

**AUTOINJECTOR AOC-20i  
AUTOSAMPLER AOC-20s  
INSTRUCTION MANUAL**

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



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# Introduction

## Read this manual thoroughly before using the instrument.

Thank you for purchasing this instrument.

This user's manual describes the operation procedure for Autoinjector AOC-20i/Autosampler AOC-20s, its relevant accessories and optional units. 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, ensure that 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 for product installation, adjustment, or re-installation (after the product is moved) is required.

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## Indications Used in the Manual

This user's manual classifies warning messages as follows according to the degree of hazardousness and property damage:

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.

## Safety Instructions

The AOC-20i Autoinjector and AOC-20s Autosampler automatically inject liquid samples into a gas chromatograph. 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.

1. Do not use for any purpose other than the above-mentioned types of analyses.
2. Follow the procedures described in the Instruction Manual, otherwise the instrument may not be used safely.
3. Observe all warnings and precautions.
4. Do not disassemble or modify the unit without the express approval of an authorized Shimadzu representative.
5. For internal repair of the product, contact your Shimadzu representative.

### ■ Installation Precautions

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

## ■ Operation Precautions

### WARNING

- **USE CARE WHEN HANDLING FLAMMABLE SOLVENTS OR SAMPLES**

To prevent flammable solvents or samples (such as carbon disulfide) from evaporating and filling the installation site, securely tighten the cap that holds the septum in place on all vials (including rinse solvent and waste liquid vials).



#### NOTE

##### Installation Precautions

Be sure to use the optional sample cooling fan when working with solvents with particularly strong flammability, such as carbon disulfide.

For other flammable solvents or samples, it is also recommended to use the sample cooling fan.

- Prevent spills by never exceeding the waste liquid vial capacity.

If the waste liquid vial overflows or the vapor fills the installation site, the heat from the injection port could ignite the liquid or vapor, causing a fire.

## ■ Inspection and Maintenance Precautions

### WARNING

- Contact your Shimadzu Service Representative for removing the cover of the power supply unit. Otherwise, electric shock could occur.

## ■ Emergency Procedures

If any abnormality is found in Autoinjector AOC-20i/Autosampler AOC-20s, bring the device to an emergency shutdown.

After the emergency shutdown, DO NOT restart immediately, but inspect the autoinjector/autosampler carefully and contact your Shimadzu representative as necessary.

### Emergency Shutdown Operation

1. Turn OFF the switch on the power supply unit.
2. Unplug the power cable to shut off the power supply.

For the autoinjector/autosampler featuring a built-in power supply unit in the gas chromatograph, bring the GC to an emergency shutdown by the following procedure.

1. Turn OFF the gas chromatograph power switch.
2. Shut off the power supply to the gas chromatograph.
  - If the power cable is fixed with screws to the switchboard, turn OFF the switch on the switchboard.
  - If the power cable is connected with a plug, unplug the power cable.

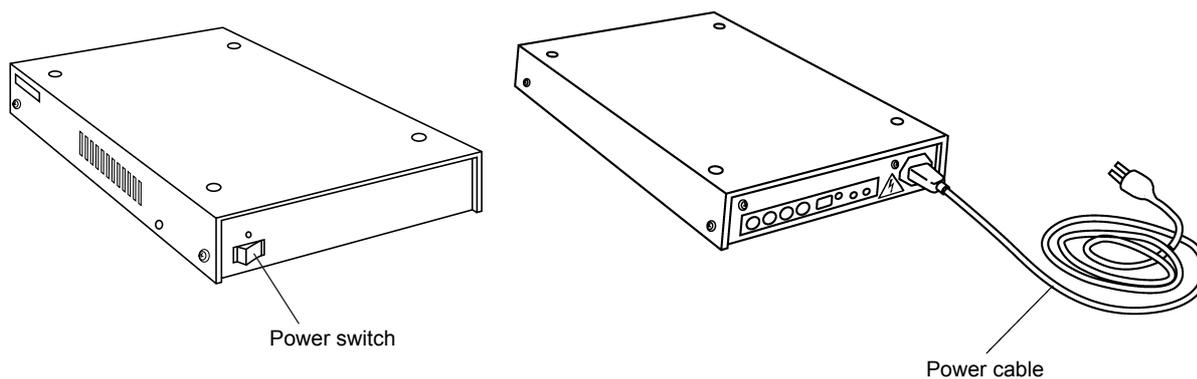


Figure 1 Power switch and power cable (External power supply unit)

## ■ Measures During Power Outage

Take the following measures in the event of power outage.

1. Switch OFF power to the autoinjector and the autosampler (the gas chromatograph for a built-in power supply unit).
2. After the power outage recovery, use the standard startup procedure to start the autoinjector and the autosampler.

## Warning Labels

For safety operation, warning labels are affixed to where special attention is required. Should any of these labels peel off or be damaged, obtain replacements from Shimadzu Corporation.

### ■ Autoinjector

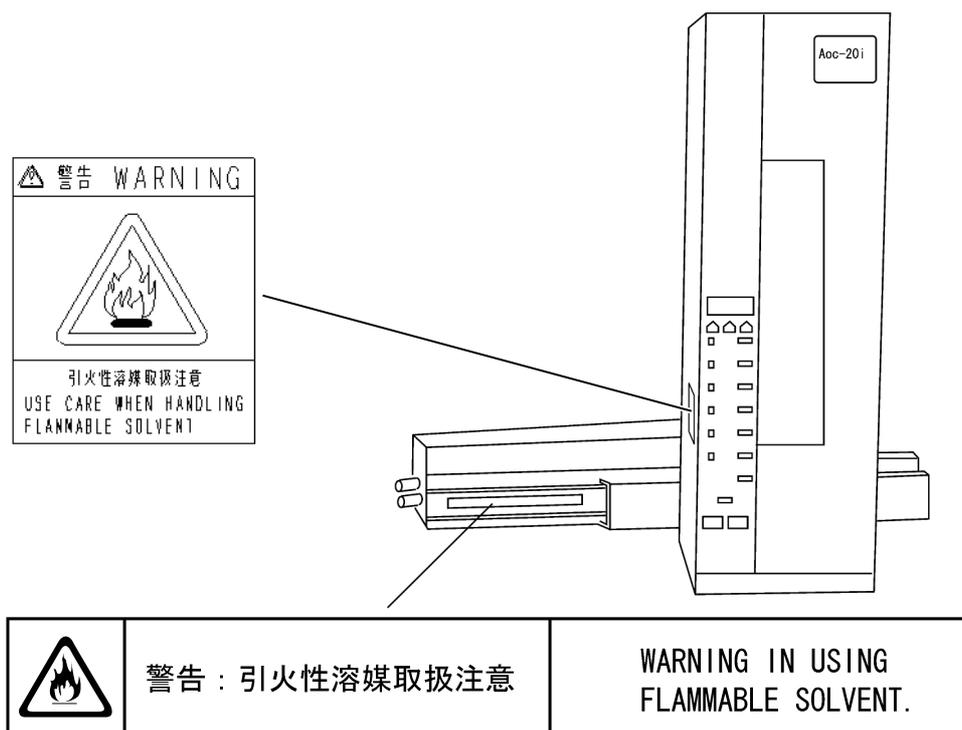


Figure 2

### ■ Power Supply Unit

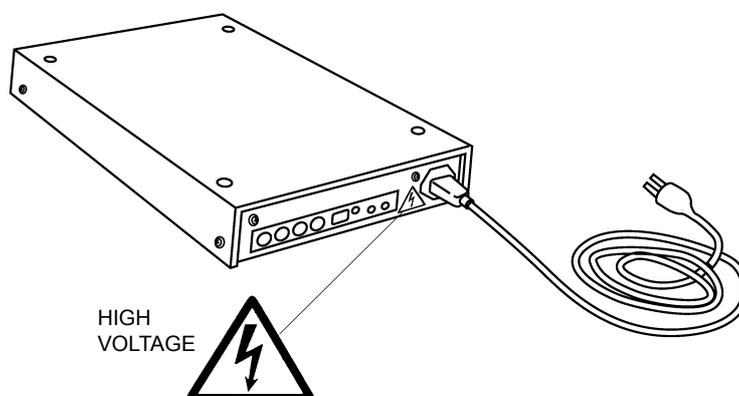


Figure 3

# Product Warranty

Our company provides a warranty on this product, as stated below.

