

Degassing Unit for Shimadzu Liquid Chromatograph

DGU-405 CL

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 CD-ROM (Part No. 228-97193-41).

Document Name	Document No.	Description
Instruction Manual (PDF)	228-97196	This instruction manual.
System Guide (PDF)	228-97194	This manual provides details on how to use the system: system performance optimization, analysis procedure, troubleshooting, validation, installation, etc.
Safety Guideline (Booklet/PDF)	228-97195	This document provides important information for safe use.

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.
- All rights are reserved, including those to reproduce this manual or parts thereof in any form without permission in writing from Shimadzu Corporation.
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Indications Used in This Manual

Warnings, Cautions, and Notes are indicated using the following conventions:

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

The following symbols are used in this manual:

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

Electromagnetic Compatibility

Descriptions in this section apply only to the following models:

- 228-65019-55 DGU-405 CL

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.

Operating Nexera CL System

■ Intended Use

This system is designed to perform qualitative and quantitative analysis of target compounds in a sample matrix and can be used as a degassing unit of the liquid chromatograph for general in vitro diagnostic applications. However, only personnel who have received appropriate training on use of the system can use it for these purposes.

IVD

■ Calibration

A calibration curve should be generated for each analyte in appropriate methods. At least four out of six non-zero standards should meet the appropriate criteria, including the calibration standard lower than the assumed LOQ and the calibration standard at the highest concentration.

■ Quality Control

Implement quality control of the instrument by routinely measuring at least one each of four types of quality-control samples (a sample with a normal concentration level, a sample with a concentration level higher than normal as well as a sample lower than normal, and a blank sample). Check the selectivity/specificity in the matrix used for the actual sample, the accuracy, correctness, recovery rate, dynamic range, linearity, and lower limit of quantitation.

Based on these assessment results, check that the results are within the permissible range. If the assessment results are out of range, the measured data may be invalid, so do not use analysis results obtained from the instrument in question until it can be confirmed that it is functioning normally. When, for example, analyzing samples that contain complex sample matrices such as serum, plasma or urine, it may be possible to obtain stabilized data by using an appropriate pre-treatment or an internal standard.

Contents

Introduction

Indications Used in This Manual	ii
Electromagnetic Compatibility	iii
Operating Nexera CL System	iii

1 Overview

1.1 Features	1
1.2 Component Parts	2
1.3 Optional Parts	3

2 Parts Identification and Function

2.1 Front	4
2.2 Back	6

3 Operation

3.1 Introducing Liquid into the Instrument and Starting Solvent Delivery	7
3.2 Replacing the Mobile Phase Solvent	9
3.3 Stopping Operation	10
3.4 Degassing Performance	11

4 Maintenance

4.1 Periodic Inspection and Maintenance	12
4.1.1 Prior to Inspection and Maintenance	12
4.1.2 List of Periodic Inspection and Maintenance	13
4.1.3 Installing/Removing Right Panel	14
4.2 Maintenance Work	15
4.3 Cleaning the Exterior	15
4.3.1 Usual cleaning	15
4.3.2 Decontamination cleaning	16

5 Technical Information

5.1 Specifications	17
5.1.1 Performance Specifications for DGU-405	17

5.1.2 Other Specifications 18

5.2 Connection of External Output Terminal
(ALARM Terminal) 19

5.2.1 Wiring Method 19

5.2.2 Connection with External Equipment 20

5.3 Serial Connection of Channels 21

Index 22

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1 Overview

1.1 Features

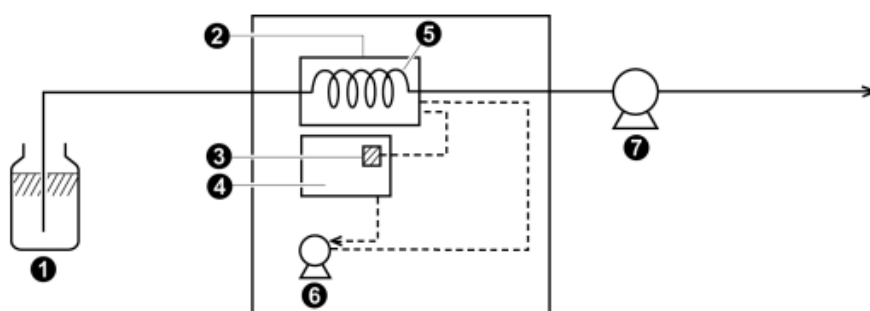
This instrument is a degassing unit that can continuously remove dissolved gases from liquid through a degassing membrane.

