228-90933B
Sep. 2015

# DEGASSING UNIT
## FOR SHIMADZU HIGH PERFORMANCE LIQUID CHROMATOGRAPH
## DGU-20A3R/20A5R
## INSTRUCTION MANUAL

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

SHIMADZU

This page is intentionally left blank.

# Introduction

## Read this manual thoroughly before using the instrument.

Thank you for purchasing this instrument. This manual describes: the installation, operation,  cautions for use, and details on the accessories. Read the manual thoroughly before using the instrument. Use the instrument in accordance with the manual's instructions. Keep this manual for future reference.

**IMPORTANT**

- If the user or usage location changes, be sure this Instruction Manual is always kept together with the product.
- If this documentation or the warning labels on the instrument become lost or damaged, promptly obtain replacements from your Shimadzu representative.
- To ensure safe operation, read the **Safety Instructions** before using the instrument.
- To ensure safe operation, contact your Shimadzu representative if product installation, adjustment, or re-installation (after the product is moved) is required.

**Notice**

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


Original version is approved in English.

# Warranty and After-Sales Service

## Warranty

### 1. Period

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

### 2. Description:

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

### 3. Limitation of Liability

1) In no event will Shimadzu be liable for any lost revenue, profit or data, or for special, indirect, consequential, incidental or punitive damages, however caused regardless of the theory of liability, arising out of or related to the use of or inability to use the product, even if Shimadzu has been advised of the possibility of such damage.
2) In no event will Shimadzu's liability to you, whether in contract, tort (including negligence), or otherwise, exceed the amount you paid for the product.

### 4. Exceptions

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

1) Improper product handling
2) Repairs or modifications performed by parties other than Shimadzu or Shimadzu designated companies
3) Product use in combination with hardware or software other than that designated by Shimadzu
4) Computer viruses leading to device failures and damage to data and software, including the product's basic software
5) Power failures, including power outages and sudden voltage drops, leading to device failures and damage to data and software, including the product's basic software
6) Turning OFF the product without following the proper shutdown procedure leading to device failures and damage to data and software, including the product's basic software
7) Reasons unrelated to the product itself
8) Product use in harsh environments, such as those subject to high temperatures or humidity levels, corrosive gases, or strong vibrations
9) Fires, earthquakes, or any other act of nature, contamination by radioactive or hazardous substances, or any other force majeure event, including wars, riots, and crimes

10) Product movement or transportation after installation
11) Consumable items
Recording media such as floppy disks and CD-ROMs are considered consumable items.

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

## After-Sales Service

If any problem occurs with this instrument, inspect it and take appropriate corrective action as described in the Section "5 Troubleshooting". If the problem persists, or symptoms not covered in the Troubleshooting section occur, contact your Shimadzu representative.

## Replacement Parts Availability

Replacement parts for this instrument will be available for a period of seven (7) years after the discontinuation of the product. Thereafter, such parts may cease to be available. Note, however, that the availability of parts not manufactured by Shimadzu shall be determined by the relevant manufacturers.

# Safety Instructions

- To ensure safe operation of the instrument, read these Safety Instructions carefully before use.
- Observe all of the WARNINGS and CAUTIONS described in this section. They are extremely important for safety.
- In this manual, warnings and cautions are indicated using the following conventions;

| | |
|---|---|
| ⚠ **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.** |

■ Application Precautions

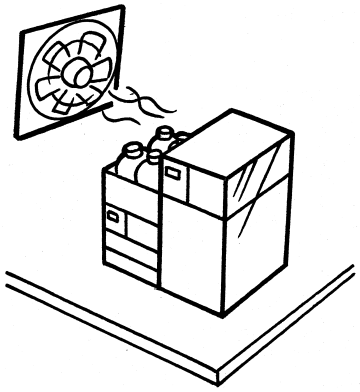
## ⚠ WARNING

**This instrument is High Performance Liquid Chromatograph for use with a high performance liquid chromatography system.**
**Use this instrument ONLY for the intended purpose.**
Using this instrument for any other purpose could cause accidents.

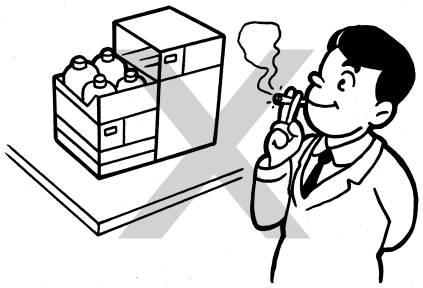
■ Installation Site Precautions

## ⚠ WARNING

- **The solvents used in high performance liquid chromatograph are flammable and toxic. The room where the instrument is installed should be well ventilated;** otherwise, solvent vapors could cause poisoning or ignite and cause a fire.



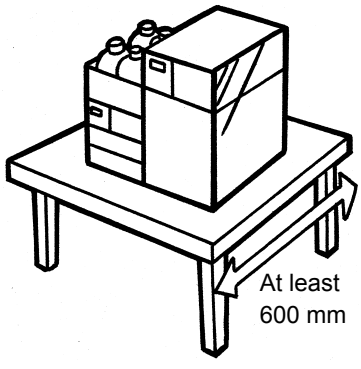
- **High performance liquid chromatograph uses large amounts of flammable organic solvents. Use of open flame in the vicinity of this instrument must be strictly prohibited. Do not install the instrument in the same room with any other equipment that emits or could potentially emit sparks, since sparks could cause a fire.**
  Provide fire extinguishers for use in case of fire.



- **Provide protective equipment near the instrument.**
  If solvent gets into the eyes or on the skin, it must be flushed away immediately. Provide equipment, such as eye wash stations and safety showers, as close to the instrument as possible.

## ⚠ CAUTION

- **The weight of this instrument is 4 kg.**
  **During installation, consider the entire weight combined with other LC components.**
  The lab table on which this instrument is installed should be strong enough to support the total weight of the LC system. It should be level, stable and have depth of at least 600 mm.
  Otherwise, the instrument could tip over or fall off the table.




- **Keep at least 100 mm between the rear of the instrument and the wall.**
  This allows for sufficient air circulation and ventilation from the grille to provide cooling and prevent the instrument from overheating and impairing the performance.

## ⚠ CAUTION

- **Avoid installation sites that are exposed to corrosive gases or excessive dust.**
  These adverse conditions may be detrimental to maintaining the instrument performance and may shorten its service life.

### ■ Installation Precautions

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

## ⚠ WARNING

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

- **Ground the instrument.**
  Grounding is necessary to prevent electric shock in the event of an accident or electrical discharge, and important for ensuring stable operation.

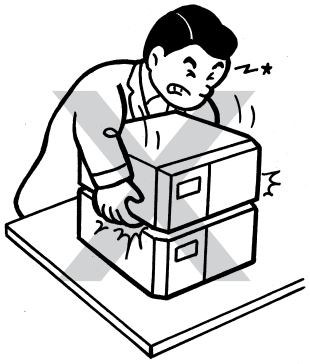
- **Do not place heavy objects on the power cable and keep any hot items away.**
  The cable could be damaged, resulting in fire, electrical shock or malfunction.
  If the cable becomes damaged, contact your Shimadzu representative immediately.

- **Do not modify the cable in any way. Do not bend it excessively or pull on it.**
  The cable could be damaged, resulting in fire, electrical shock or malfunction.
  If the cable becomes damaged, contact your Shimadzu representative immediately.

## ⚠ CAUTION

- **When installing the instrument, be careful not to pinch your fingers between the system components, as this could result in injury.**

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



## ■ Operation Precautions

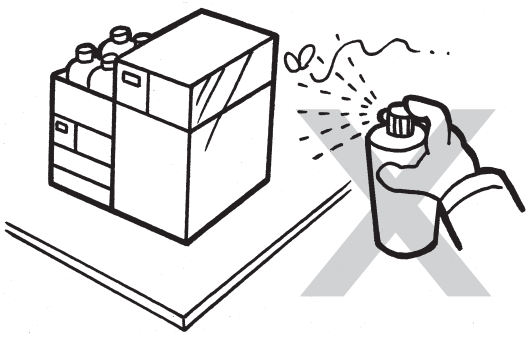
### ⚠ WARNING

- **Take thorough measures to prevent buildup of static electricity.**
  ☞ "Static Electricity Precautions" P.XI
  Static electricity could result in fires or explosions.

- **Always wear protective gloves and protective goggles when handling solvents and samples.**
  If solvent gets into the eyes, blindness could result. Should solvent get into the eyes, flush immediately with large amounts of water and get medical attention.

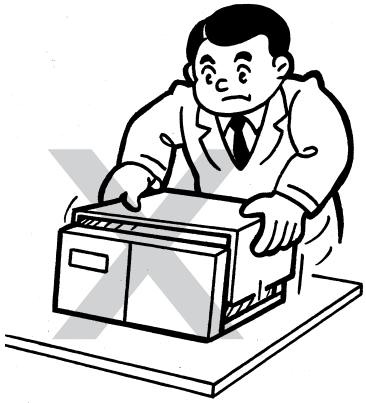
- **Always wear protective gloves when handling any toxic or biologically infectious samples.**

- **Do not use flammable sprays (hair sprays, insecticide sprays, etc.) near the instrument.**
  They could ignite and cause a fire.



## ■ Precautions for Instrument Inspection, Maintenance, Adjustment and Care

### ⚠ WARNING



- **Never remove the main cover.**
  This may cause injury or malfunction of the instrument.
  The main cover does not need to be removed for routine maintenance, inspection and adjustment. Have your Shimadzu representative perform any repairs requiring removal of the main cover.

- **Replacement parts must be of the specifications given in "1.2 Component Parts".**
  Use of any other parts may result in instrument damage and malfunction.

- **If any water gets onto the instrument, wipe it away immediately to prevent rust. Never use alcohol or thinner solvents for cleaning the instrument.**
  They could cause discoloration.

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

## ■ In an Emergency

### ⚠ WARNING

If any problem is detected, such as something smells like burning, take the following action.
Also, when the instrument is used again, inspect the instrument and, if necessary, contact your Shimadzu representative to request servicing.

Emergency Shutdown Procedure

1) Turn OFF the power switch on the power supply unit or the solvent delivery module to which the power cable of DGU-20A3R/20A5R is connected.
2) Disconnect the power cable at the rear of the power supply unit or the solvent delivery module to which the power cable of DGU-20A3R/20A5R is connected.

## ■ During a Power Outage

### ⚠ CAUTION

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

1) Turn OFF the power switch on the power supply unit or the solvent delivery module to which the power cable of DGU-20A3R/20A5R is connected.
2) After confirming all related items in this section "Installation Precautions" and "Operation Precautions", use the standard startup procedure to start the instrument.

# Maintenance, Inspections, and Adjustment

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

- For daily maintenance, inspection, and replacement parts, see the "Maintenance" section of this Instruction Manual.
- Periodic inspection/calibration should be requested to your Shimadzu representative.
- Replacement cycles described for periodic replacement parts are rough estimate. Replacement may be required earlier than the described replacement cycles depending on usage environment and frequency.

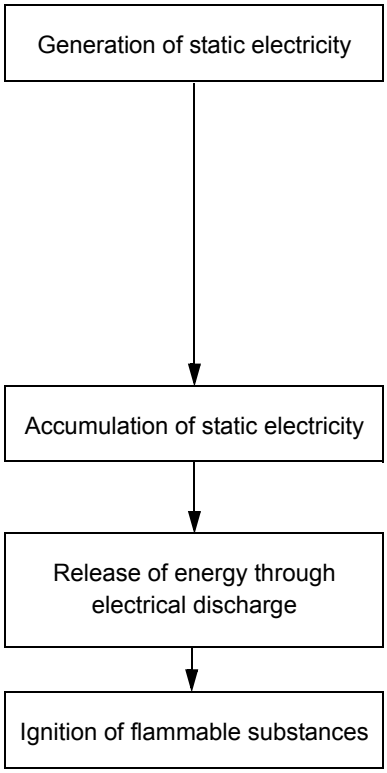
# Static Electricity Precautions

Liquid chromatograph (LC) uses flammable organic solvent(s) as the mobile phase. LC systems are also often used where large amount of flammable substances are present. Thus, an accident can produce large scale damage. Operators must be constantly on guard against accidents involving fire or explosion.