- 1. Warranty Period:** Please consult your Shimadzu representative for information about the extent of the warranty.
- 2. Warranty Description:** If failure occurs for reasons attributable to our company during the warranty period, our company will provide repairs or the replacement of parts without charge (including USB dongles). However, we may not be able to provide identical products in the case of products such as PCs, and their peripherals and parts, which have a short life span in the market.
- 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. Warranty Exceptions:** The failures caused by the following events are excluded from the warranty, even if they occur during the warranty period.
  - 1) The product is handled in an improper way.
  - 2) Repairs or modifications are performed by companies or people other than our company and our designated companies.
  - 3) This product was used in combination with hardware or software other than those designated by our company.
  - 4) Device failures and damage to data and software, including the basic software, that are caused by computer viruses.
  - 5) Device failures and damage to data and software, including the basic software, that are caused by power failures, including power outages and sudden drops of voltage.
  - 6) Device failures and damage to data and software, including the basic software, that are caused by powering off the device without the proper shutdown procedure.
  - 7) Failures are caused by reasons other than the device itself.
  - 8) Failures are caused by the use in harsh environments, such as in high temperature or humidity, corrosive gas, or vibration.
  - 9) Failures are caused by fires and earthquakes or any other act of providence, contamination by radio active substances and hazardous substances, or any other force majeure event including wars, riots, and crimes.
  - 10) Problems that occur because the device is transferred or transported after installation.
  - 11) Expendable items and parts  
Note: Recording media such as floppy disks and CD-ROMs are considered expendables.

\* If there is a document such as a warranty attached to the product, or there is a separate contract agreed upon that includes warranty conditions, the rules stated in those documents shall be followed. Warranty periods for products with special specifications and systems are provided separately.

## After-Sales Service and Replacement Parts Availability

### After-Sales Service

If any problem occurs with this instrument, inspect it and take appropriate corrective action as described in the "[6 Troubleshooting](#)" P.151. 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.

## Disposal Precautions

When disposing the AOC-20i/AOC-20s, contact your Shimadzu representative.

If disposing the product inappropriately, the environment could be polluted by substances in its parts.

## Inspections and Maintenance

To maintain the performance of the product over the long term and ensure accurate measurement data, daily inspections as well as periodic inspections and calibration are required.

- For details on daily inspections and replacement parts, see "[5 Maintenance](#)" in this manual.
- For details on periodic inspections and calibration, contact your Shimadzu representative.
- The replacement cycle for periodic replacement parts should only be regarded as a guide. The replacement cycle may be shorter depending on the operation environment and frequency of use.

# Electromagnetic Compatibility



## NOTE

Descriptions of this section are only applied to the following models:

- S221-72315-38 AOC-20i for GC-2010
- S221-72315-38 AOC-20i for GC-2010Plus
- S221-72314-38 AOC-20i for GC-2014
- S221-73957-38 AOC-20i for GC-2025
- S221-72353-38 AOC-20i with external power supply unit
- S221-72300-31 AOC-20s

This instrument complies with European standard EN61326-1: 2006, class A for electromagnetic interference (emission) and minimum requirement for electromagnetic susceptibility (immunity).

## ■ Electromagnetic Interference (Emission)

This instrument is a class A product, designed not for use in residential environment.



## NOTE

When an electromagnetic disturbance occurs to the instruments being used close to this product, take an appropriate distance between the instruments and this product in order to eliminate the disturbance.

## ■ Electromagnetic Susceptibility (Immunity)

Compliance to the standard does not ensure that the instrument can work with any level of electromagnetic interference stronger than the level tested. Interference greater than the value specified in the standard may cause malfunction of the instrument.



## NOTE

Take the following measures before installing and/or using the instrument especially in an industrial location:

- Install the instrument away from the device emitting strong electromagnetic noise.
- Supply power from a different power source from the one emitting strong electromagnetic noise.
- Take the following measures to prevent the occurrence of static electricity.
  - Before touching the instrument, discharge the static electricity charged in operator's body by touching metallic structure connected to the ground.
  - Do not touch the terminals and connectors unconnected with cables, while the instrument is operating.



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# 1

# Overview

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## 1.1 Introduction

1

Shimadzu Autoinjector AOC-20i/Autosampler AOC-20s automatically injects liquid samples to gas chromatographs (GC). It can be mounted to Shimadzu gas chromatographs such as GC-14A/B, GC-15A, GC-16A, GC-17A Ver.1/2/3, GC-1700, GC-18A, and GC-2010/2010Plus/2014/2025.

AOC-20i/AOC-20s for GC-2010/2010Plus/2014/2025 is a built-in power type, where the AOC power supply unit is incorporated in the GC main unit.

The existing "External power type" can also be used with GC-2010/2010Plus/2014/2025, if the AOC-20i installation kit is attached. See ["5.5 Optional Parts" P.149](#).

## 1.2 Components

Autoinjector AOC-20i/Autosampler AOC-20s consists of three units: ❶ Autoinjector, ❷ Power supply unit, and ❸ Autosampler.

(The configuration without the autosampler is also available.)

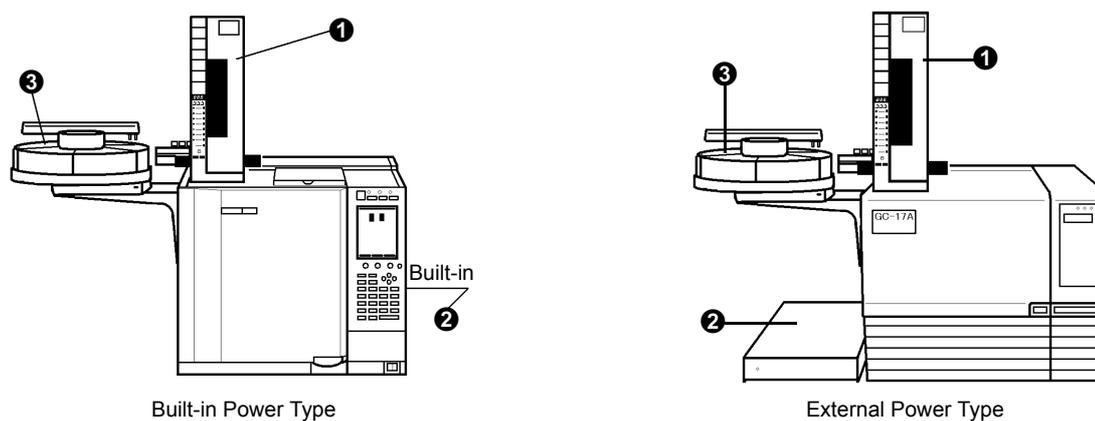


Figure 1-1

	Name		Part No.	Remarks		
❶	Autoinjector		S221-72310-41			
❷	Power supply unit	Built-in power type	For GC-2014	S221-72350-41	The terminals for the built-in power supply unit are located on the gas chromatograph back panel. (See <a href="#">"1.8.3 Power Supply Unit" P.17</a> )	
			For GC-2010/2010Plus			S221-72352-41
			For GC-2025			S221-73959-91
		External power type		S221-72347-42		
❸	Autosampler		S221-72300-41			

## 1.3 System Configuration and Operation

There are four ways to operate autoinjector/autosampler according to the GC configurations described below [(1) to (4)], including the stand alone operation using only the autoinjector keypad and LED display.

This user's manual mainly describes the operation procedure for (2) and (4).

For details on procedures specific to (1) and (3), refer to the instruction manual for the operating PC software such as GCsolution, etc.

1

### ■ GC-2010/2010Plus/2014/2025

#### (1) When Using GCsolution

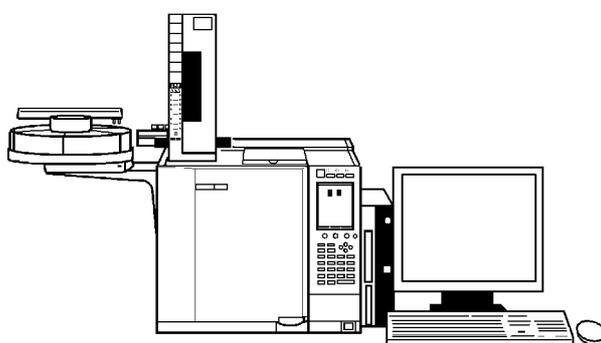


Figure 1-2

Complete the setting to make the autoinjector/autosampler available via the PC software.

In principle, set the parameters for the autoinjector/autosampler via the PC software.

Operate the gas chromatograph keypad only for the function settings not accessible via the GCsolution software.

Operate the autoinjector keypad only for the function settings not available even via the gas chromatograph.

#### (2) When Not Using GCsolution

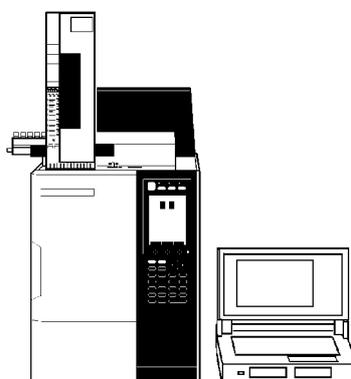


Figure 1-3

In principle, set the parameters for the autoinjector/autosampler via the gas chromatograph.