By connecting this instrument to the solvent delivery module for liquid chromatographs, it is possible to continuously degas the gas dissolved in the mobile phase solvent without changing the mobile phase composition.

As a result, it is possible to prevent the generation of bubbles due to the dissolved gas, defective liquid-feed by the solvent delivery module due to bubbles, generation of noise on the detector base line, and fluctuation of the detector base line due to changes in dissolved gas concentration. This results in further improvements in analysis stability and reproducibility of liquid chromatographs.

This instrument is a degassing unit with five independent channels, but the degassing performance per channel and various functions are common.

The operation principle of this instrument is as shown in the diagram.



No.	Display or Name
①	Mobile phase
②	Degassing chamber
③	Pressure sensor
④	Control board
⑤	Degassing membrane
⑥	Vacuum pump
⑦	Solvent delivery module

The mobile phase (liquid) that needs to be degassed passes through the degassing membrane installed in the degassing chamber of this instrument.

The dissolved gas in the liquid has a small molecular size and a higher mobility as compared with liquid, and also has a strong affinity to a degassing membrane. Therefore, the dissolved gas permeates through the membrane into the degassing chamber and is then discharged from the device, removed from the solvent.

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
			DGU-405 CL
-	Main Unit DGU-405 CL	-	1
-	Safety Guideline (Booklet/PDF) *1	228-97195	1
-	Instruction manual (CD-ROM)	228-97193-41	1
-	Stop joint*2	228-44479-03	10
1	Power cable Dsub 9pin	228-70732-41	1
2	Pressure Signal Cable	228-70733-41	1
3	Ground cable	228-70735-41	1
4	Alarm output cable	228-80699-41	1
5	SF Nut, 1/8	228-44449-36	10
6	SF Ferrule, 1/8	228-44449-51	10
7	STANDARD OUT DRAIN	228-42205	1
8	CTO OUT DRAIN	228-42206	1
9	DRAIN TUBE SI (L1000)	228-25162-03	1
10	STRAIGHT JOINT	228-28163	1
11	FITTING, L-TYPE 1253	035-61561-12	1
12	DRAIN ADAPTER	228-42204	1

*1 This document describes information such as precautions for use of the product.

*2 The stop joint is attached to the liquid inlet/outlet port of the degassing unit main body beforehand.

1.3 Optional Parts

Part Name	Part No.	Remarks
LINK-CHAMBER KIT	228-61149-41	Use when serially connecting the channels. ▶▶ Reference "LINK-CHAMBER KIT Part No. 228-61149-41" P.3

LINK-CHAMBER KIT Part No. 228-61149-41

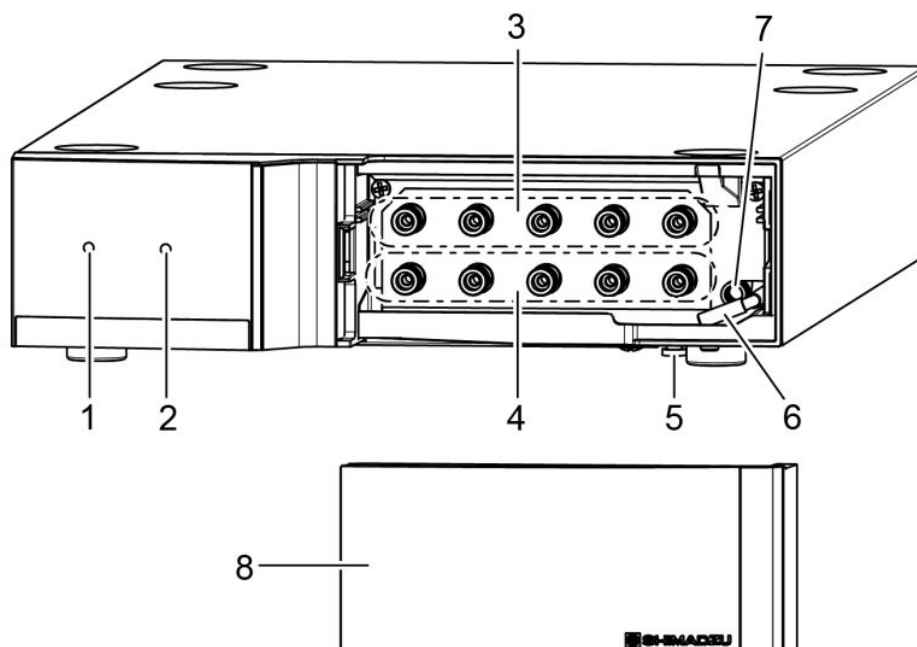
Part Name	Part No.	Q'ty
Instruction manual	-	1
Ferrule	228-54508-01	10
FLANGELESS FITTING	228-46472	10
FEP TUBE 3X1.5 (100 mm)*1	670-10321-05	5