The major cause of these accidents is static electricity. Devising preventative measures for static can be difficult, because the symptoms before an accident vary and can be hard to detect, since such accidents occur as a result of several simultaneous coincidences. Recommended methods for preventing static electricity accidents are provided below. Take thorough safety measures based on this information.

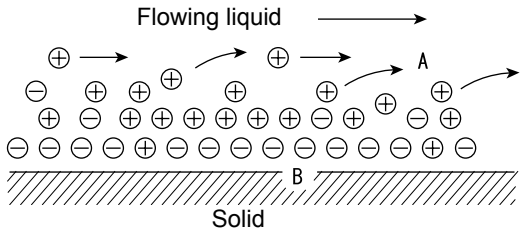
## ■ Typical Cause of Static Electricity Accidents

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




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

Generation of Static Electricity by a Liquid Flowing over a Solid

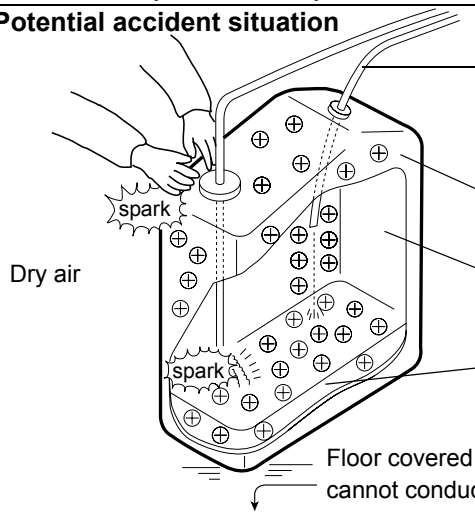



A: Charges move with flow of liquid.

B: Immobile charges, fixed to surface of solid.

If electrostatically charged liquid is allowed to accumulate in an electrically insulated container, the charge will gradually increase, and can eventually reach several thousand volts. If this happens and an electrical conductor is brought within a certain distance of the container, electrical discharge will occur, releasing thermal energy which will ignite any flammable gas of sufficient density in the vicinity.

**Potential accident situation**




Liquid flowing through thin tubing at high rate.
* Air bubbles in liquid facilitate generation of static electricity.

Insulated container of polyethylene, etc.

Flammable gas present in container.

Flammable organic solvent with large electrostatic charge.

Floor covered with rubber, etc., cannot conduct electricity away.

## ■ Preventing Static Electricity Accidents

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

### ⚠ CAUTION

- **It is important to take multiple preventive measures simultaneously.**
- **If large amounts of flammable solvents are collected in a large container, implement preventative measures 1, 2, and 3 below.**

**Preventive Measure 1**

Use a metal container for the waste liquid, and ground the container.
This will ensure that the electrical charges of the container and liquid pass to the ground.

**Accessories for this measure**

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

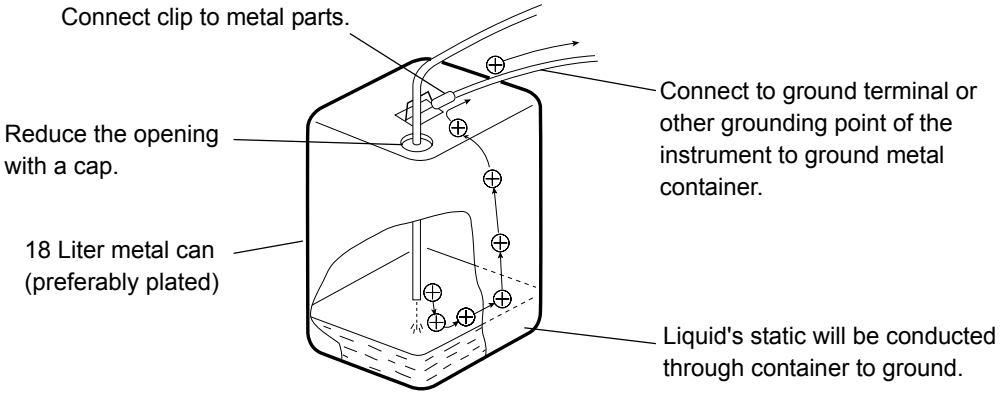
### ⚠ CAUTION

- **Be sure to ground the metal waste container properly.**
  If the grounding wire is not properly attached or connected to the ground, static electricity can build up in the container.

- **Some metal containers have surfaces that are laminated or oxidized, and therefore do not conduct electricity. After grounding the metal container, use a tester to verify that electricity is conducted to the ground.**

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

**Preventive Measures for Static**



### Preventive Measure 2

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

**Accessories for this measure**

Caps for 18 liter or 4 liter containers (with three 3 mm diameter openings)
Part No. S228-21354-91

### Preventive Measure 3

Keep electrostatically charged objects, including the human body, away from the waste liquid container. To prevent electrostatic charging of the human body, take the following precautions:

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

## ⚠ CAUTION

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

### Preventive Measure 4

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

## ⚠ CAUTION

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

**Preventive Measure 5**

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

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

## ⚠ CAUTION

**The above precaution will be ineffective for low conductivity (less than $10^{-10}$ S/m) liquids.**

- **Use as small a container as possible to minimize damage in the event of fire.**
- **Keep the room at a proper humidity.**
  Ambient humidity exceeding 65 % will prevent static.

### For Reference

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

# Precautions for Mobile Phase Selection and Use

## ⚠ CAUTION

- **The following solvent could damage the system. Never use it in the degassing unit.**

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

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

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

- **If PEEK resin parts are used in the plumbing, do not use the following mobile phases. These mobile phases weaken the PEEK resin, which could result in cracked plumbing and mobile phase leaks:**

  Concentrated sulfuric acid, concentrated nitric acid, dichloroacetic acid, acetone, tetrahydrofuran (THF), dichloromethane, chloroform, dimethyl sulfoxide (DMSO), fluorine organic solvents such as hexafluoroisopropanol (HFIP)

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

NOTE

- Use only HPLC grade or comparable mobile phase, and filter it with a filter of 0.45 μm mesh or finer before use to remove particulates and foreign matter.

- Halogen ions can corrode the stainless steel material (SUS316L) used in the plumbing, so if such materials are used for the wetted parts of the equipment, avoid, as much as possible mobile phases that contain halogen ions - such as KCl, NaCl and NH4Cl or mobile phases that generate halogen ions in certain reactions. If such mobile phases must be used, clean all flow lines thoroughly with distilled water immediately after analysis.

- When SPD or a similar UV detector is used for high-sensitivity analysis, be sure to use HPLC grade mobile phases that have a low absorptivity of UV rays.

- Always degas the mobile phase, as air bubbles may tend to form during solvent mixing or during temperature or pressure changes. Air bubbles may cause pump malfunctions and detector signal noise.

- Understand the properties, including boiling point, flash point and viscosity, of the mobile phase.
- Using some mobile phases with pH 10 or above for long periods may damage the flow cell quartz and change its transmission property. After using such mobile phases, be sure to pump HPLC pure water or the equivalent into the flow cell to clean it.

# Action for Environment (WEEE)
# To all users of Shimadzu equipment in the European Union:

WEEE Mark

Equipment marked with this symbol indicates that it was sold on or after 13th August 2005, which means it should not be disposed of with general household waste. Note that our equipment is for industrial/professional use only.

**Contact Shimadzu service representative when the equipment has reached the end of its life. They will advise you regarding the equipment take-back.**

With your co-operation we are aiming to reduce contamination from waste electronic and electrical equipment and preserve natural resource through re-use and recycling.
Do not hesitate to ask Shimadzu service representative, if you require further information.

This page is intentionally left blank.

# Contents

# 1 Configuration

## 1.1 Overview

This instrument is a degassing unit that can continuously remove dissolved gases from liquids using a special degassing membrane.
By connecting this degassing unit to a high-performance liquid chromatograph solvent delivery module, gasses dissolved in mobile phase solvents can be continuously degassed without changing the composition of the mobile phase.
This can prevent the formation of gas bubbles caused by dissolved gases, in the solvent delivery module malfunctions due to bubbles, noise from being generated on the detector baseline, and fluctuations occurring in the detector baseline due to changes in the dissolved gas concentration. It can also improve the stability and reproducibility of HPLC analysis.
This degassing unit includes three or five independent flow lines and provides the same degassing performance and functions for each flow line.
"Fig. 1.1" shows the principle of how the degassing unit operates.

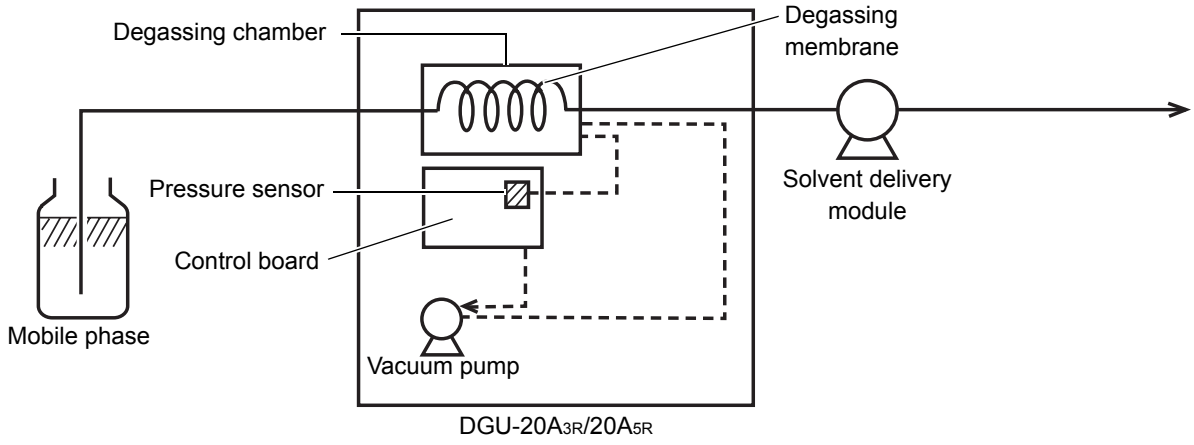



Fig. 1.1

The mobile phase (liquid) that needs to be degassed passes through a degassing membrane contained inside the degassing chamber.
The dissolved gas has a smaller molecular size and higher mobility than the liquid, and has a strong affinity for the degassing membrane. Therefore, it permeates through the membrane into the degassing chamber, is discharged from the degassing unit, and is thereby eliminated from the solvent.

# 1.2 Component Parts

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

| Parts | Part No. | Q'ty | |
|---|---|---|---|
| | | DGU-20A3R | DGU-20A5R |
| DGU-20A3R | S228-54525-01 | 1 | - |
| DGU-20A5R | S228-54525-02 | - | 1 |
| Power cable DSUB 9-pin (1 m) | S228-53484 | 1 | 1 |
| Pressure signal cable pin jack (1 m) | S228-53485 | 1 | 1 |
| Please Read (information booklet) *1 | S228-92124 | 1 | 1 |
| Instruction manual (CD-ROM) *2 | S228-62457-41 | 1 | 1 |
| STOP JOINT *3 | S228-44479-03 | 6 | 10 |
| Ferrule | S228-54508-01 | 6 | 10 |
| Flangeless fitting | S228-46472 | 6 | 10 |
| Standard OUT drain | S228-42205 | 1 | 1 |
| CTO OUT drain | S228-42206 | 1 | 1 |
| Silicone tubing (1 m) | S228-25162-03 | 1 | 1 |
| Straight joint | S225-28163 | 1 | 1 |
| L-joint | S035-61561-12 | 1 | 1 |
| Drain adapter | S228-42204 | 1 | 1 |
| Ground cable | S228-53486 | 1 | 1 |
| Alarm output cable | S228-53487 | 1 | 1 |

*1 The booklet describes information such as precautions for use of the product.
*2 The bound copy of the manual (S228-90933) is available for a fee.
*3 The stop joints are provided with solvents IN/OUT ports in front of degassing unit in advance.

## ■ Optional Parts

If connecting the DGU-20A3R or A5R degassing unit to an LC-6AD or other unit, use the following external power supply kit.