Operate the autoinjector keypad for the function settings not accessible via the gas chromatograph.

Configure the AOC on the analytical flow line using the [SET] key [Line Config] on the gas chromatograph. (Refer to the instruction manual of the gas chromatograph.)

## ■ Gas Chromatographs Other than GC-2010/2010Plus/2014/2025

- (3) When Using CBM-101/102 or Chromatopac GC Network

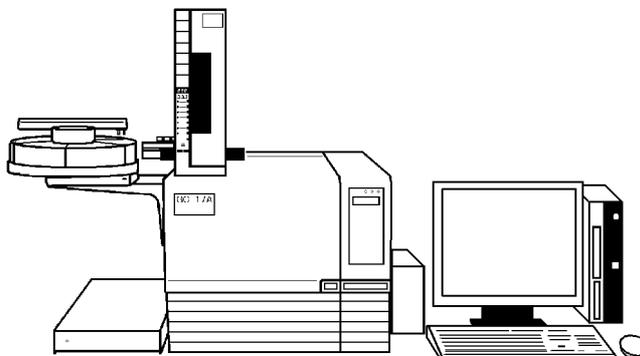


Figure 1-4

In principle, set the parameters for the autoinjector/autosampler via the computer or chromatopac. Operate the autoinjector keypad for the functions not accessible via the operating software.

- (4) In Cases Other than the Above  
(E.g. GC-14A/B+C-R8A, when not using GC network)

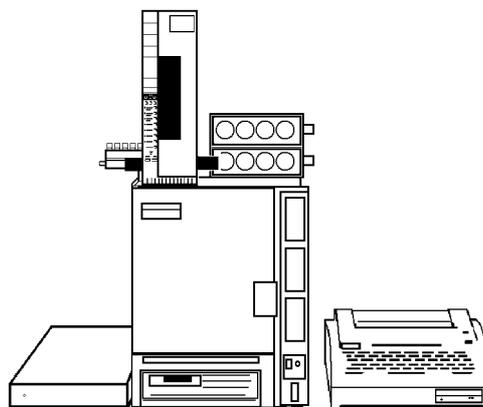


Figure 1-5

Set all parameters via the autoinjector main unit.



### NOTE

When GC-2010/2010Plus/2014/2025 or CBM-101/102 is not linked with AOC-20i/AOC-20s, perform the operation procedure for (4).

---

## 1.4 Unpacking

Carefully inspect the condition of the shipping container before unpacking your AOC-20i/AOC-20s. If you find any severe damage or other problems with the container, contact your Shimadzu representative immediately.

After unpacking the container, verify that all items have been included by referring to the Accessories List given in "[1.5 Accessories List](#)" P.6. If there are any missing parts or damaged items, contact your Shimadzu representative immediately.

1

## 1.5 Accessories List

The autoinjector/autosampler comes with the accessories listed below. When unpacking the container, look through the list and verify that all items have been included.

### 1.5.1 Autoinjector Standard Accessories

	Name	Part No.	Q'ty	Remarks
①	AOC cable	S221-49794-91	1	Ferrite core on the power supply end.
②	Rack guide (short)	S221-45608-91	1	Short Rack Guide Set S221-45610-91
③	4 ml vial rack (for solvent/waste liquid)	S221-32949-01	1	
④	1.5 ml vial rack	S221-45609-92	1	
⑤	Syringe (10 µl)	S221-34618	1	
⑥	Cable clamp	S072-60330-01	1	
⑦	Needle guide	S221-44584	2	
⑧	Plunger holder	S221-44790	5	
⑨	Barrel holder	S221-44780	2	
⑩	Plunger knob (Knurled screw)	S037-02820	1	
⑪	Large vial (4 ml)	S221-34267-91	1 pack (5 pcs.)	
⑫	Large cap (4 ml)	S221-34268-91	1 pack (5 pcs.)	
⑬	Large septum (4 ml)	S221-34266-91	1 pack (15 pcs.)	
⑭	Small vial (1.5 ml)	S221-34272-91	1 pack (20 pcs.)	
⑮	Small cap (1.5 ml)	S221-34273-91	1 pack (20 pcs.)	
⑯	Small septum (1.5 ml)	S221-34239-92	1 pack (40 pcs.)	
⑰	Syringe clip	S221-48989-91	1	
⑱	PAC START cable	S221-35975-41	1	

### 1.5.2 AOC Power Supply Unit

For GC-2010/2010Plus (S221-72351-41)

	Name	Part No.	Q'ty	Remarks
①	AOC power supply unit	S221-72352-41	1	
②	READY/START cable	S221-48405-91	1	power supply unit accessories (P/N S221-48403-91)
③	RS-232C cable for AOC	S221-48406-91	1	

**For GC-2014 (S221-72349-41)**

	Name	Part No.	Q'ty	Remarks
①	AOC power supply unit	S221-72350-41	1	
②	READY/START cable	S221-48405-91	1	power supply unit accessories (P/N S221-48403-91)
③	RS-232C cable for AOC	S221-48406-91	1	

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**For GC-2025 (S221-73958-91)**

	Name	Part No.	Q'ty	Remarks
①	AOC power supply unit	S221-73959-91	1	
②	READY/START cable	S221-48405-91	1	power supply unit accessories (P/N S221-48403-91)
③	RS-232C cable for AOC	S221-48406-91	1	

**For External Power Supply Unit 100 - 120 V (S221-72346-42)**

	Name	Part No.	Q'ty	Remarks
①	AOC power supply unit (100 - 120 V)	S221-72347-42	1	
②	AC cable	S071-60821-08	1	power supply unit accessories (P/N S221-72348-92)
③	READY/START cable	S221-44818-39	1	
④	Stand	S221-44992-92	2	
⑤	Screw, M4 × 8 (for stand)	S020-46547	4	
⑥	Grounding wire	S221-45073-91	1	

**For External Power Supply Unit 220 - 240 V (S221-72346-44)**

	Name	Part No.	Q'ty	Remarks
①	AOC power supply unit (220 - 240 V)	S221-72347-42	1	
②	AC cable	S071-60814-05	1	power supply unit accessories (P/N S221-72348-94)
③	READY/START cable	S221-44818-39	1	
④	Stand	S221-44992-92	2	
⑤	Screw, M4 × 8 (for stand)	S020-46547	4	
⑥	Grounding wire	S221-45073-91	1	

## 1.5.3 Autoinjector Installation Parts

### For GC-2010/2010Plus (P/N S221-44548-93) Standard Accessories

	Name	Part No.	Q'ty	Remarks
①	Spacer, rear left	S221-44585	1	
②	Spacer, front left	S221-44892	1	
③	Spacer, adjuster	S221-45215	1	
④	Spacer, rear right	S221-48270	1	
⑤	Spacer, front right	S221-48271	1	
⑥	Spacer	S037-38786-29	1	
⑦	Spring washer, M4	S023-77040	4	
⑧	Washer, M4	S023-66140-01	2	
⑨	Nut, M4	S023-04140	1	
⑩	Wrench, 7 × 8	S086-03047-04	1	
⑪	Wrench, 5.5 × 7	S086-03047-03	1	
⑫	Screw, M4 × 30, for mounting AOC-20s	S020-46554	4	

### For GC-2014 (P/N S221-44548-94) Standard Accessories

	Name	Part No.	Q'ty	Remarks
①	Spacer, rear	S221-70185	2	
②	Spacer, front right	S221-70183	1	
③	Spacer, front left	S221-44892	1	
④	Spacer, adjuster	S221-70184	1	
⑤	Spring washer, M4	S023-77040	2	
⑥	Washer, M4	S023-66240-01	2	
⑦	Nut, M4	S023-04140	1	
⑧	Wrench, 7 × 8	S086-03047-04	1	
⑨	Wrench, 5.5 × 7	S086-03047-03	1	
⑩	Screw, M4 × 30, for mounting AOC-20s	S020-46554	4	
⑪	Washer, M3	S023-77030	2	
⑫	Clamp	S072-60330-01	2	
⑬	Protection sticker	S221-70923	1	