*1 FEP tube: one with outer diameter 3.0 mm × inside diameter 1.5 mm can be purchased by the meter.

2

Parts Identification and Function

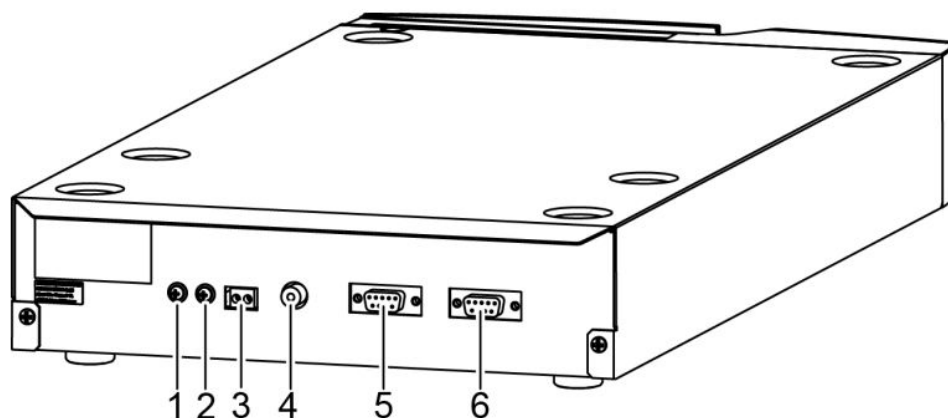
2.1 Front



No.	Display or Name	Function
1	Control LED	The LED lights when the degree of vacuum for degassing is maintained and the degassing operation is proceeding normally. ▶▶ Reference "3.1 Introducing Liquid into the Instrument and Starting Solvent Delivery" P.7
2	Error LED	When the target degree of vacuum is not being maintained, the LED (red) flashes. When it continues flashing for a predetermined time, the red LED will start to glow and the vacuum pump will stop. ▼ NOTE The material of degassing membrane has a high gas permeability and may allow the mobile phase in vapor state to permeate it. When the power is turned off in the presence of steam in the vacuum line, dew condensation may occur due to room temperature fluctuations, which makes the pressure of the vacuum line temporarily unstable when the power is turned on again, causing the Error LED to light. ▶▶ Reference System Guide "5 Troubleshooting" "3.1 Introducing Liquid into the Instrument and Starting Solvent Delivery" P.7
3	Liquid inlet/outlet ports	These are fluid inlets/outlets. Since there is an independent channel for the upper and lower ports, connect an upper port and a lower port. Inlet and outlet are not specified.
4	Liquid inlet/outlet ports	

No.	Display or Name	Function
5	Leakage port	Leaked liquid is discharged from the port to a drain port of a solvent delivery module located under the degassing unit. ▶▶ Reference System Guide "7 Installation"
6	Exhaust port	Air in the internal piping is expelled via the exhaust port.
7	Drain tube	Leakage from the reservoir tray etc. located above the degassing unit is discharged from the drain tube.
8	Right Panel	Protection of piping connections. ▶▶ Reference System Guide "7 Installation"