<table>
<tr><th>Part Name</th><th>Part Number</th><th>Remarks</th></tr>
<tr><td>Power Supply Unit For DGU-20A 120 V</td><td>S228-45110-42</td><td>An English instruction manual is enclosed.</td></tr>
<tr><td>Power Supply Unit For DGU-20A<br>220 V to 240 V</td><td>S228-45110-58</td><td>An English instruction manual is enclosed.</td></tr>
<tr><td>PREP/DGU tubing kit<br>(1 flow line)</td><td>S228-54221-41</td><td>When connecting to the LC-20AP, the PREP/DGU tubing kit (1 flow line) must be used due to the difference in outer diameter of tubing.<br>Parts Included
<table>
<tr><th>Part Name</th><th>Part No.</th><th>Q'ty</th></tr>
<tr><td>Instruction manual</td><td>S228-91041</td><td>1</td></tr>
<tr><td>Conversion connector</td><td>S228-54226</td><td>2</td></tr>
<tr><td>FEP tube, 3 × 2</td><td>S670-10321-03</td><td>1 m</td></tr>
<tr><td>Bushing, 3PEEK<br>(for O.D. 3 mm tubing)</td><td>S228-39084</td><td>2</td></tr>
<tr><td>Ferrule 3F-T<br>(for O.D. 3 mm tubing)</td><td>S228-12493</td><td>2</td></tr>
<tr><td>Tube (4 × 3) set*1</td><td>S228-54222-41</td><td>1</td></tr>
</table></td></tr>
<tr><td>PREP/DGU tubing kit<br>(4 flow lines)</td><td>S228-54221-42</td><td>When parallel connecting multiple flow lines to the LC-20AP, the PREP/DGU tubing kit (4 flow lines) must be used.<br>Parts Included
<table>
<tr><th>Part Name</th><th>Part No.</th><th>Q'ty</th></tr>
<tr><td>Instruction manual</td><td>S228-91041</td><td>1</td></tr>
<tr><td>5-way joint set IN *2</td><td>S228-54254-41</td><td>1</td></tr>
<tr><td>5-way joint set OUT *3</td><td>S228-54254-42</td><td>1</td></tr>
<tr><td>Stop plug</td><td>S228-44479-06</td><td>6</td></tr>
</table></td></tr>
<tr><td>4-way Joint *4</td><td>S228-24259-91</td><td>Use this joint when parallel connecting multiple flow lines to the LC-6AD.<br>Four bushings 3D (Part No. S228-18555) for O.D. 3 mm tubing and one end plug 3D (Part No. S228-23119) are included.</td></tr>
<tr><td>5-way Joint *4</td><td>S228-24259-92</td><td>Use this joint when parallel connecting multiple flow lines to the LC-6AD.<br>Five bushings 3D (Part No. S228-18555) for O.D. 3 mm tubing and two end plugs 3D (Part No. S228-23119) are included.</td></tr>
</table>

*1 O.D. 4 mm tubing equipped with a connection fitting for the LC-20AP
*2 An assembly of a branch block to which four lines of O.D. 3 mm tubing are connected with fittings
*3 An assembly of a branch block to which four lines of O.D. 3 mm tubing and one line of O.D. 4 mm tubing with a connection fitting for the LC-20AP are connected with fittings
*4 When using a 4-way joint or 5-way joint, use the FEP tube (part No. S670-10321-03: O.D. 3 mm × I.D. 2 mm × minimum order unit 1 m) at the same time.

NOTE

- For details about the use of the PREP/DGU tubing kit (4 flow lines), 4-way joint or 5-way joint, see "7.3 Connecting Flow Lines in Parallel" P. 7-3.

# 2 Parts Identification and Function

## 2.1 Front

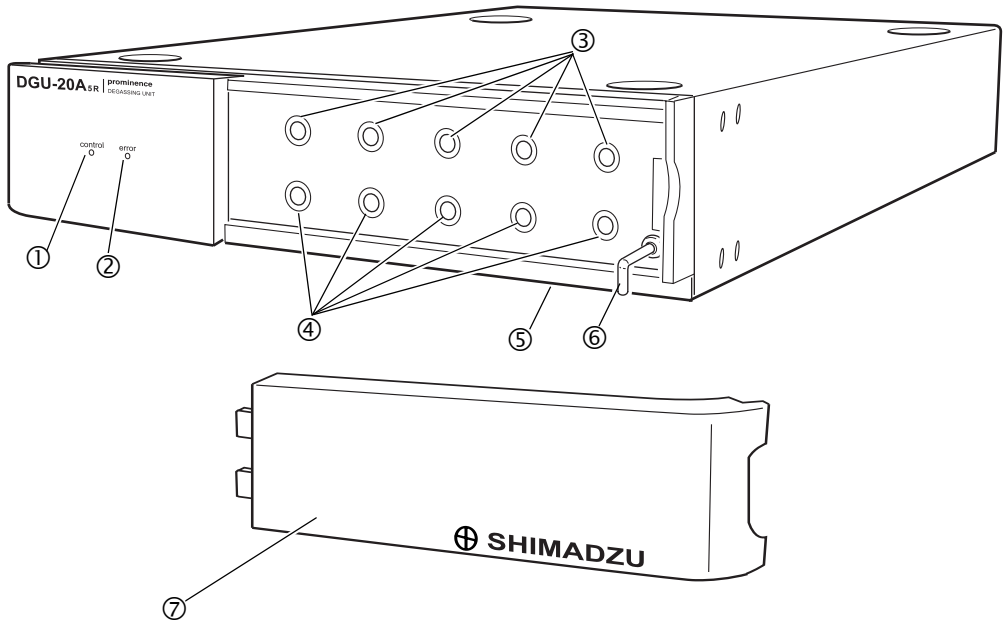



Fig. 2.1

| No. | Display or Indicator | Function |
|---|---|---|
| ① | Control light | The green LED lights when there is sufficient vacuum for degassing and degassing can be performed properly. |
| ② | Error light | The red LED flashes when the target vacuum level is not maintained. After 6 minutes of flashing red, the LED will light without flashing and the vacuum pump will stop.<br>See NOTE in the next page. |
| ③ | Solvent IN/OUT ports | Inlet and outlet ports for the solvent. The upper and lower ports are paired into independent flow lines, so configure tubing connections by combining upper and lower ports. The ports are not specifically designated as either inlet or outlet. |
| ④ | Solvent IN/OUT ports | |
| ⑤ | Leakage drain outlet | Any solvent leakage is discharged via this port and discarded via the waste port for the solvent delivery module, etc., located under the degassing unit.<br>☞ "3.8 Connecting Leakage Drain Tubing" P. 3-9 |
| ⑥ | Exhaust port | Air from the internal flow lines is discharged from this port. |
| ⑦ | Front panel | Protects the tubing connectors.<br>☞ "3.9 Mounting and Dismounting the Front Panel" P. 3-13 |

NOTE

The degassing membrane is made of highly gas-permeable material and may allow permeation of mobile phase or moisture. If the power is turned off while moisture is present in the vacuum line, condensation may occur due to the fluctuation of room temperature. When the power is turned on again in this condition, the pressure in the vacuum line may be unstable temporarily and the [Error] lamp may light up. Take action by referring to "5.1 Troubleshooting and Corrective Action" P. 5-1.

# 2.2 Back

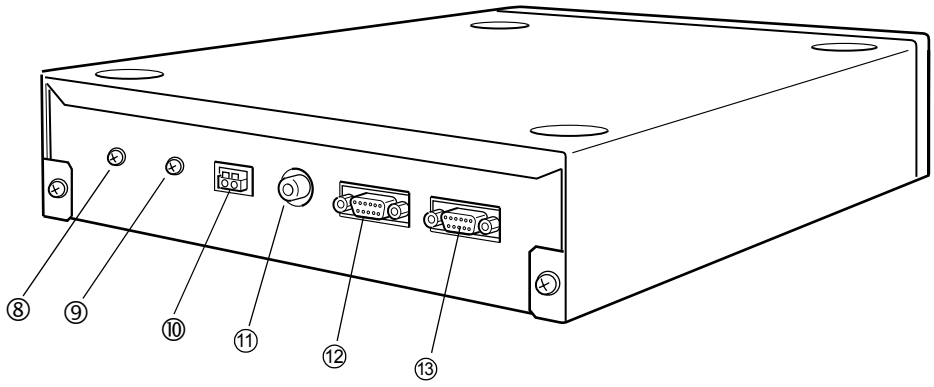



Fig. 2.2

| No. | Display or Indicator | Function |
|---|---|---|
| ⑧ | Ground terminal for degassing unit | Used to ground the degassing unit.<br>☞ "3.4 Connecting the GND Cable" P. 3-4 |
| ⑨ | Ground terminal for [ALARM] | To reduce the external noise for ALARM signal line.<br>☞ "7.4 Connecting the External Output Terminal (ALARM Terminal)" P. 7-4 |
| ⑩ | [ALARM] terminal | Sends external output signal when alarms occur.<br>☞ "7.4 Connecting the External Output Terminal (ALARM Terminal)" P. 7-4 |
| ⑪ | [DGU PRESS OUT] connector | Used to output the vacuum pressure level.<br>☞ "3.6 Connecting the [DGU PRESS OUT] Connector" P. 3-6 |
| ⑫ | [AUX] power supply connector | Supplies power to other components.<br>☞ "3.5 Connecting the [AUX] Connector" P. 3-5 |
| ⑬ | [PUMP] power supply connector | The power cable DSUB 9-pin connector is inserted.<br>☞ "3.3 Power Supply Connection" P. 3-3 |

# 3 Installation

## 3.1 Suitable Sites and Preparation

### ■ Suitable Sites and Preparation

To ensure safe operation, install the instrument in a suitable location that satisfies the following "Installation Site Precautions" P.V.

**⚠ CAUTION**

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

- room temperature is between 4 and 35 °C, with minimal temperature variation through a day.
- air currents from heating or air conditioning equipment are not directed on the instrument.
- sunlight does not shine directly on the instrument.
- there is no vibration.
- humidity stays within 20 - 85 %.
- place without condensation.

### ■ Removing the Shipping Screw

A shipping screw is attached to the instrument for preventing shock during transportation.

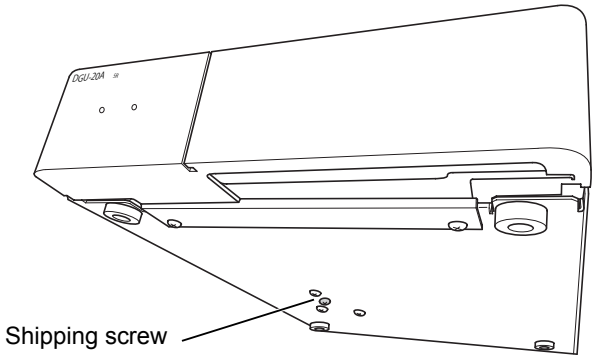



Fig. 3.1

NOTE

Remove the shipping screw before installation.
If the instrument is used with the shipping screw attached, vibrations of the instrument may be transmitted across the system resulting in abnormal noise and noise on the baselines.

# 3.2 Installation

This degassing unit is designed so that it can be installed on the LC-20A series or LC-30AD solvent delivery module. Refer to the installation example illustrated in "Fig. 3.2" when installing the degassing unit.