### For GC-2025 (P/N S221-44548-95) Standard Accessories

	Name	Part No.	Q'ty	Remarks
①	Spacer, front right	S221-73791	1	
②	Spacer, front left	S221-73792	1	
③	Spacer, rear right	S221-73793	1	
④	Spacer, rear left	S221-73794	1	
⑤	Spacer, adjuster	S221-45215	1	
⑥	Spacer	S037-38786-29	1	
⑦	Spring washer, M4	S023-77040	4	
⑧	Washer, M4	S023-66140-01	2	
⑨	Nut, M4	S023-04140	1	
⑩	Wrench, 7 × 8	S086-03047-04	1	
⑪	Wrench, 5.5 × 7	S086-03047-03	1	
⑫	Screw, M4 × 30, for mounting AOC-20s	S020-46554	4	

### For GC-17A, 18A, and 1700 (P/N S221-44548-91) Optional Parts

	Name	Part No.	Q'ty	Remarks
①	Spacer, rear	S221-44585	2	
②	Spacer, front left	S221-44892	1	
③	Spacer, front right	S221-44613	1	
④	Spacer, adjuster	S221-45215	1	
⑤	INJ positioning plate, SPL	S221-44785	1	
⑥	INJ positioning plate, OCI	S221-44785-01	1	
⑦	INJ positioning plate, upper A	S221-44934	1	
⑧	INJ positioning plate, upper B	S221-44935	1	
⑨	Spacer, 2 mm, CU-402	S037-38872-21	1	
⑩	Screw, M3 × 6	S020-46134	4	
⑪	Washer, M3	S023-66130-01	4	
⑫	Spring washer, M4	S023-77040	4	
⑬	Washer, M4	S023-66140-01	2	
⑭	Nut, M4	S023-04140	1	
⑮	Wrench, 7 × 8	S086-03047-04	1	

## For GC-14A/B, 15A, and 16A (P/N S221-44549-91) Optional Parts

	Name	Part No.	Q'ty	Remarks
①	Spacer, rear	S221-44727	2	
②	Spacer, front left	S221-44726	1	
③	Spacer, front right	S221-44895	1	
④	Positioning pin	S221-44725	2	
⑤	Installation bracket	S221-44731	1	
⑥	Positioning plate (PACKED)	S221-44728	1	
⑦	Positioning plate (SPL)	S221-44729	1	
⑧	Positioning plate (OCI)	S221-44730	1	
⑨	Septum nut (PACKED)	S221-44587	2	
⑩	Septum nut (SPL)	S221-44588	1	
⑪	Septum nut (OCI)	S221-45204	1	
⑫	Needle guide (OCI)	S221-45205	1	
⑬	Screw, M3 × 6	S020-46534	2	
⑭	Screw, M4 × 12	S020-46549	4	
⑮	Spring washer, M4	S023-77040	4	
⑯	Nut, M4	S023-04140	1	
⑰	Wrench, 7 × 8	S086-03047-04	1	

## 1.5.4 Autosampler Standard Accessories

	Name	Part No.	Q'ty	Remarks
①	1.5 ml vial rack	S221-44709-91	6	
②	1.5 ml vial rack for autosampler	S221-45181	1	
③	4 ml vial rack	S221-32949-01	2	
④	Large septum, 4 ml, 10 pcs.	S221-34266-93	1	
⑤	4 ml vial, 10 pcs.	S221-34267-93	1	
⑥	Large cap, 10 pcs.	S221-34268-93	1	
⑦	Small septum	S221-41233	20	
⑧	1.5 ml vial, 20 pcs.	S221-34272-91	1	
⑨	Small cap, 20 pcs.	S221-34273-91	1	
⑩	AOC cable	S221-49794-92	1	Ferrite core on both ends.
⑪	Autosampler installation bracket	S221-44486-92	1	
⑫	Autosampler installation plate for GC-17A Ver. 1	S221-44918	1	
⑬	Autosampler installation plate for GC-14B	S221-45168	1	
⑭	Spacer, CB-405	S037-38787-64	2	
⑮	Screw, M4 × 8	S020-46547	1	
⑯	Screw, M4 × 12	S020-46549	2	
⑰	Screw, M4 × 16	S020-46551	3	
⑱	Screw, M4 × 25	S020-46553	4	
⑲	Screw, M4 × 30	S020-46554	4	
⑳	Screw, M3 × 8	S221-46535	6	
㉑	Label, for rack guide	S221-45094	1	
㉒	Washer, toothed lock, M4	S023-81040-01	4	
㉓	Grounding wire	S221-45073-91	1	

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## 1.5.5 Autosampler Installation Parts (for GC-2014, GC-14A/B)

These parts are necessary when using the autosampler at INJ2 to 4 on GC-2014 and GC-14A/B.

Note that these are optional parts, which can be purchased as necessary.

Name	Part No.
Mounting bracket for GC-2014 (for AOC-20)	S221-46217-92
Long rack assembly	S221-45622-91

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## 1.6 Features

### 1.6.1 Autoinjector Features

- (1) Variable injection speed
- (2) High-viscosity sample aspiration available
- (3) Simple and easy attachment to gas chromatographs

### 1.6.2 Autosampler Features

- (1) Using the optional Isothermal cooling/heating vial rack, you can keep samples cool or warm.  
(A circulating constant temperature bath is separately required for supplying cooling/heating water.)

### 1.6.3 Features Common to Autoinjector and Autosampler

- (1) 1.5 ml vials and 4 ml vials are both available.
- (2) Priority analysis is available by specifying a PRIORITY SAMPLE.
- (3) Three different solvents can be used for washing the syringe.
- (4) You can set AOC parameters via the gas chromatograph main unit (when using GC-2010/2010Plus/2014/2025).

## 1.7 Specifications

### 1.7.1 Autoinjector Specifications

Injection Method: Liquid sample injection via microsyringe  
0.5 µl, 5 µl, 10 µl, 50 µl, and 250 µl (optional except 10 µl)

#### CAUTION

- Be sure to use only a designated syringe. Failure to do so may damage the microsyringe, vials, or other parts, or cause instrument malfunctions.
- The short-circuit current rating of this instrument is 50 A.
- This instrument has been designed to operate in an environment categorized as Installation Category II and Pollution Degree 2.
- Use this instrument in locations below an altitude of 2000 meters.
- Use this instrument indoors.

Types of Vials:	1.5 ml screw cap 4 ml screw cap (optional)
Number of Samples:	6 or 12 vials (optional parts required for using 12 vials)
Syringe Speed:	2 modes: Low and high
Plunger Speed:	3 modes: Low, middle, and high
Wait Time:	0 - 99.9 sec following sample aspiration (in 0.1 sec. steps) 0 - 99.9 sec following sample injection (in 0.1 sec. steps)
Injection Volume:	0.01 - 0.50 µl in 0.01 µl steps (0.5 µl syringe) 0.1 - 4.0 µl in 0.1 µl steps (5 µl syringe) 0.1 - 8.0 µl in 0.1 µl steps (10 µl syringe) 0.5 - 40.0 µl in 0.5 µl steps (50 µl syringe) 5 - 200 µl in 5 µl steps (250 µl syringe)
Sample Wash Times:	0 - 99
Solvent Wash Times:	0 - 99
Priority Analysis:	Available
Solvent:	3 different solvents are available.
Solvent Flush:	Available
Power Supply:	100 V AC ± 10% (50 Hz/60 Hz), 250 VA
Dimensions, Weight:	Injector Unit: 200 (W) × 78 (D) × 380 (H) (mm), 2.6 kg External Power Supply Unit: 260 (W) × 420 (D) × 70 (H) (mm), 2.8 kg

## 1.7.2 Autosampler Specifications

Solvent Designated for Solvent Flush:	Available
Standard Addition:	Available
Cooling/Heating:	Available when using a cooling/heating unit (optional) (Temperature range: 0 °C to 60 °C)
Number of Samples:	1.5 ml vials: 25 vials can be set on a vial rack. 4 ml vials: 16 vials can be set on a vial rack.