2.2 Back



No.	Display or Name	Function
1	Ground terminal for the degassing unit	Grounds the degassing unit. ▶▶ Reference System Guide "7 Installation"
2	Alarm ground terminal	Used for noise reduction of alarm output. ▶▶ Reference "5.2 Connection of External Output Terminal (ALARM Terminal)" P.19
3	ALARM terminal	When an abnormality occurs, signal is externally output. ▶▶ Reference "5.2 Connection of External Output Terminal (ALARM Terminal)" P.19
4	[DGU PRESS OUT] connector	Outputs the degree of vacuum. ▶▶ Reference System Guide "7 Installation"
5	[AUX] power supply connector	A connector for supplying power to other devices. ▶▶ Reference System Guide "7 Installation"
6	[PUMP] power supply connector	Insert the supplied D _{SUB} 9-pin power cable. ▶▶ Reference System Guide "7 Installation"

3 Operation

3.1 Introducing Liquid into the Instrument and Starting Solvent Delivery

CAUTION



Prohibition

Never introduce the following solvents into the instrument as it may be damaged.

- HFIP (hexafluoroisopropanol)
- Hydrogen fluoride
- 1,1,2-Trichloro-1,2,2-trifluoroethane
- Fluorinert™ Electronic Liquids FC-40
- Fluorinert™ Electronic Liquids FC-72
- Fluorinert™ Electronic Liquids FC-75
- Perfluoro benzene
- Perfluoro octane
- Perfluoro decalin
- Perfluoro 1-methyldecalin
- Perfluoro dimethyldecalin
- Perfluoro methyl-cyclohexane
- Perfluoro dimethyl-cyclohexane
- AK-225
- Other fluorinated solvents
- Nitric acid having a concentration of 30% min.
- Hydrogen peroxide



Prohibition

Do NOT feed pressurized liquid to this instrument.
This instrument may be damaged.

1

Set the power switch of the solvent delivery module to "ON".

2

Wait until the vacuum pump in the degassing unit starts operating and the "Control" LED on the front of the degassing unit turns on.

NOTE • Changes in LED indications after turning on the power

Error LED flashing	Immediately after turning on the power, vacuum line is reduced to a set upper limit pressure. If, after 40 minutes, the specified vacuum pressure has not been reached, the red LED lights and the instrument stops with an error.
Control LED lit	The vacuum line is being controlled at the control pressure. (Indicates that the instrument is in a usable state.)
Error LED lit	The vacuum pressure did not reach the specified value and the instrument stopped with an error. ▶▶ Reference System Guide "5 Troubleshooting"

• Change in LED indication after the Control LED lights

Error LED flashing	The vacuum pressure has not reached the specified level. When this condition lasts for 6 minutes, the red LED lights and the instrument stops with an error.
Error LED lit	The vacuum pressure did not reach the specified value and the instrument stopped with an error. ▶▶ Reference System Guide "5 Troubleshooting"

3

Prepare the mobile phase to be used and install piping from the reservoir to the solvent delivery module.

▶▶ Reference System Guide "7.3.2 Connecting Low-Pressure Flow Channel Tubing"

4

Connect the disposable syringe attached to each solvent delivery module to the drain tube outlet of the solvent delivery module.

▶▶ Reference System Guide "2.3.3 Manual Purging the Solvent Delivery Pump"

5

Open the drain valve of the solvent delivery module.

Slowly draw the liquid with a disposable syringe.

▶▶ Reference System Guide "2.3.3 Manual Purging the Solvent Delivery Pump"

NOTE

- For operation of solvent delivery module, refer to the instruction manual of each solvent delivery module.
- When drawing the liquid with a syringe, pull it slowly so that the flow rate is 10 mL/min or less. A high flow rate may cause the degassing membrane to be overloaded and the degassing chamber may be damaged.

6

Remove the disposable syringe connected to the drain tube and insert the end of the drain tube into the drain tank to purge the solvent delivery module.

NOTE If a low pressure gradient unit is connected, set each solenoid valve A-to-D to "ON" one by one and repeat steps 4 and 5 for each solenoid valve channel.

7

Close the drain valve of the solvent delivery module.

3.2 Replacing the Mobile Phase Solvent

For the replacement of the mobile phase, refer to "Replacing Mobile Phase Solvent" in the "System Guide" provided. (This applies to replacement of compatible mobile phase, incompatible mobile phase, and buffer solution mobile phase.)