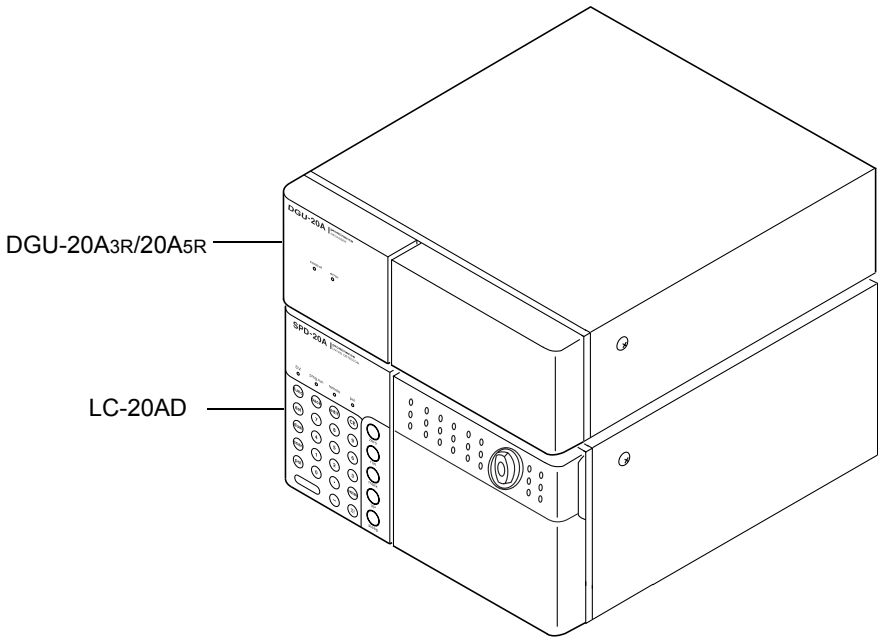



Fig. 3.2

NOTE

Do not install the degassing unit on the bottom level.
The degassing unit does not include a leak sensor, so leakage will not be detected. If installing the unit at the bottom is unavoidable, then refer to Section "3.8 Connecting Leakage Drain Tubing" P. 3-9.

NOTE

It is recommended that the reservoir box containing mobile phase bottles be installed on the top level of the degassing unit. If it is placed below the degassing unit, it is likely, while the power is turned OFF, negative pressure is put on the degassing membrane, generating air and eventually creating bubbles inside the mobile phase tube. When you use the system while placing the reservoir box below the degassing unit, purge the mobile phase thoroughly to remove the bubbles first after the power is turned ON.

# 3.3 Power Supply Connection

Connect the degassing unit to the solvent delivery module using the power cable that is provided (☞ Fig. 3.3).
Power is provided to the degassing unit when the power switch for the solvent delivery module is turned on.
The power supply voltage is 24 volts DC.

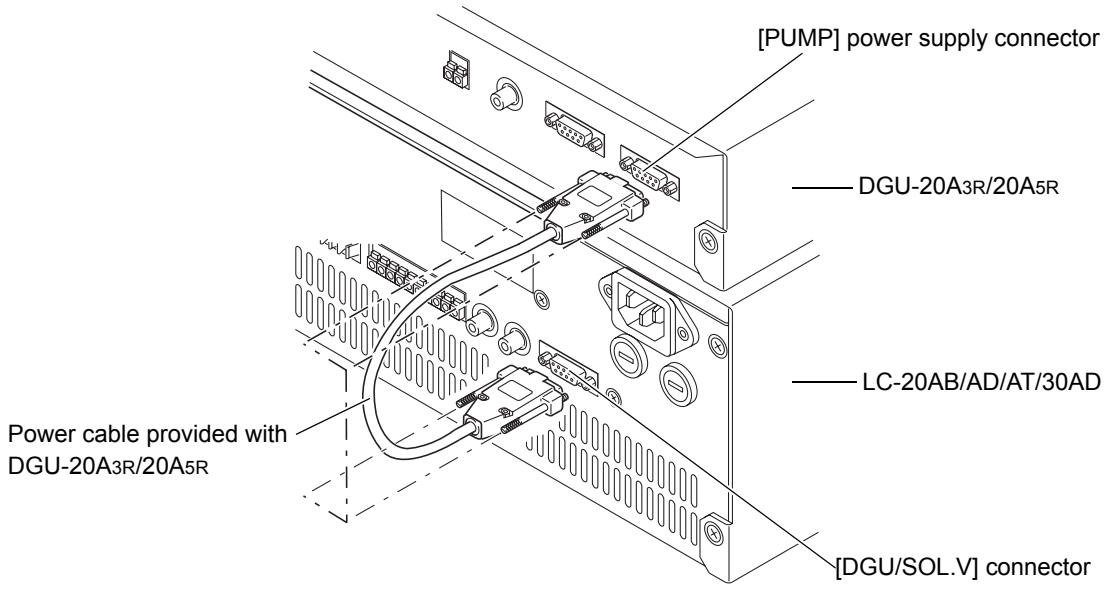



Fig. 3.3

NOTE

If it is difficult to tighten the setscrew for the power cable, use a Phillips screwdriver.

**⚠ CAUTION**

Do not connect two degassing units to one solvent delivery module.
Connecting two degassing units will increase power consumption and may cause a degassing unit or the solvent delivery module to malfunction.

NOTE

This degassing unit can be connected to a solvent delivery module of the LC-VP series (LC-10ADvp/10ATvp) or 10A series (LC-10AD/10AT/10Ai).
In this case, connect the power cable provided with the DGU-20A3R/20A5R to the SOL.V connector on the solvent delivery module.
When using two or more degassing units for one solvent delivery module, install an optional power supply kit. One power supply kit is required for connecting one degassing unit.

# 3.4 Connecting the GND Cable

Due to external noise, when the external output terminal (ALARM terminal) is connected the red LED may light up, or when the DGU PRESS OUT connector (vacuum pressure level output) is connected, the vacuum pressure level may fluctuate. Connect the GND cable as shown in "Fig. 3.4".
Once the M4 screw has been removed, it becomes difficult to insert it again. Loosen the screw to the extent that the crimp-style terminal can be inserted.

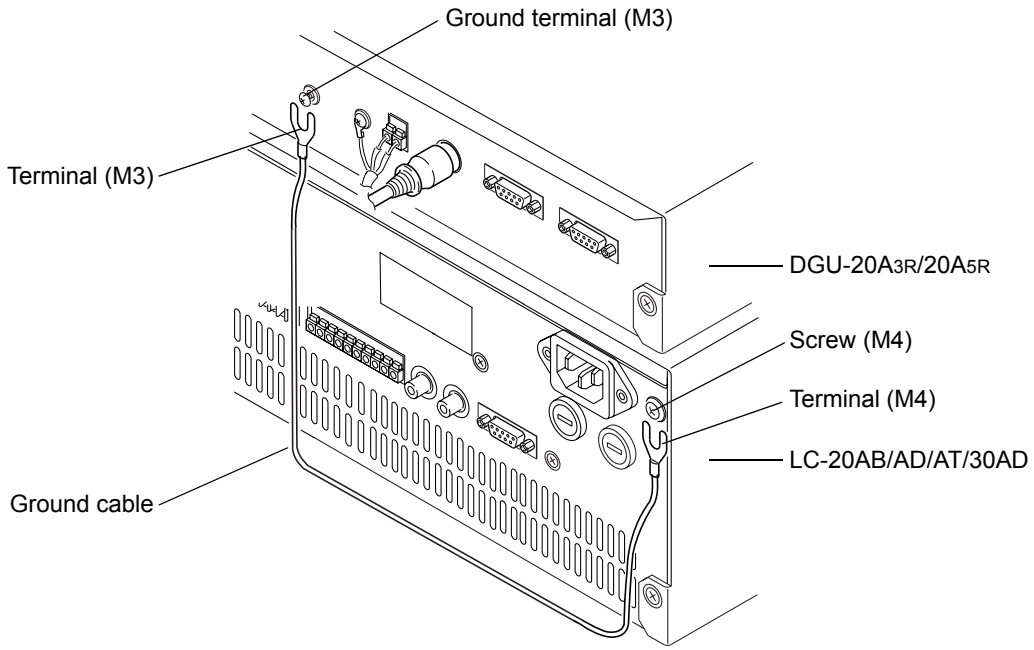



Fig. 3.4

**⚠ CAUTION**

In the case of the LC-VP series (LC-10ADvp/10ATvp), connect the GND cable as shown in "Fig. 3.5".
Once the M4 screw has been removed, it becomes difficult to insert it again. Loosen the screw to the extent that the crimp-style terminal can be inserted.

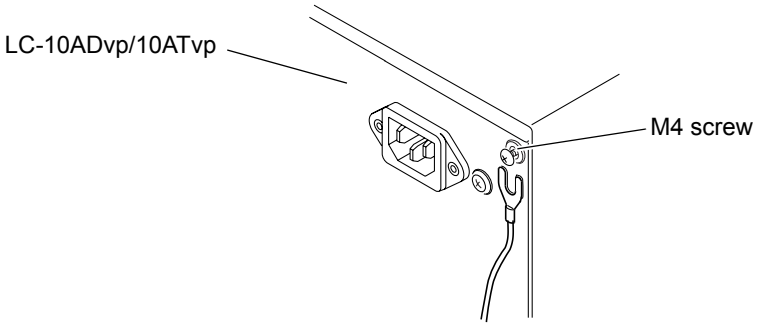



Fig. 3.5

In the case of 10A series (LC-10AD/10AT/10Ai) a grounding terminal is provided on the rear panel. Connect the GND cable to this terminal.

# 3.5 Connecting the [AUX] Connector

Connect the flow-selector valve for the solvent delivery module (FCV Series) to the [AUX] (power-supply) connector on the degassing unit.
The same signal as the output signal is provided from the [AUX] connector to the flat cable connector ( ☞ Fig. 3.6).

(Connection Example)

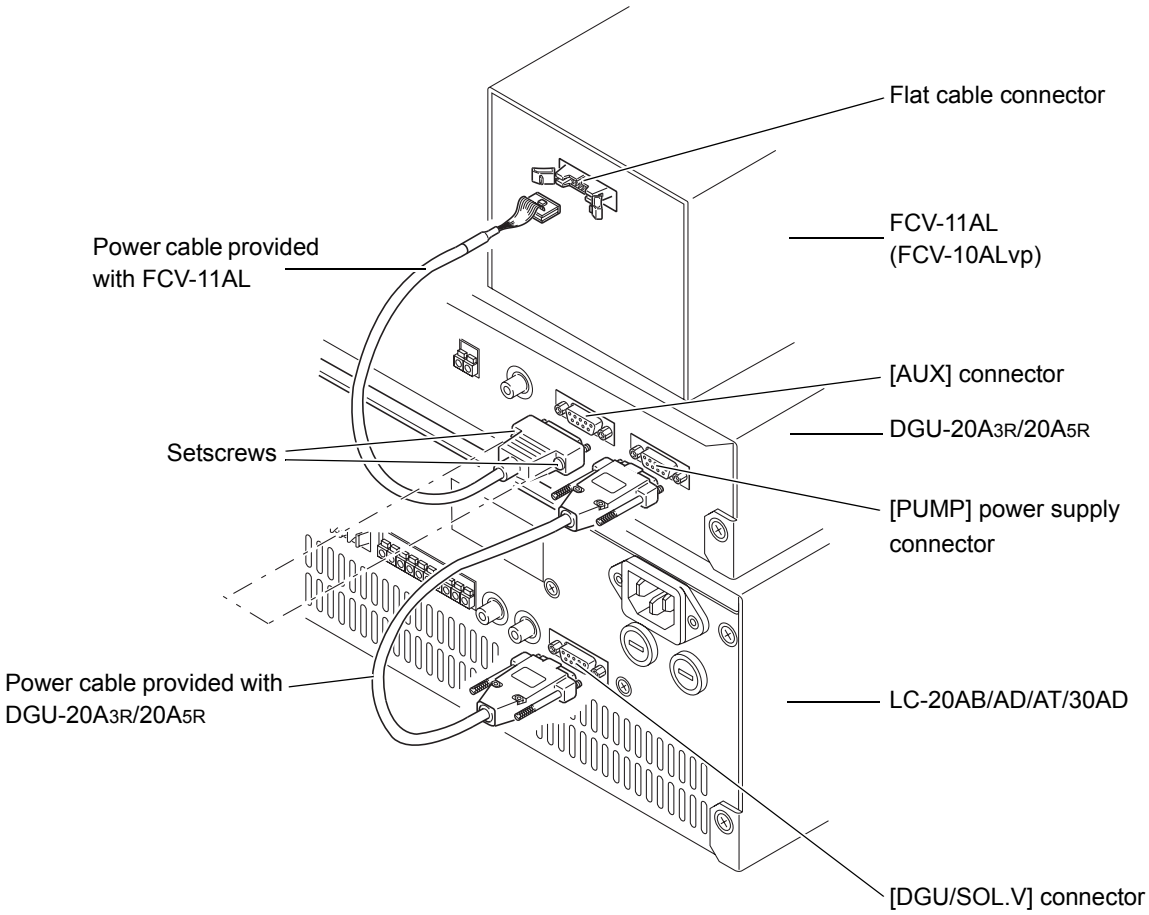



Fig. 3.6

NOTE

Tighten the setscrews at the FCV power cable using the Phillips screwdriver.