		Number of Rack	1.5 ml Vials	4 ml Vials
Auto Sampler installation bracket (Standard accessory)		6	150	96
	When Using the Optional Cooling/ Heating Unit	Heating	125	80
		Cooling	75	48
Mounting bracket for GC-2014, GC-14A/B (for AOC-20) (S221-46217-92, Optional)		6	150	96
	When Using the Optional Cooling/ Heating Unit	Heating	75	48
		Cooling	50	32

Cooling/Heating Unit (Optional):	For 1.5 ml vials:	S221-44889-91
	For 4 ml vials:	S221-44999-91

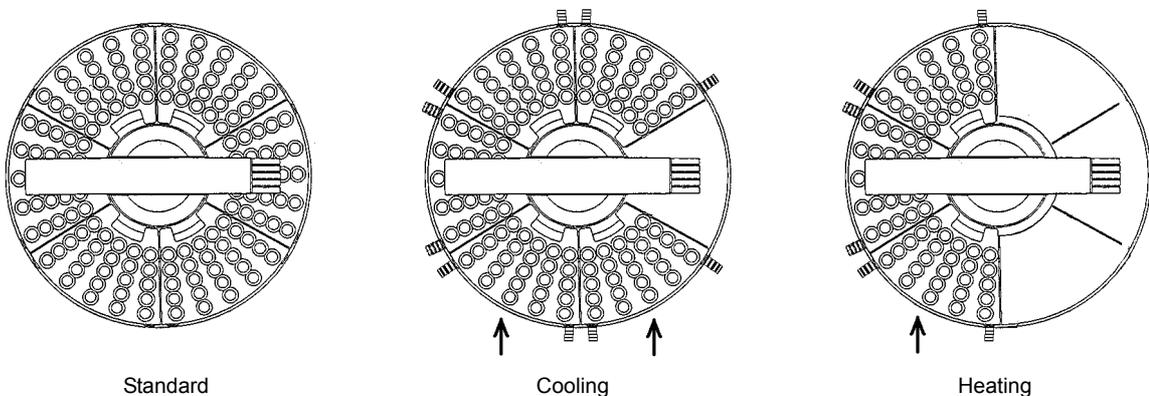


Figure 1-6



### NOTE

When using the Mounting bracket for GC-2014 (for AOC-20), the vial racks indicated by arrows cannot be mounted.

Dimensions, Weight: 320 (dia.) × 135 (H) mm, 2.4 kg

## 1.8 Part Names

### 1.8.1 Autoinjector

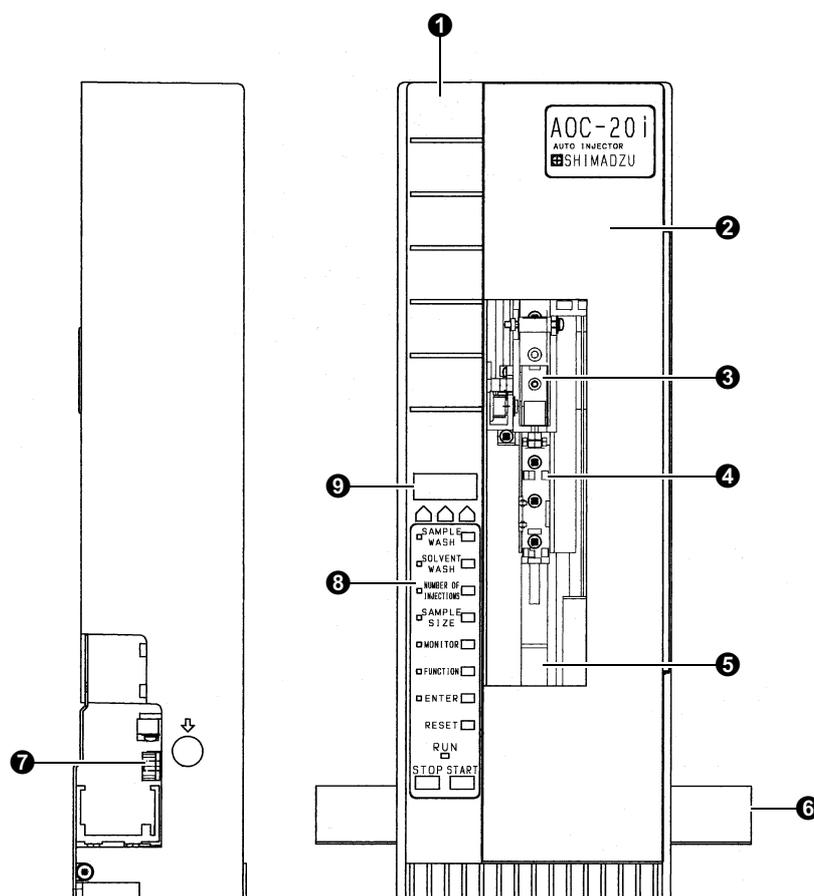


Figure 1-7

No.	Name	No.	Name
①	Case	⑥	Rack guide
②	Door	⑦	Rack gear
③	Plunger drive unit	⑧	Keyboard unit
④	Syringe drive unit	⑨	Display
⑤	Needle guide		

## 1.8.2 Autosampler

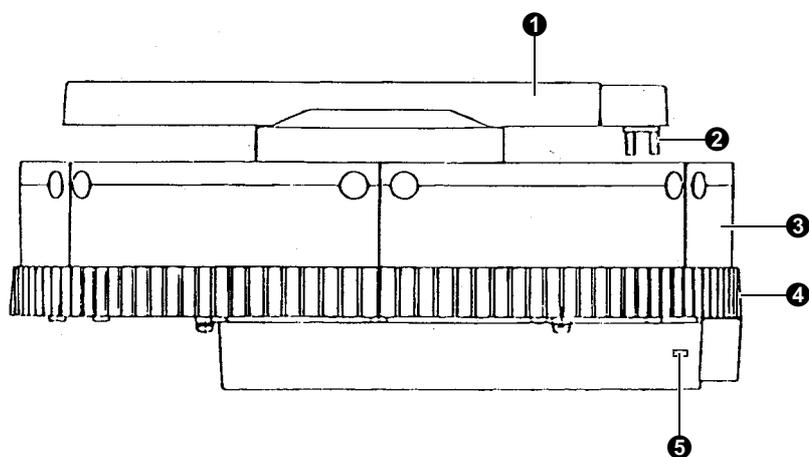


Figure 1-8

No.	Name	No.	Name
①	Arm	④	Tray
②	Gripper	⑤	Power/status indicator
③	Vial rack		

## 1.8.3 Power Supply Unit

### ■ Built-in Power Type

The power supply unit is located at the left bottom on the gas chromatograph back panel.

#### ⚠ WARNING

- HIGH VOLTAGE  
Risk of electric shock. Only authorized Shimadzu service personnel can remove the cover.

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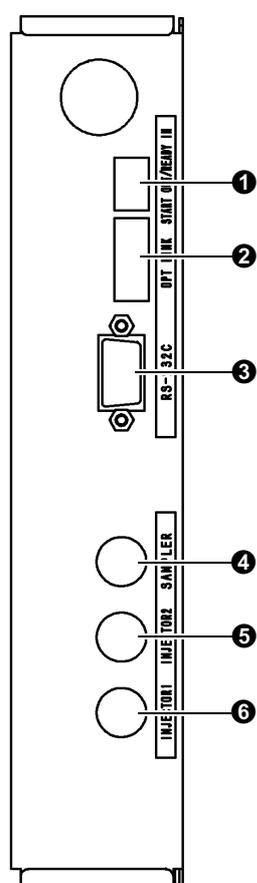


Figure 1-9 For GC-2010/2010Plus

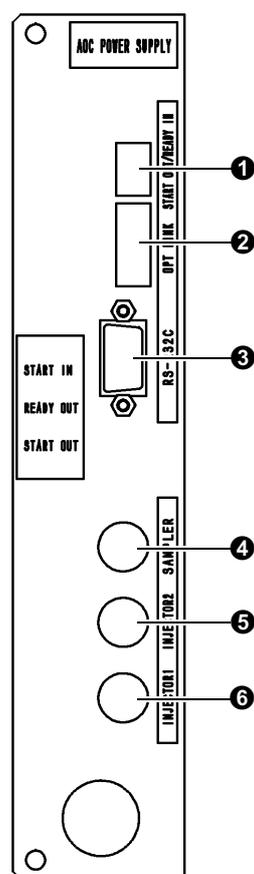


Figure 1-10 For GC-2014

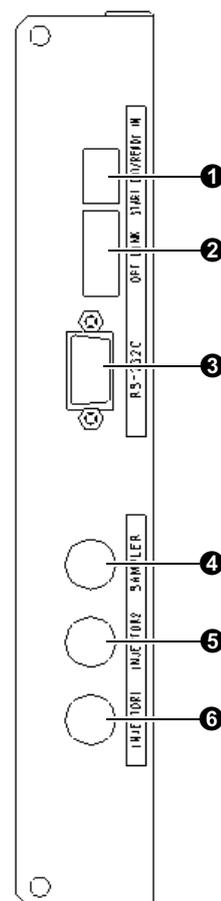


Figure 1-11 For GC-2025

No.	Name	No.	Name
①	START/READY terminal	④	Autosampler control terminal
②	Fiber optic link terminal	⑤	Injector 2 control terminal
③	RS-232C terminal	⑥	Injector 1 control terminal

Normally, No. ② Fiber optic link terminal is not used.

## External Power Type

### **⚠ WARNING**

- Be sure to use only a fuse of the specified type and rating.  
Be sure to unplug the power supply cable before replacing a fuse.

