Part Name	Part No.	Quantity	Remarks
PLUNGER SEAL, BACKUP RING UHP	228-52711-93	2	With backup ring
Line Filter ASSY	228-70796-42	1	
Suction Filter ASSY	228-39181-94	1	
Plunger Holder ASSY	228-52069-44	2	With diaphragm
Inlet Check Valve ASSY	228-52964-44	2	
Outlet Check Valve ASSY	228-53334-99	2	
Air Filter for Right Panel	228-53924-06	1	

### ■ Maintenance Kit for LC-40i

The maintenance kit for LC -40i is not prepared, so please purchase the necessary parts separately.

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