# 3.6 Connecting the [DGU PRESS OUT] Connector

If the degassing unit is connected to the solvent delivery module (LC-20AB/AD/AT/30AD) using the pressure signal cable provided, the level of vacuum pressure inside the internal lines of the degassing unit will be displayed on the solvent delivery module monitor.
Please connect the degassing unit to the solvent delivery module using the pressure signal cable included as a standard accessory. (☞ Fig. 3.7)
Please refer to the instruction manual for the solvent delivery module regarding how to display the pressure data.

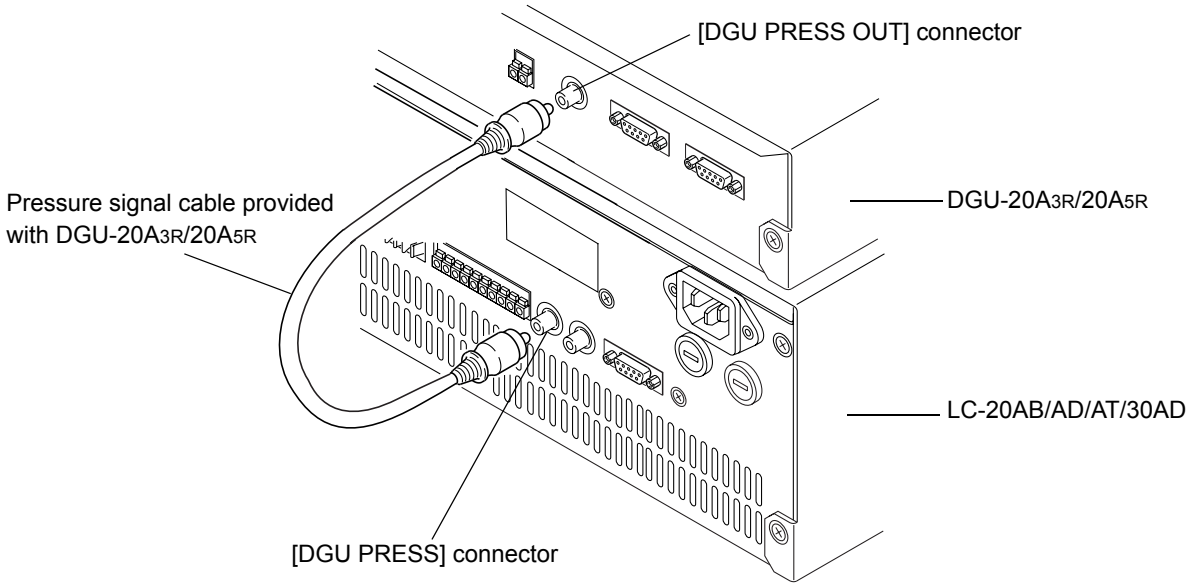



Fig. 3.7

NOTE

The LC-VP series (LC-10ADvp/10ATvp) has the PRESS connector for receiving the output signal from the pressure sensor provided to the solvent delivery module. Do not use this connector for connecting the degassing unit.

# 3.7 Plumbing

Please configure the tubing between the reservoirs and degassing unit and between the degassing unit and solvent delivery module (or low pressure GE unit). (☞ Fig. 3.8)
Before connecting the tubing, remove the stop joints that are installed on the solvent IN/OUT ports of the degassing unit.
(Leave the stop joints installed on the flow lines that are not being used.)
Also, save the stop joints that were removed.
When the degassing unit is not used for an extended period of time, these stop joints are necessary for preventing dust and debris from entering the flow lines.

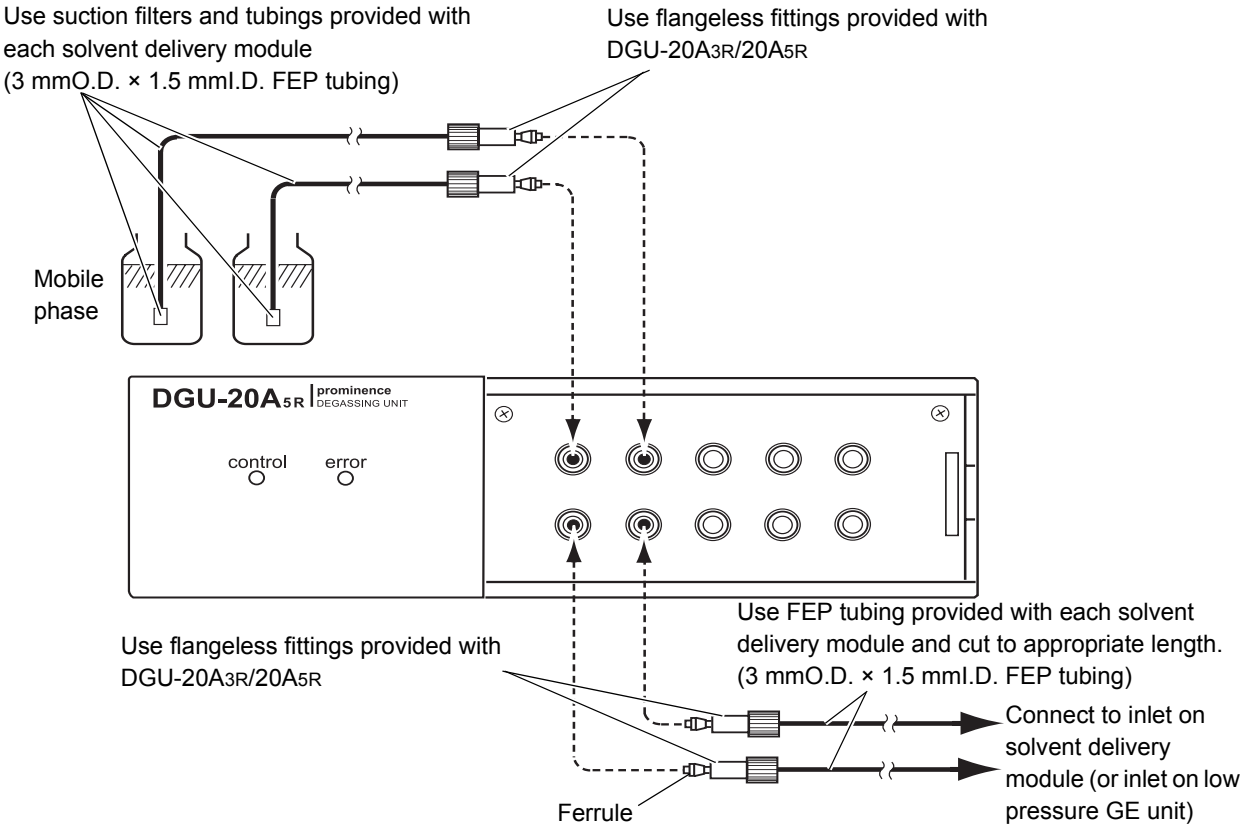



Fig. 3.8

NOTE

- Cut the FEP tubing so the cut face is a right angle. When connecting lines to the degassing unit's solvent IN/OUT ports, be careful of direction of ferrule. (☞ Fig. 3.8) Please make sure the FEP tubing end is pushed in until it contacts the far side of the joint and firmly tighten the flangeless fitting so the ferrule securely grips the tubing. It is secured when the flangeless fitting no longer turns. Do not force the nut beyond that point, as the flangeless fitting could break.
- The FEP tubing leading from the degassing unit OUT ports to the solvent delivery module inlet or from the degassing unit OUT ports to the low pressure GE unit should not be too long. If the tubing is unnecessarily long, it could re-suction air inside the FEP tubing.
- When connecting lines to the inlet of the solvent delivery module, use the connector joints used with each solvent delivery module.

## [Connecting to a Low Pressure GE Unit]

Use the DGU-20A5R model degassing unit to perform gradient up to quaternary with a low pressure GE unit connected to the solvent delivery module.

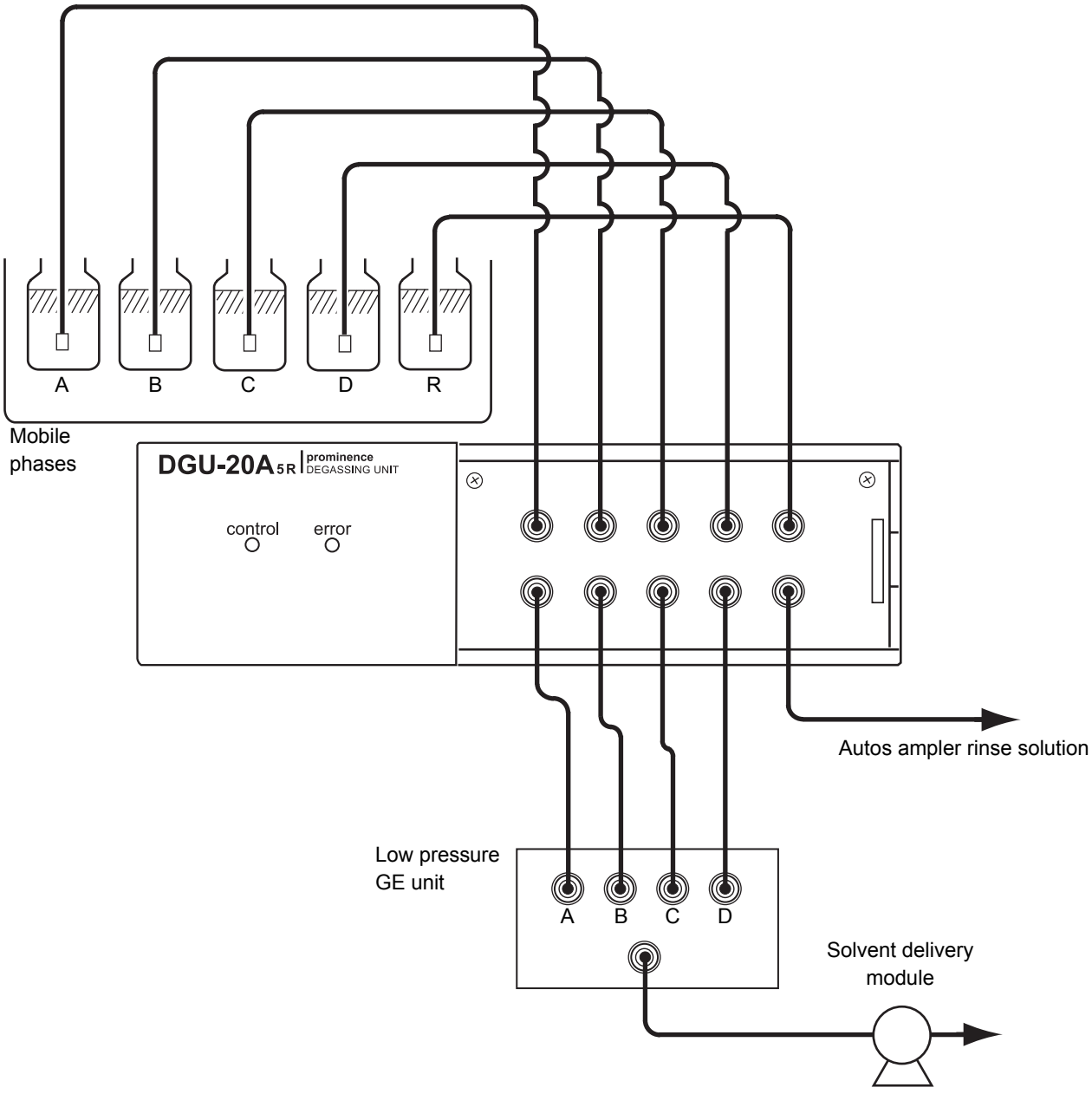



Fig. 3.9

When generating binary or ternary gradients, connect the unused ports on the low pressure GE unit to one of the mobile phase reservoirs. If air fills an unused flow line, the air will mix with the mobile phase and prevent the gradient from being generated properly. Always keep flow lines filled with liquid by keeping unused lines connected as shown in "Fig. 3.9".