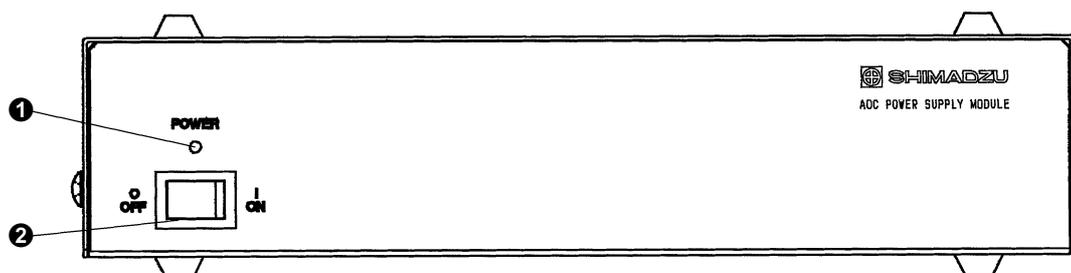


Figure 1-12

No.	Name	No.	Name
①	Power indicator	②	Power switch

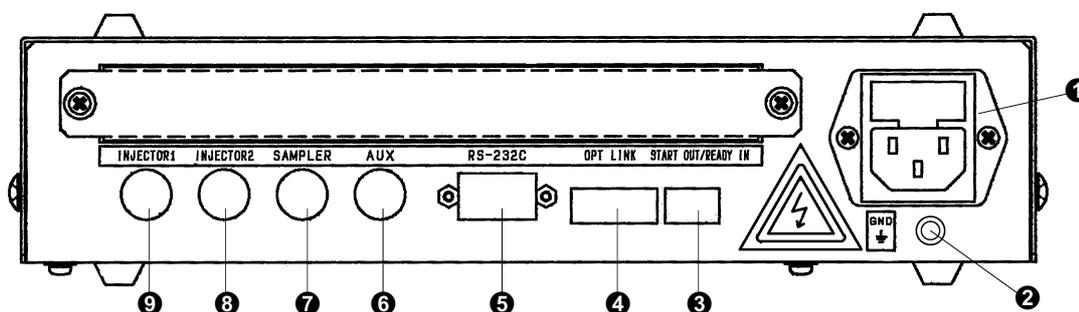


Figure 1-13

No.	Name	No.	Name
①	AC Power inlet and Fuse holder	⑥	Aux control terminal
②	Ground terminal	⑦	Autosampler control terminal
③	START/READY terminal	⑧	Injector 2 control terminal
④	Fiber optic link terminal	⑨	Injector 1 control terminal
⑤	RS-232C terminal		

## 1.9 Operation Environment

To maintain the instrument performance, always use the instrument within the specified temperature/humidity ranges described below. This instrument can operate within the operating temperature/humidity ranges described below.

Specified Temperature Range: 10 °C - 30 °C

Specified Humidity Range: 50% - 60%

Operating Temperature Range: 5 °C - 40 °C

Operating Humidity Range: 5% - 90%

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# 2

# Autoinjector/ Autosampler Installation

## 2.1 Installing the Autoinjector to the Gas Chromatograph

### 2.1.1 Installation to the Gas Chromatograph

When installing the autoinjector to the gas chromatograph, you can use the uniform procedure described below regardless of your gas chromatograph model.

The following explanation uses GC-2010 as an example in Figures.

- 1 Place the autoinjector directly upon the four installation pins located on top of the gas chromatograph. Press the autoinjector down until it is set onto the septum nut and completely secured.**

Then, plug in the AOC cable to connect the AOC to the GC, if it is unplugged.

#### CAUTION

- Be sure to connect/remove the AOC cable when the AOC power is OFF. Connecting/removing the cable while the AOC power is ON will result in instrument malfunction or failure.

- 1 Place directly upon the installation pins until the autoinjector is completely secured.
- 2 AOC cable: Align the parts indicated by arrows to plug/unplug the cable.
- 3 Place the AOC cable on the hook (accessory) to avoid interrupting the rack movement.

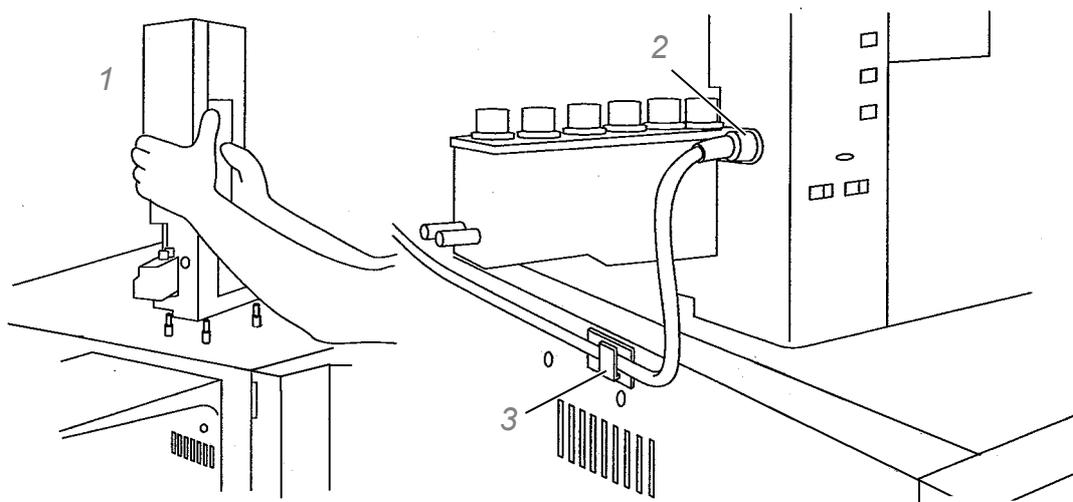


Figure 2-1



**NOTE**

If the autoinjector is not completely secured, the error message "-11" appears on the display when the power is turned ON. In this case, check whether the autoinjector is properly mounted, and press it thoroughly until it is securely fixed.



**NOTE**

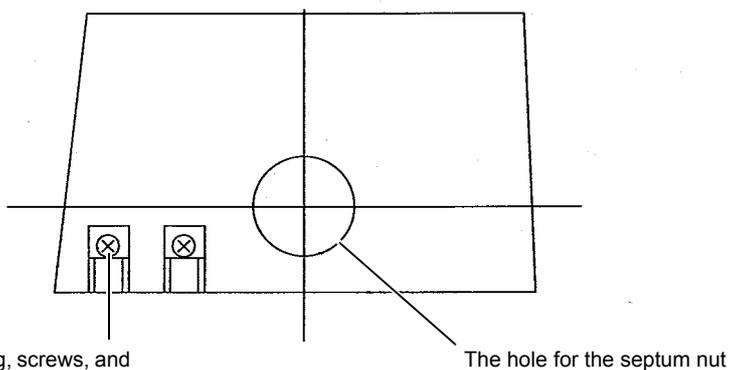
Even though the AOC cable is connected, you can install/remove the autoinjector. Remove the AOC cable when moving the autoinjector to places where the AOC cable cannot reach (e.g. when carrying the autoinjector away).

To remove the autoinjector, pull it straight upwards.



**NOTE**

If the autoinjector is used for a GC-2014 or GC-14A/B, Shimadzu personnel remove at installation the plate spring, screws, and spacers (shown in [Figure 2-2](#)) used for mounting to GC-2010 or other gas chromatographs. These parts are necessary when using the autoinjector with GC-2010, etc. Please store them in a safe place.



The plate spring, screws, and spacers here have been removed. (They are required for a GC-2010, GC-17A or other chromatographs.)

The hole for the septum nut

Bottom view of autoinjector

Figure 2-2

## 2.1.2 Mounting Spacers on GC-2014/GC-14A/B

For GC-2014, the spacers (autoinjector installation parts) are mounted to the positions described below, according to the installation position of the autoinjector. (The positions of the spacer are also the same for GC-14A/B even though the front and rear spacers are fixed to the mounting plate.)