NOTE Inside the degassing chamber, piping with a small inner diameter is used. If you replace the solution with an organic solvent in the state of using a buffer solution or seal the buffer solution in a degassing chamber for a long period, the channel may clog with the salt precipitated inside the piping. Be sure to replace the liquid with pure water after sending buffer solution. For details, see ["4.2 Maintenance Work"](#).

In addition, when the normal phase solvent and the reversed phase solvent are switched and used over and over in a short period of time, the large difference in property between the solvents can cause the resin part of the degassing chamber to temporarily change in volume and then a small amount of mobile phase to enter the vacuum tube, resulting in an unstable vacuum performance and causing the Error LED to light. In such a case, refer to "5 Troubleshooting" in the System Guide and take corrective action.

3

3.3 Stopping Operation

This degassing unit can be stopped from a PC workstation in the following way.

1

Using the shutdown function, stop the operation of the degassing unit after the analysis is complete.

CAUTION



Instruction

When solvents with high volatility and solubility (hexane, heptane, THF, ethyl acetate etc.) are used, replace the channel inside the instrument with isopropyl alcohol (IPA) and stop operation. Alternatively, remove the inlet tube, fully withdraw the liquid from inside the instrument with a syringe or the like, then operate the instrument for 30 minutes or more and finally, stop operation.

Vacuum performance may become unstable or malfunction may be caused if parts are exposed to a vaporized solvent atmosphere for a long time.



Instruction

When turning off the power to this instrument after analysis using chloroform, be sure to replace the channel inside the instrument with a compatible solvent such as isopropyl alcohol (IPA) or ethanol.

Chloroform contains chlorine. If it is enclosed, the metal channel parts may corrode or the pressure sensor may break down due to the vaporized solvent atmosphere.

3.4 Degassing Performance

At present, there are two types of liquid chromatography available that enable continuous degassing of mobile phases (online).

- Decompression degassing method using a degassing membrane (This mechanism is used for this instrument)
- A system in which Helium gas is bubbled in the mobile phase in the reservoir to drive out dissolved air

These two methods have the following features.

	Decompression degassing method using membrane	Helium degassing method
Degassing Capacity (Flow rate dependency)	There is a limit to the degassing capacity because the liquid is degassed while it is flowing. The degassing capacity decreases as the flow rate increases.	This method has the best degassing capacity. It has no flow dependency and can be used over a wide range of flow rates.
Degassing of Mixed Solvent	Degassing is possible without changing solvent composition.	Depending on the type of solvent, the solvent composition changes by continuous bubbling of helium gas.
Types of reservoir bottles that can be used	Any type is available.	Reservoir bottles that can be used are limited in order to prevent release of the solvent vapor into the atmosphere by bubbling of helium gas, and for effective degassing.
Running Costs etc	The only thing needed is the power supply. It consumes little electricity and is very economical.	Helium gas is necessary. Space is needed to install the helium gas cylinder.

This instrument adopts "Decompression degassing method using membrane" and has many superior features compared to the "Helium degassing method". However, since the degassing is performed through the membrane while the liquid is flowing, depending on the flow rate, the degassing capacity (degassing performance) is limited.

When performing a low pressure gradient with a low pressure gradient valve connected, bubbles may appear when the flow rate exceeds a certain value (this flow rate depends on the solvent used).

NOTE The flow rate range that can be used without bubbles when performing a gradient with a low pressure gradient valve connected to this instrument is as follows.

With one channel connected to this instrument per solvent,

Water/methanol: 1.5 mL/min

When using at 1.5 mL/min or more, do ultrasonic vacuum degassing etc of the mobile phase in advance.

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 representatives on a contractual basis.

For maintenance and inspection contracts, contact your Shimadzu representative.

WARNING



Instruction

Turn off the main power switch on the back of the solvent delivery unit and unplug the power cable prior to maintenance when instructed.

Failure to do so may cause a fire, electric shock, or breakdown.

CAUTION



Prohibition

Never remove the main cover.

Otherwise, injury or malfunction may occur.

If it is necessary to remove the main cover for repair, contact your Shimadzu representative.



Instruction

When replacing parts, use the parts described in "1.2 Component Parts".

If any other parts are used, injury or malfunction may occur.