# 3.8 Connecting Leakage Drain Tubing

This instrument is designed so that if leaks occur internally (except the column oven), the leaked liquid flows down to the lowest level of the instrument and is drained into the waste container.
The procedure for connecting leakage drain tubing is given below.
(Except for the waste container, all parts shown in the figure on the right are standard accessories.)

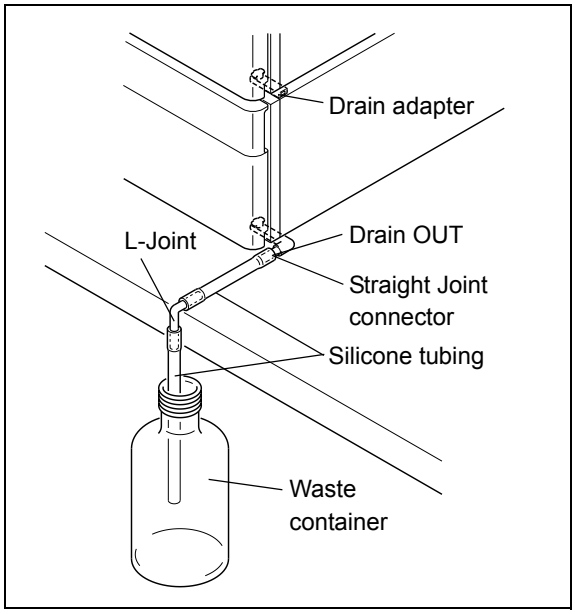



Fig. 3.10

NOTE

- For connecting, cut a silicone tubing into the length in which both of the cut parts will not sag.
- Set the silicone tubing so that its edge does not touch the liquid surface in the waste container.

## Bottom of Instrument

**1** Insert the drain OUT, STD into leakage drain outlet from the front of the instrument.

**2** Turn the drain OUT, STD counterclockwise 45° to secure.

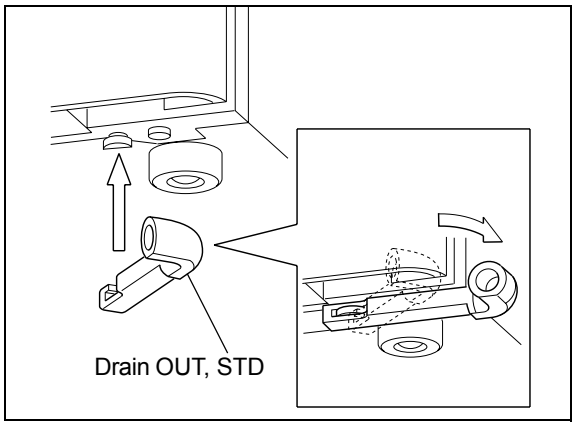



Fig. 3.11

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

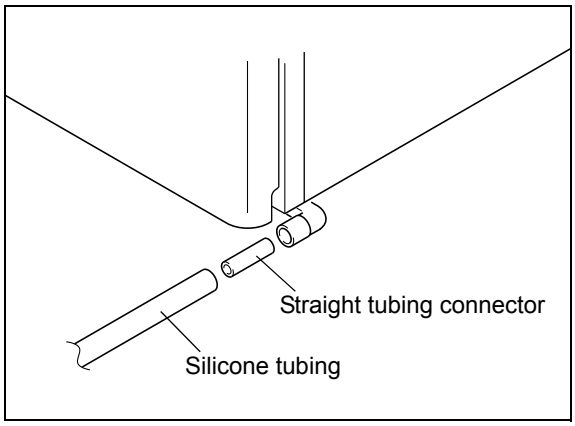



Fig. 3.12

**4** Cut the silicone tubing at the edge of the table, and connect an L-Joint. Let the L-Joint head downward as in the right figure and connect the other cut part of the silicone tubing.

**5** Insert the other end of the silicone tubing into the waste container.

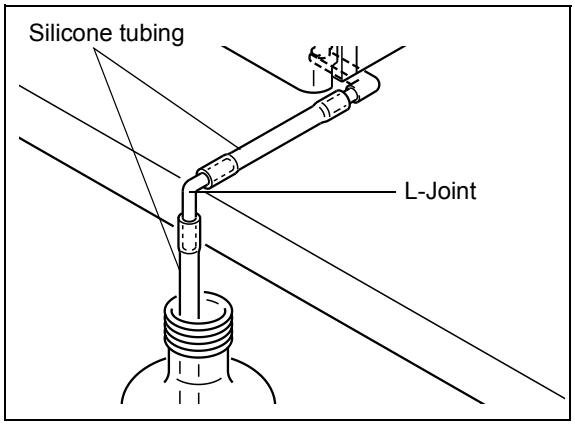



Fig. 3.13

NOTE

To ensure a smooth flow of liquid, insert the silicone tubing into the container with its tip pointing downward.

## Second Unit from Bottom

NOTE

If any components are installed on top of the column oven, carry out the same procedure as in "Installation on top of the column oven" on next page.

**1** Insert the drain adapter into the position shown in the illustration, and slide it on the instrument of bottom.

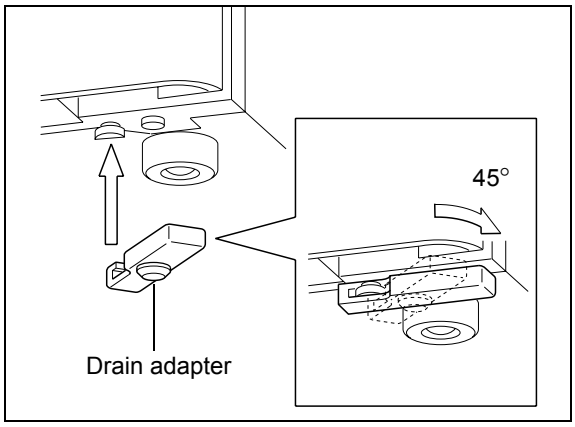



Fig. 3.14

**2** The drain adapter connects the drain outlet to the leakage hole of the bottom unit.

**3** Pour some water onto a spot near the drain outlet of the top unit, and verify that the water flows to the waste container.

●Cross-section of connection parts

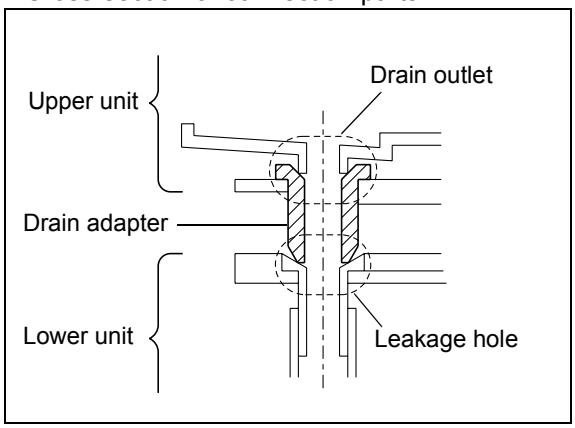



Fig. 3.15

## Installation on Top of the Column Oven

NOTE

When the bottom unit has no leakage hole ("Fig. 3.15"), carry out the same procedure described bellow.

**1** Insert the drain OUT, CTO into leakage drain outlet from the front of the instrument.

**2** Turn the drain OUT, CTO counterclockwise 45° to secure.

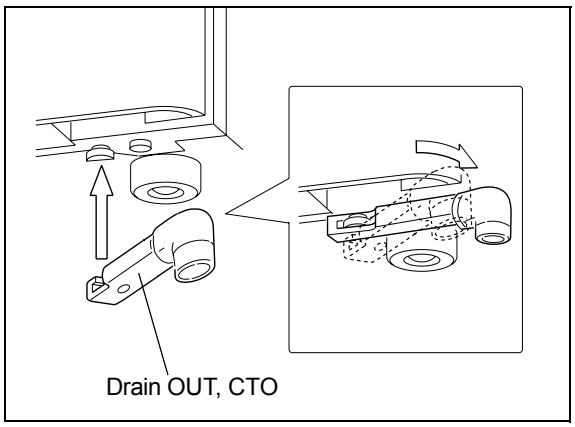



Fig. 3.16

**3** Connect one end of the silicone tubing adapter to the drain OUT, CTO with a straight tubing connector.

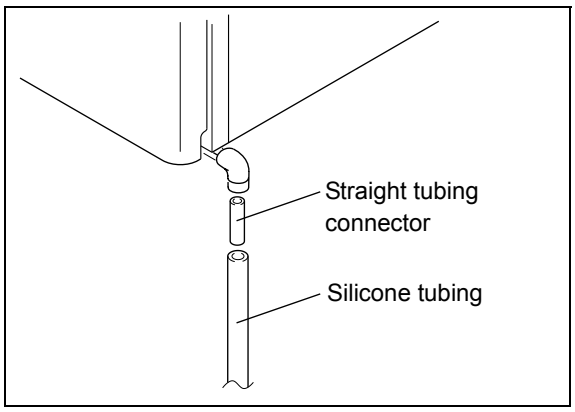



Fig. 3.17

**4** Insert the other end of the silicone tubing into the waste container.
Fig. 3.13

NOTE

- To ensure a smooth flow of liquid, insert the silicone tubing into the container with its tip pointing downward.
- Set the silicone tubing so that its edge does not touch the liquid surface in the waste container. When the tip of tubing touches into the liquid of waste container, the drainage becomes difficult to flow.

# 3.9 Mounting and Dismounting the Front Panel

1 To connect tubings from reservoirs or solvent delivery module to the degassing unit, remove the front panel, as shown in "Fig. 3.18".

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

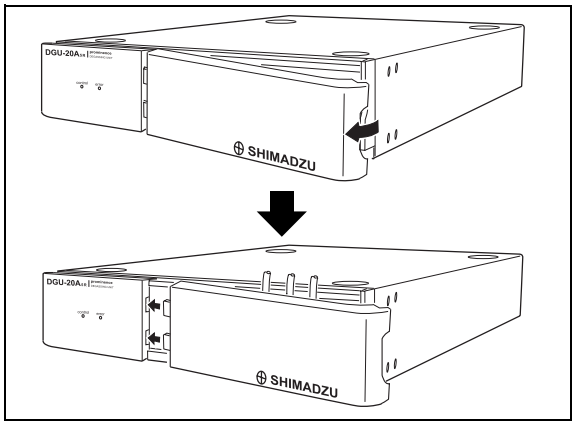



Fig. 3.18

This page is intentionally left blank.

# 4 Operation

## 4.1 Introducing Liquid into the Instrument and Starting Solvent Delivery

**⚠ CAUTION**

Never use the following solvents as they may damage the system.

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

**⚠ CAUTION**

Do NOT deliver pressurized solvent to the degassing unit.

Doing so could damage the degassing unit.

**⚠ CAUTION**

When the instrument is turned OFF after analysis using chloroform, be sure to replace it in the flow lines of the instrument with a mutually soluble solution such as isopropyl alcohol (IPA) and ethanol. If the flow lines are left filled with chloroform, chlorine contained in chloroform may cause the metal parts of the flow lines to corrode or air containing vaporized chlorine may damage the pressure sensor.

**1** Turn on the power switch of the solvent delivery module. The vacuum pump inside the degassing unit will begin running and the [Control] LED on the front panel of the degassing unit will light up.

NOTE

The LED indication will change as follows after the power supply is turned on.

- Red LED flashes
  As soon as the power is turned on, the pressure in the vacuum lines is reduced to the set upper pressure limit. If the specified vacuum pressure is not attained within 10 minutes, the red LED will light up and the degassing unit will stop due to an error.
- Green LED stays illuminated
  The vacuum lines are being controlled at the control pressure. (This indicates that the degassing unit is ready to operate.)
- Red LED stays illuminated
  The degassing unit is stopped due to an error because the specified vacuum pressure is not attained. See "5.1 Troubleshooting and Corrective Action" P. 5-1.

The LED indication will change as follows after the green LED stays illuminated.