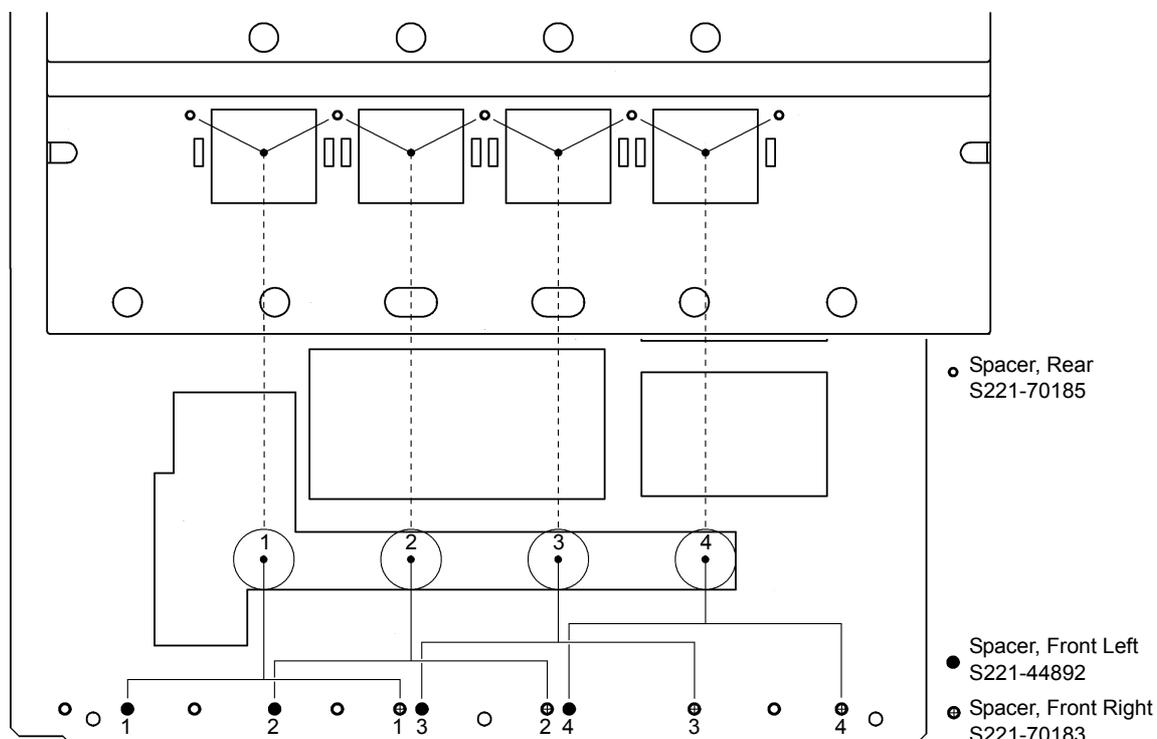


Figure 2-3

When installing the autoinjector on GC-2014 and GC-14A/B, you can mount up to two sets of the spacers simultaneously. The positions can be selected from the following combinations.

(1 and 2), (2 and 3), (3 and 4), and (1 and 4)

To install the autoinjector to the injection port with no spacer mounted, move the spacers by the following procedure:

**For GC-2014**

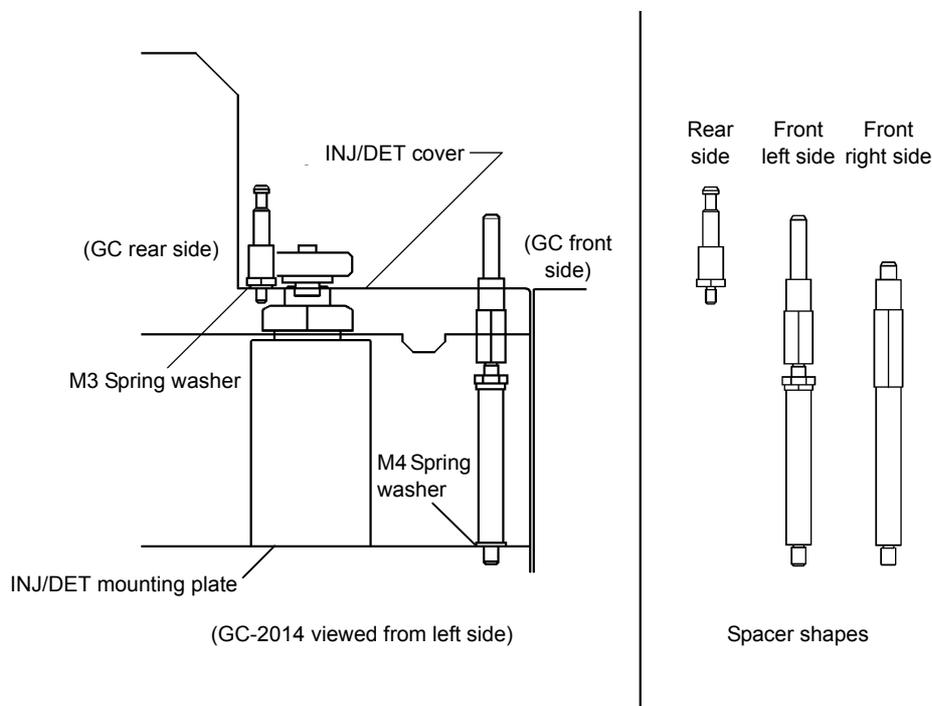


Figure 2-4

The front left spacer is an assembly of Spacer, front left bottom (S221-44892), Nut (S023-04140), and Spacer, adjuster (S221-70184).

- 1** Turn OFF the power of GC-2014.
- 2** Loosen the knurled screw fixing the INJ/DET cover, and remove the cover.
- 3** Using the wrench (accessory), remove two of the front spacers mounted to the INJ/DET mounting plate. Remount them to the designated positions by referring to [Figure 2-3](#).
- 4** Using the wrench, remove two of the rear spacers mounted to the INJ/DET mounting plate. Remount them to the designated positions by referring to [Figure 2-3](#).
- 5** Reinstall the INJ/DET cover to the original position, and tighten the knurled screw to fix the cover.

**NOTE**

- Be careful not to lose the spring washers, which have been set with spacers.
- Pay extra attention not to confuse the right and left front spacers.
- If the autoinjector is unstable when it is installed, open the oven door and adjust the length of the front left spacer.  
Loosening the nut in the middle of the front left spacer allows you to adjust its height of the spacer top. After completing the adjustment, tighten the nut to fix the spacer top securely.

**For GC-14A/B**

Perform procedures similar to that for GC-2014 to mount spacers designated in the [Figure 2-5](#) below.

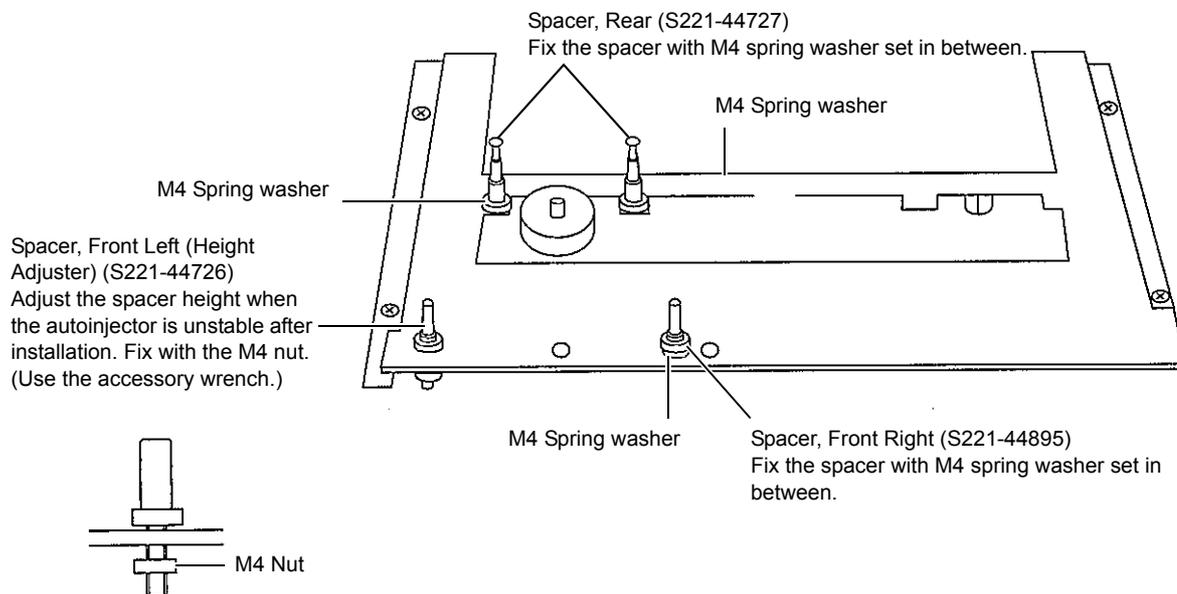


Figure 2-5

## 2.2 Mounting and Removing the Syringe

The 10  $\mu$ l syringe (P/N S221-34618) is supplied with the autoinjector as a standard accessory.

This section describes the procedures for mounting/removing the microsyringe.