4.1.1 Prior to Inspection and Maintenance

- Replace the mobile phase in the channel with water.
- Wipe away any dirt from the front panel or the main cover.

4.1.2 List of Periodic Inspection and Maintenance

Consult your Shimadzu service personnel regarding inspection/change.

Replacement and inspection may be required earlier than the described replacement cycles. The described interval is not necessarily guaranteed.

These cycles differ depending on the usage environment.

Inspection/Maintenance Item	1 year	2 years	3 years	Remarks
Inspection/replacement of vacuum pump's intake filter	✓			Replace the filter if it is not white.
Inspection/replacement of vacuum tube filter	✓			Replace the filter if it is not white.
Replacement of vacuum pump		✓		Degradation of the vacuum pump components may cause the degassing unit to stop in error.
Inspection/replacement of vacuum tube *1			✓	Replace the vacuum tube if it is hardened or cracked.
Replacement of degassing chamber		✓		Depending on the operating conditions, leakage may occur if the degassing chamber is used for a long period of time.

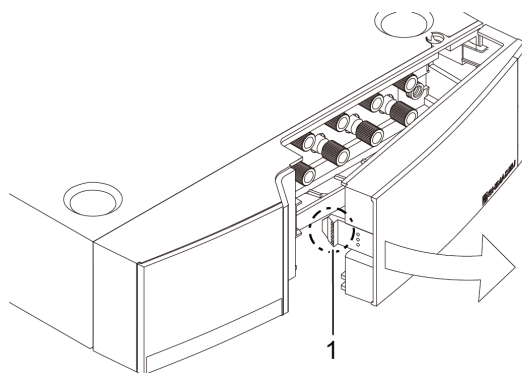
*1 Check every year after three years of use.

4.1.3 Installing/Removing Right Panel

When installing piping from the reservoir or solvent delivery module to the instrument, remove/attach the right panel from/to the front of the instrument as follows.

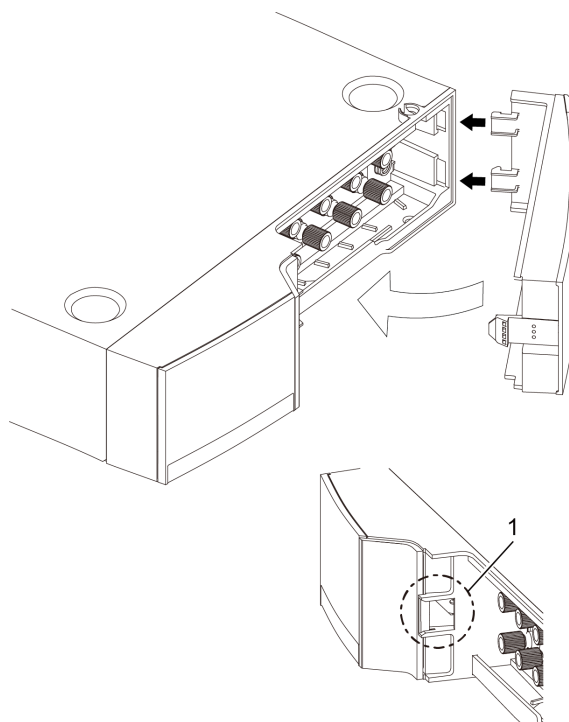
■ Removing the right panel

- 1 Remove the right panel by pressing (1).



■ Installing the right panel

- 1 Align the two protruding parts on the right side of the right panel with the notches on the instrument.
- 2 Hook the right panel claw onto (1) of the instrument.



4.2 Maintenance Work

If the solvent delivery module is not used for a long time, turn "OFF" the power to the unit and perform the following tasks.

NOTE Particularly after using a buffer solution, the solvent can cause the precipitation of salt and the growth of algae and microorganisms inside the instrument (at the membrane). After use, thoroughly wash the interior with distilled water or ion exchanged water and then pour in methanol or the like to replace it. (Only suction operation using a device such as solvent delivery module is allowed.)

- Remove the inlet tube and completely withdraw the liquid from inside the instrument with a syringe or the like.
- After withdrawing the liquid, operate the degassing unit for at least 30 minutes to dry the inside of the instrument with the stop joint of the liquid inlet/outlet ports removed.
- Finally, plug the liquid inlet/outlet ports with the stop joints.