- Red LED flashes
  The specified vacuum pressure is not attained. If this condition continues for 6 minutes, the red LED will light up and the degassing unit will stop due to an error.
- Red LED stays illuminated
  The degassing unit is stopped due to an error because the specified vacuum pressure is not attained. See "5.1 Troubleshooting and Corrective Action" P. 5-1.

**2** Prepare the mobile phase to be used and connect the degassing unit, the solvent delivery module and the reservoir.
"3.7 Plumbing" P. 3-7

**3** Connect the disposable syringes provided with each solvent delivery module to the solvent delivery module's drain pipe outlets.

**4** Open the solvent delivery module drain valves.
Slowly draw the solvent into a disposable syringe.

NOTE

- Refer to the instruction manual for the respective solvent delivery module regarding how to connect the syringe or operate the solvent delivery module.
- When drawing the solvent into a syringe, pull it slowly so that the flow rate will be 10 mL/min or less. If the solvent is drawn at a high flow rate, the degassing membrane may be overloaded, resulting in damage to the degassing chamber.

**5** Remove the disposable syringe from the drain tubing, put the end of the drain tubing into the waste container, and purge the solvent delivery module.

NOTE

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

**6** Close the drain valve.

# 4.2 Replacing Mobile Phase

Refer to “Replacement of Mobile Phase” in the instruction manual for each solvent delivery module regarding how to replace the mobile phases.
(Including how to replace mobile phases with mutually soluble mobile phases, mutually insoluble mobile phases, or buffer solutions)

NOTE

The tubing used inside the degassing chamber has a very small diameter. If a buffer solution is left in the lines and the mobile phase is replaced with an organic solvent or the buffer solution is left sealed in the degassing chamber for an extended period, salt precipitation formed inside the tubing can block the lines. After delivering buffer solution, always replace buffer solution in the flow line with deionized water. For details, see "6.2 Maintaining the Degassing Unit" P. 6-3.
If normal-phase and reverse-phase solvents are switched repeatedly within a short time, since the properties of these solvents differ greatly, the resin parts in the degassing chamber may alter in volume temporarily and allow a trace of mobile phase to permeate into the vacuum tube. This could destabilize vacuum performance, causing the [Error] lamp to light up.
In such a case, take action by referring to "5.1 Troubleshooting and Corrective Action" P. 5-1.

# 4.3 Degassing Performance

Currently there are two major methods used in liquid chromatography for continuously (on-line) degassing mobile phases.

(1) Pressure reduction type degassing method using a degassing membrane (method used for this degassing unit)
(2) Bubbling helium gas in a mobile phase in the reservoir and driving out the dissolved air.

These two methods have the following characteristics.

| | Pressure reduction degassing method using membrane | Helium degassing method |
|---|---|---|
| Degassing capacity (flow rate dependency) | Solvent is degassed as it flows, so degassing capacity is limited. The higher the flow rate, the lower the degassing capability. | Degassing capacity is the best. With no flow rate dependency, it can be used over a wide range of flow rates. |
| Degassing solvent mixtures | Degassing is possible without changing solvent composition. | Depending on solvent type, continuous helium bubbling can change solvent composition. |
| Reservoir types that can be used | No limits. | To reduce evaporation of solvents to atmosphere from helium bubbling, or for higher degassing efficiency, reservoir (bottle) types are limited. |
| Running cost, etc. | Requires only electricity. Power consumption is minimal, so method is very economical. | Requires helium gas.<br>Requires space to setup helium tanks. |

The DGU-20A3R/20A5R degassing unit employs the "Pressure Reduction Degassing Method Using Membrane", so it has many advantages over systems using the "Helium Degassing Method". However, because the gas is removed by permeating the solvent through a membrane, its degassing capacity (degassing performance) can be limited, depending on the flow rate.
Note that when generating low pressure gradients with the low pressure gradient valve connected, bubble formation can occur above a certain flow rate (the flow rate depends on the solvent being used).

NOTE

The following flow rate ranges can be used to avoid bubble formation during generating gradients when a low pressure gradient valve is connected to the degassing unit.
When one flow line of the DGU-20A3R/20A5R degassing unit is connected to each solvent:

- water/methanol: 1.5 mL/min

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

This page is intentionally left blank.

# 5 Troubleshooting

## 5.1 Troubleshooting and Corrective Action

This section describes the probable causes of problems that can arise, and the corrective action to be taken to eliminate the causes.
If the problem cannot be resolved even after taking the indicated measures, or if there are problems not included in the following tables, contact your Shimadzu representative.

| Symptom | Probable cause | Corrective action |
|---|---|---|
| Bubbles are discharged from a degassing unit OUT port. | A solvent IN/OUT port joint is loose and air is sucked. | • Securely tighten joints<br>• If the joint is damaged, replace it with a new one.<br>Flangeless fitting: Part No. S228-46472 (1 pc) or Part No. S228-46472-02 (2 pcs)<br>Ferrule: Part No. S228-54508-01 (1 pc) or Part No. S228-54508-02 (2 pcs) |
| | The flow rate is too high. | Keep the flow rate within the specification value. |
| | The suction filter at the inlet is clogged and the flow resistance is increased. | Clean or replace the suction filter. |
| | Flow resistance has increased due to a bent suction tubing, etc. | Cut the bent portion of tubing or replace it with a new one. |
| | The amount of solvent in the mobile phase bottle is small and air is sucked. | Supply mobile phase until the suction filter is immersed in the liquid. |
| | Due to incomplete solvent change, dissimilar solvents are mixed in the flow line and are foamed. | Replace the solvent. In particular, when replacing a solvent with low solubility, first thoroughly flush the lines with a solvent that is soluble with to both solvents, and then replace with target solvent. |
| The solvent doesn't flow. | The delivery module has not sent a solvent properly. | Check the solvent delivery module. (See the instruction manual for the solvent delivery module.) |
| | The delivery system (including degassing unit and solvent delivery module) is dirty or clogged. | Especially when replacing buffered solvents, salt deposits may occur depending on the solvent solubility. Try cleaning lines with a suitable solvent first. |
| | Wrong tubing | Check that tubing is connected to the respective flow lines correctly. |

| Symptom | Probable cause | Corrective action |
|---|---|---|
| No power is provided. (The LED does not light up.) | The power cable is connected too loosely to supply the power. | Connect it securely |
| Red error lamp is on. | The evacuation capability of the vacuum pump is lowered due to condensation of solvent gas, etc. (Liquid may drop from the exhaust port.) | The evacuation capability may be unstable temporarily due to condensation of solvent gas in the vacuum line. See "6.2 Maintaining the Degassing Unit" P. 6-3, drain liquid from the degassing unit, remove the stop joint, turn on the degassing unit, and idle the degassing unit for two or three hours. If the [Error] lamp lights up and the degassing unit stops during idle running, turn off the solvent delivery module and back it on, and restart the degassing unit. In the event that the [Error] lamp lights up or any liquid continuously flows out even after the restarting is repeated several times, the degassing unit may have failed. Contact your Shimadzu representative. |

# 6 Maintenance

## 6.1 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 service personnel on a contractual basis.
For information regarding the maintenance inspection contract, contact your service personnel.

**⚠ WARNING**

- Unless the instructions here specified, turn off the power always and unplug the instrument prior to performing inspection and maintenance. Otherwise, fire, electric shock or malfunction may occur.

**⚠ CAUTION**

- When replacing parts, use only the parts listed in "1.2 Component Parts" P. 1-2.
  If any other parts are used, injury or malfunction may occur.
- Never remove the main cover. Otherwise, injury or malfunction may occur.
  Contact your Shimadzu Representative to remove the main cover.

### 6.1.1 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.

## 6.1.2 List of Periodic Inspection and Maintenance

Contact your service personnel for inspections and parts replacement.

> **⚠ CAUTION**
>
> The replacement and maintenance 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 | 1 year | 2 years | 3 years | Remarks |
|---|---|---|---|---|
| Inspection and replacement of vacuum pump intake air filter | × | | | If the filter is fouled badly, replace it. |
| Inspection and replacement of vacuum tubing filter | × | | | If the filter is fouled badly, replace it. |
| Inspection and replacement of vacuum pump *1 | | | × | Check and remove condensation from the vacuum line, and if the vacuum pressure is still unstable, replace it. |
| Inspection and replacement of vacuum tubing *1 | | | × | If the vacuum tubing is hardened or cracked, replace it. |
| Inspection and replacement of degassing chamber *1 | | | × | Check and remove condensation from the vacuum line, and if moisture is still visible inside the vacuum tube, replace it. |

*1 Check every year after three years has passed since the installation.

# 6.2 Maintaining the Degassing Unit

If the solvent delivery module will not be used for a long period, turn off the solvent delivery module power and perform the following procedure.

- Remove the inlet tube and completely extract the solvent inside the degassing unit using a syringe.
- Lastly, store degassing unit by plugging the solvent IN/OUT ports using the stop joints provided.

**⚠ CAUTION**

Be sure to suction out all the solvent from the degassing unit. Do not use any method that would pressurize the degassing unit.

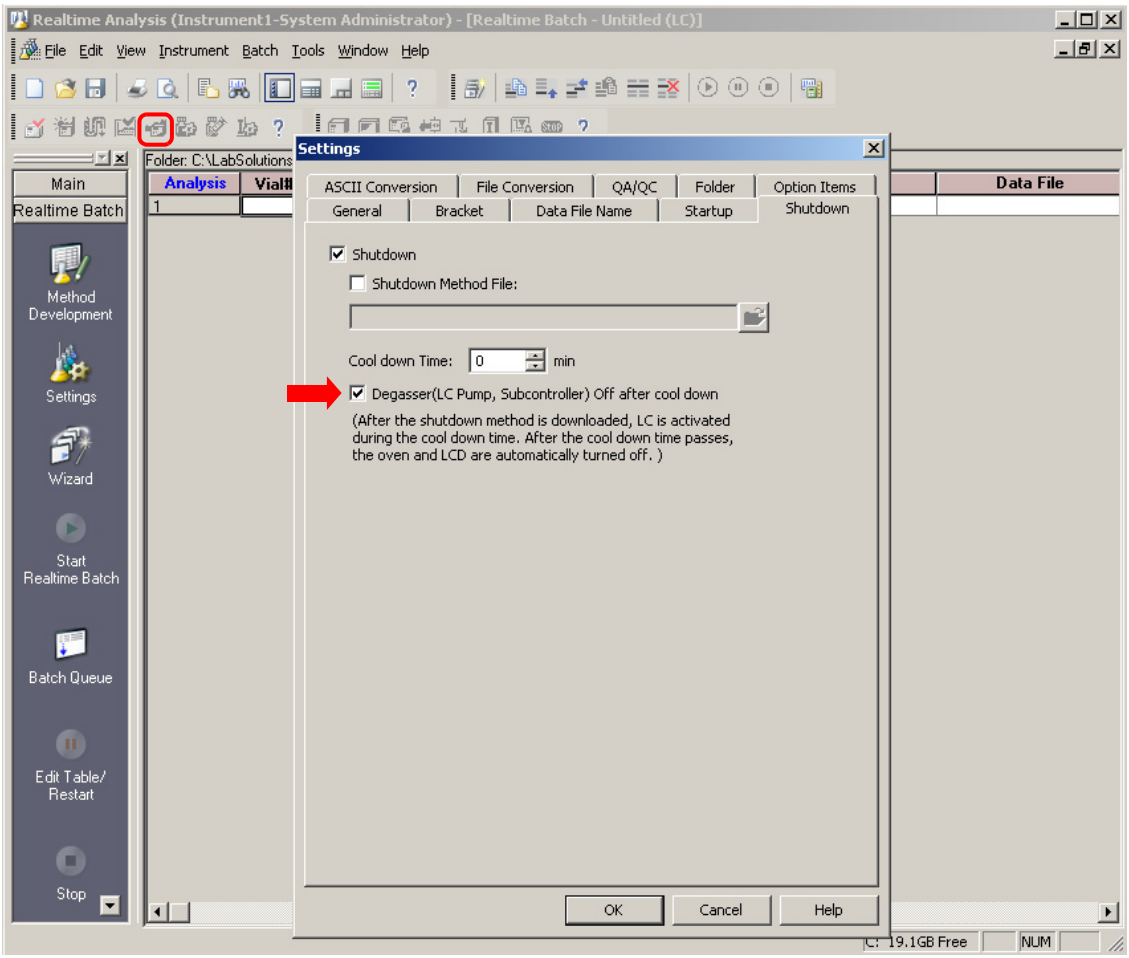
- Especially after using buffer solutions, salt deposits, algae, or microorganisms can form inside the degassing unit (on the membrane), depending on the type of solvent used. Thoroughly clean inside the degassing unit using distilled water or deionized water and replace the water with a solvent such as methanol. (Suction out the degassing unit using the solvent delivery module.) Once replaced, thoroughly remove the solution (methanol, etc.), using a syringe, etc. Plug the solvent IN/OUT ports when storing the degassing unit.
- When drawing the solvent using a syringe, slowly pull it to achieve at a flow rate of 10 mL/min or less. If the degassing unit is used at a high flow rate, the degassing membrane may be overloaded, resulting in a shortened degassing chamber service life.