CAUTION



Prohibition

Be sure to withdraw the liquid inside the instrument by drawing it. Do NOT pressurize the instrument.

When withdrawing liquid with a syringe or the like, slowly withdraw it at a flow rate of 10 mL/min or less. A high flow rate may cause the degassing membrane to be overloaded, resulting in shorter lifetime of the degassing chamber.

4

4.3 Cleaning the Exterior

4.3.1 Usual cleaning

If the exterior of the instrument is dirty, clean it with a dry soft cloth or paper wiper. 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.

CAUTION



Prohibition

Do NOT leave any part wet nor use thinner for cleaning.
Doing so may cause rust or discoloration.

4.3.2 Decontamination cleaning

After handling the hazardous substances, use the following procedure.

1

Turn off the power of the column oven.

 **NOTE** The gas sensor may defect volatile gas generated from organic solvent.

2

Clean with a cloth soaked in Aqueous ethanol solution (80%) or aqueous sodium hypochlorite solution (0.05%) and wrung tightly.

CAUTION



Prohibition

Do not leave metal surfaces wet.
This can cause rusting and discoloration.

5 Technical Information

5.1 Specifications

5.1.1 Performance Specifications for DGU-405

Item	Specifications
Number of Channels	5 channels
Degassing Performance	When a UV absorption detector with wavelength of 210 nm and sensitivity of 0.5 AU is used and methanol saturated with dissolved oxygen (HPLC grade at 25 °C) is flowed at a rate of 1 mL/min, UV absorption difference with or without the degassing unit is 300 mAU or more
Maximum Operating Flow Rate	10 mL/min per channel * Assuming that the degassing capacity of He degassing of methanol as 100 %, the capacity at the flow rate of 1 mL/min and 10 mL/min will be 89 % and 25 % respectively. If more degassing capacity than the above is required, ultrasonic vacuum degassing of the mobile phase etc. shall be carried out beforehand.
Internal Capacity	400 µL/1 channel
Pressure Resistance	± 0.1 MPa (only for suction with the solvent delivery module. It is not possible to pressurize the degassing unit.)
Self Purge	A mechanism is provided that operates stably by capturing outside air during vacuum pump operation

 **NOTE** If the maximum operating flow rate is exceeded, bubbles may appear or the degassing chamber may be overloaded and damaged.

5.1.2 Other Specifications

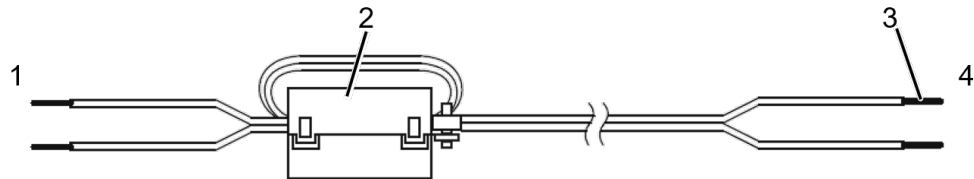
Item	Specifications	
Materials Contacting Liquid	Fluororesin, PEEK, FEP, PPS	
Operating Temperature	4 °C to 35 °C	
Operating Humidity	20 % to 85 % (non condensing environment)	
Operating pH	1 to 14	
Piping Used	PTFE tube having external diameter of 3 mm × internal diameter of 1.5 mm	
Dimensions	W 260 mm × H 72 mm × D 500 mm (not including protruding parts)	
Mass	DGU-405 CL: 4 kg	
External Output	- Ratings of contacts: 5 V, 10 mV - Vacuum pressure monitor:	
	Voltage	Vacuum Pressure Output
	2 V	0 kPa (atmospheric pressure)
	0.18 V	-90.6 kPa
	0.1 V	-94.6 kPa
Power Supply	24 V DC, SELV (Power is supplied by connecting a cable to the solvent delivery module)	
Installation Environment (IEC)	Installation category II, Pollution degree 2, Altitude up to 2000 m, Installed indoor.	

5.2 Connection of External Output Terminal (ALARM Terminal)

5.2.1 Wiring Method

1

Insert the core wire of the alarm output cable into the hole. Note that the ferrite core of the cable is closer to the solvent delivery module side.



No.	Display or Name
1	Solvent delivery module side
2	Ferrite core
3	Core wire
4	DGU side

5.2.2 Connection with External Equipment

NOTE Connection with external equipment is done by service personnel during installation.

- When stopping the solvent delivery module with the output signal from the ALARM terminals, connect them to "PUMP OFF" and "COM".
- When controlling the solvent delivery module or column oven from the controller, connecting this degassing unit to the "IN 1" terminals of the controller enables the external signal from this degassing unit to stop the solvent delivery module and the column oven controlled by the controller.

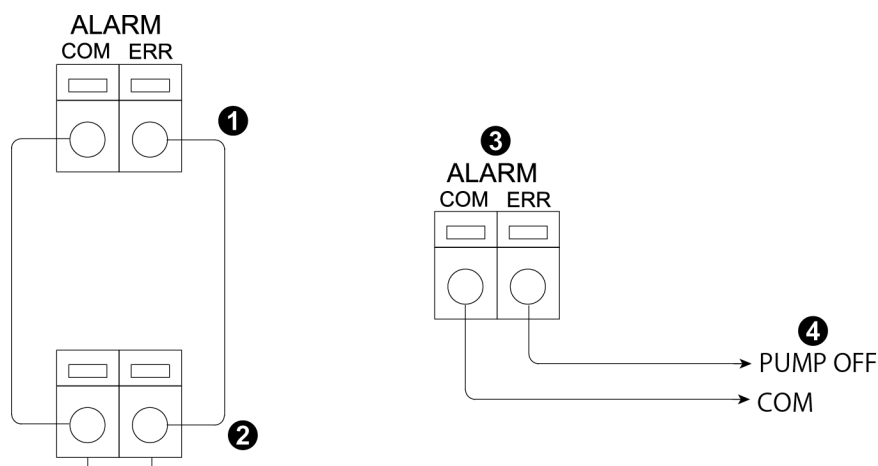
CAUTION



Instruction

When connecting the ALARM terminals to an external device, connect them correctly as shown in the figure. (Do not connect the left and the right in reverse.)

If each terminal is connected incorrectly, they will not operate properly.



No.	Display or Name
①	DGU side
②	IN 1 CBM side
③	DGU side
④	Solvent delivery module side

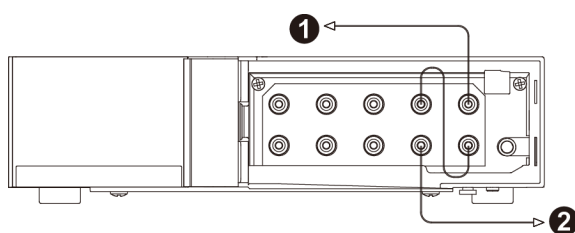
5.3 Serial Connection of Channels

By using channels in series, higher levels of degassing can be performed.

The maximum operating flow rate when channels are connected in series depends on the number of channels connected: 5 mL/min for two channels, 3.33 mL/min for three channels, 2.5 mL/min for four channels, and 2 mL/min for five channels.

If there are insufficient tubes and fastening components for series connection, prepare LINK-CHAMBER KIT FOR DGU-20A (Part No. 228-61149-41) for Shimadzu liquid chromatographs.

When two channels are connected in series



No.	Display or Name
①	Reservoir
②	Solvent delivery module

NOTE The LINK-CHAMBER KIT FOR DGU-20A for Shimadzu liquid chromatographs can connect five channels in series.

Index

A

[AUX] power supply connector	6
------------------------------	---

C

Connection of External Output Terminal (ALARM Terminal)	19
---	----

Control LED	4
-------------	---

D

Degassing Performance	17
-----------------------	----

[DGU PRESS OUT] connector	6
---------------------------	---

Drain tube	5
------------	---

E

Error LED	4
-----------	---

I

Internal Capacity	17
-------------------	----

M

Mass	18
------	----

Maximum Operating Flow Rate	17
-----------------------------	----

O

Operating Humidity	18
--------------------	----

Optional Parts	3
----------------	---

P

[PUMP] power supply connector	6
-------------------------------	---

R

Replacing the Mobile Phase Solvent	9
------------------------------------	---

Right Panel	5, 14
-------------	-------

S

Serial Connection of Channels	21
-------------------------------	----