**⚠ CAUTION**

If the cover or front panel becomes dirty, wipe it with a dry soft cloth or tissue paper. If significantly dirty, apply a neutral synthetic detergent on a cloth, wring it tightly, and wipe the dirt. Once the dirt is removed, soak the cloth in water, tightly wring it out and wipe the area so no detergent remains. Then wipe away any water with a dry cloth.

NOTE

If an LC system that includes the degassing unit is operated from a computer workstation (such as LabSolutions), the shutdown function can be used to shut down the vacuum pump (which stops the degassing function) after analysis is finished.



# 7 Technical Information

## 7.1 Specifications

| Item | Specification |
|---|---|
| Number of flow lines | DGU-20A3R : 3 lines<br>DGU-20A5R : 5 lines |
| Degassing Performance | UV absorption difference with and without using the degassing unit is over 300 mAU in the following conditions.- using UV absorption detector (wavelength of 210 nm, sensitivity 0.5 AU) flowing methanol saturated with dissolved oxygen (HPLC grade at 25 °C) at a rate of 1 mL/min |
| Max. Operating Flow Rate | 10 mL/min per flow line<br>(Reference) Degassing capability: 1 mL/min: 89 %, 10 mL/min: 25 % with respect to He degassing of methanol as 100 %<br>If a degassing capability higher than the above is required, degas the mobile phase using an ultrasonic vacuum degassing system beforehand. |
| Internal Capacity | 400 µL per flow line |
| Pressure Resistance | ±0.1 MPa<br>(only when suctioning with the delivery module. Pressurized delivery to the degassing unit is prohibited.) |
| Tubing | 3 mm O.D. × 1.5 mm I.D. PTFE tubing |
| Materials Contacting Solvents | Fluorine contained resin, PEEK, FEP, stainless steel 316L, PPS |
| External Output | Contact rating: 5 V, 10 mV<br>Vacuum pressure monitor: See the chart below.<br>Voltage / Vacuum Pressure Output<br>2 V / 0 kPa (atmospheric pressure)<br>0.18 V / -90.6 kPa<br>0.1 V / -94.6 kPa |
| Self purge | Includes the mechanism that increases, the degassing capability by taking fresh air during vacuum pump operation |
| Dimensions | 260 mm (W) × 72 mm (H) × 421 mm (D) (not including protrusions) |
| Weight | DGU-20A3R : 3.9 kg (excluding cables)<br>DGU-20A5R : 4 kg (excluding cables) |
| Operating Temperature and Humidity Range | Temp : 4 to 35 °C  Humidity : 20 to 85 % (no dew condensation) |

| Item | Specification |
|---|---|
| Power Supply | 24 VDC, SELV source (supplied from the solvent delivery module through a remote cable) |
| Installation Site (IEC) | Installation category II<br>Pollution degree 2<br>Altitude up to 2000 m<br>Indoor use only |

NOTE

Using the degassing unit at a flow rate higher than the maximum flow rate could cause the solvent to become foamy or overload the degassing chamber, resulting in damage to the degassing chamber.

# 7.2 Connecting Flow Lines in Series

A higher level of degassing is possible if the flow lines are used in series.
The maximum operating flow rate when connected serially is 5 mL/min for two lines in series, 3.33 mL/min for three lines in series, and 2.5 mL/min for four lines in series.
(Example shows two flow lines connected in series.)

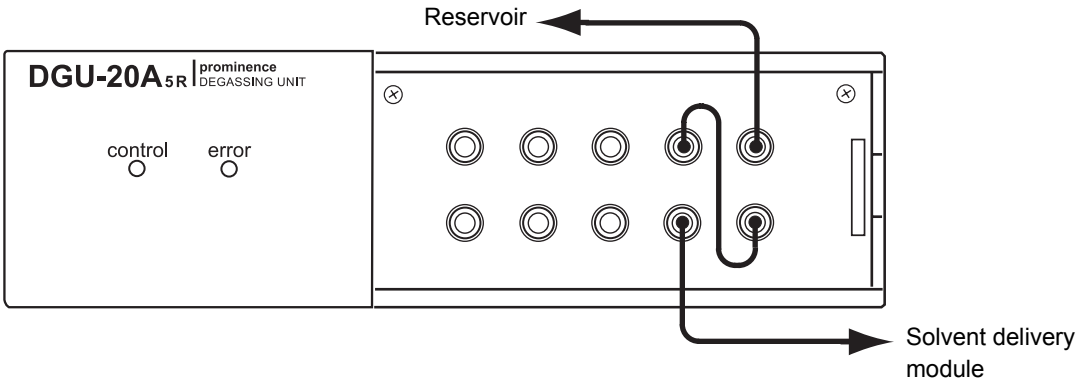



Fig. 7.1

# 7.3 Connecting Flow Lines in Parallel

The maximum flow rate for each flow line of the DGU-20A3R/20A5R degassing unit is 10 mL/min, but by utilizing the lines in parallel, it is possible to degas at rates as high as 40 mL/min.
When using multiple parallel flow lines with the LC-20AP, purchase one PREP/DGU tubing kit (4 flow lines) (part No. S228-54221-42).
When using multiple parallel flow lines with the LC-6AD, purchase two 4-way joints (part No. S228-24259-91) or two 5-way joints (part No. S228-24259-92) and as many FEP tubes (part No. S670-10321-03: O.D. 3 mm × I.D. 2 mm × minimum order unit 1 m) as required.

(Example shows flow lines connected in parallel.)

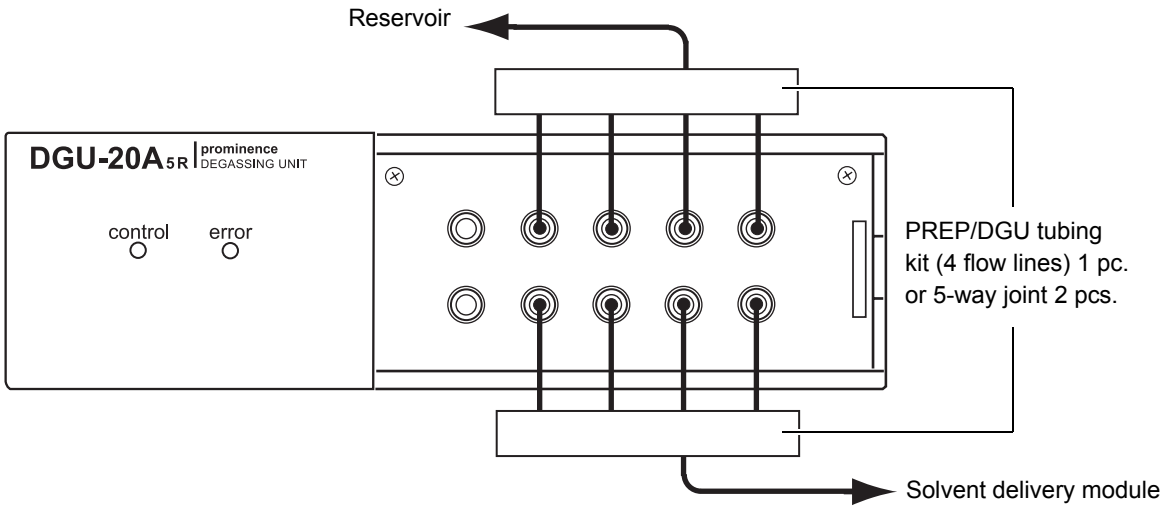



Fig. 7.2

NOTE

- If a high degassing capability is required for a high flow rate, degas the mobile phase using an ultrasonic vacuum degassing system beforehand.
- The 4-way joint is used for branching one flow line into three or merging three flow lines into one. (Maximum flow rate: 30 mL/min)
- The 5-way joint is used for branching one flow line into four or merging four flow lines into one. (Maximum flow rate: 40 mL/min)
- The PREP/DGU tubing kit (4 flow lines) is used for branching one flow line into four or merging four flow lines into one. (Maximum flow rate: 40 mL/min)
- By using stop plugs attached to the 4-way joint, 5-way joint or PREP/DGU tubing kit (4 flow lines), the number of branching or merging lines can be reduced.

# 7.4 Connecting the External Output Terminal (ALARM Terminal)

## 7.4.1 Wiring Method

**1** Insert the core of the alarm output cable into the alarm terminal hole.

**2** Remove the Ground Terminal screw. Position the crimped terminal at the end of the shielded wire and fasten it in place with the screw.

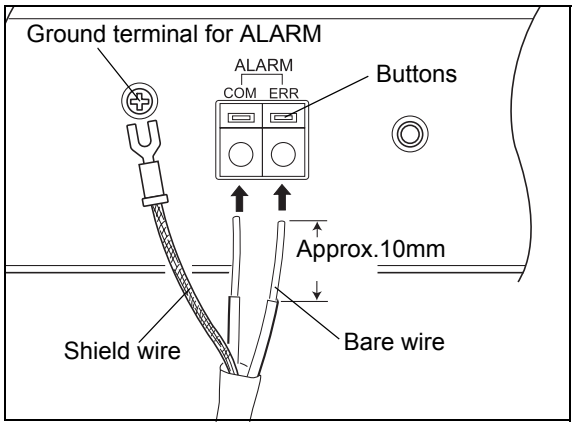



Fig. 7.3

## 7.4.2 Connecting to External Units

(1) To stop the solvent delivery module LC-20A series (20AB, 20AD, 20AT, 20Ai, 20AR) or LC-30AD using the output signal from the [ALARM] terminal, connect the signal to [PUMP OFF] and [COM].
(2) If a solvent delivery module or column oven is controlled from the CBM-20A unit, connecting the degassing unit to the [IN1], [IN2] or [IN3] terminal of the CBM-20A enables stopping the delivery module and oven by the external output signal from the degassing unit.

**⚠ CAUTION**

When connecting the [ALARM] terminal to external units, each terminal should be connected correctly as shown in "Fig. 7.4". (Be careful not to switch the left and right wires.)

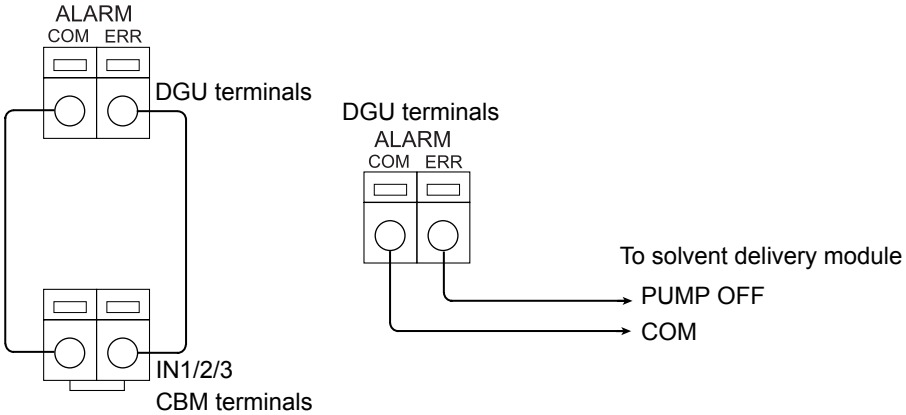



Fig. 7.4