Use the same procedures for syringes with different volumes (optional). In this case, see also the description in "[3.3.3 Injection Modes](#)", "[Large Volume Injection Mode \(Low-speed Injection Method\)](#)" P.115 to complete the required parameter change.

### 2.2.1 Mounting the Microsyringe

- 1 Turn ON the power of the autoinjector.**  
(For the power ON procedure, see "[3.1.2 Turning the Power ON/OFF](#)" P.80.)
- 2 Hook your finger at the half-circle depression on the autoinjector top, and pull the door open.**

 **NOTE**

Check that "OP" appears on the display when the door is open. If it does not appear, contact your Shimadzu representative.

- 3 Press the [STOP] key while the door is open.**  
(The plunger motor power is turned OFF, and the autoinjector becomes ready for the microsyringe to be mounted.)

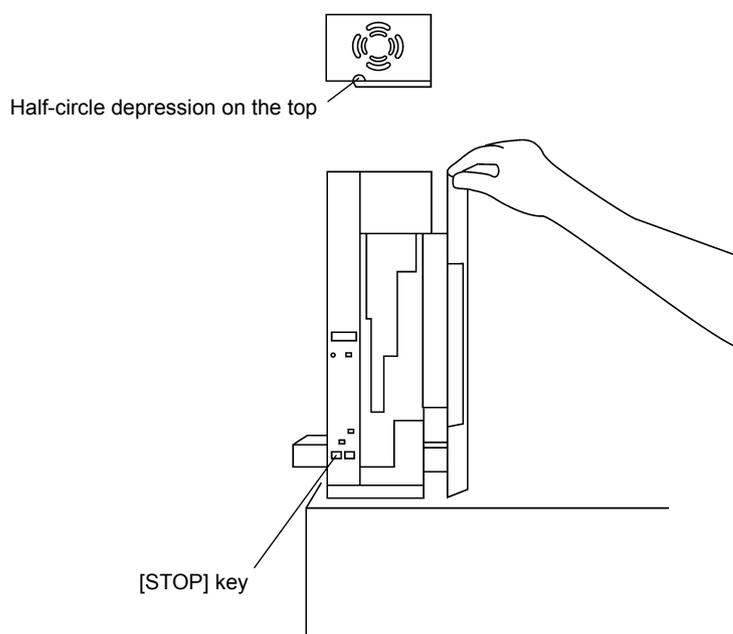


Figure 2-6

## 4 Inspect the new syringe. Check if the needle is fixed to the syringe barrel in a straight manner.

You can check the straightness of the needle by rolling the syringe on a flat surface (Avoid the flange interference). If the needle is set at an angle, the distance to the needle tip from the surface keeps changing during the rotation.

If you mount the microsyringe with an angled needle to the autoinjector, the needle may be bent during the injection operation.

When the needle is set at an angle, straighten the needle by slightly bending from the needle base (i.e., where the needle is fixed to the syringe barrel) with your fingers.

## 5 Attach the barrel holder (used for syringe removal: P/N S221-44780) onto the syringe barrel.

The barrel holder should be positioned within the range shown in [Figure 2-7](#).

- 1 Slide the barrel holder in the direction shown.
- 2 Position the barrel holder 4 to 6 mm from the flange.
- 3 Slide the barrel holder against the flange in the direction shown in the figure below at right.
- 4 Attach the barrel holder so that its protruded part comes to the graduated side of the syringe.

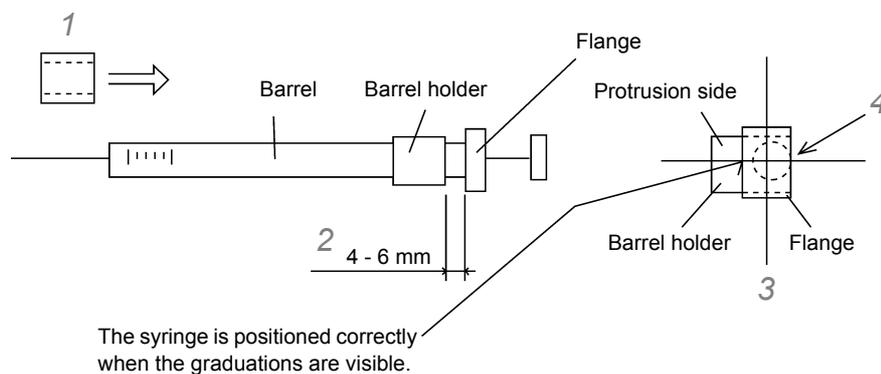


Figure 2-7

## 6 Lift the syringe drive unit to its highest position. Pull up the plunger drive unit at least 16 mm by holding the knurled screw.

If it is difficult to pull up the plunger drive unit, rotate the plunger motor pulley by hand.

- 1 Lift the syringe drive unit to its highest position.
- 2 With the power ON and the initial operations completed, the syringe drive unit is in its highest position (home position).

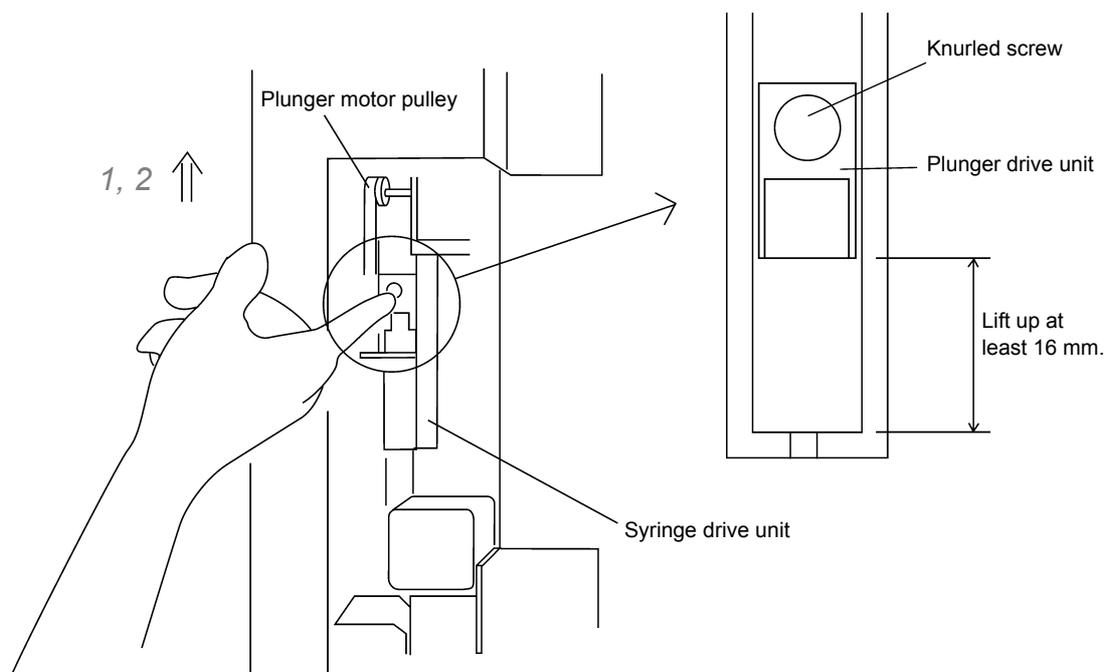


Figure 2-8

### NOTE

Until doing procedure 3 (pressing the [STOP] key while the door is open), you cannot lift up the plunger drive unit since the plunger motor power is still ON. Be sure to complete procedure 3 before proceeding.

## 7 Open the syringe clip while the syringe drive unit is located at its highest position.

- 1 Open the syringe clip.

## 8 Press the syringe plunger down to its lowest position. Tilt the syringe top toward you and insert the needle tip to the needle guide in an oblique manner.

At this point, the scale marks on the syringe barrel should be directed toward you.

- 1 Position the protrusion side of the barrel holder to face outward.
- 2 Insert the needle into the needle guide by 2 mm.
- 3 Push the barrel into the clips of the syringe drive unit until it is fixed.

## 9 Set the syringe barrel all the way until the clips of the syringe drive unit hold the barrel securely. Make sure that the plunger flange is fit on Clip 3.

If the barrel is not properly set here, the needle may be bent during operation.

Verify that the barrel holder is located in the position specified in [Figure 2-9](#), and that the needle tip is inserted into the needle guide.

- 1 Place the long side of the flange toward you.
- 2 Insert the flange above clip 3.
- 3 Position the barrel holder between clips 2 and 3.
- 4 Ensure that the needle is in the needle guide.
- 5 The syringe graduation marks should be visible.

The syringe will be positioned as in the [Figure 2-9](#) if the barrel holder is attached as shown in [Figure 2-7](#).

## 10 Fix the syringe barrel with the syringe clip.

Secure the syringe with the syringe cap.

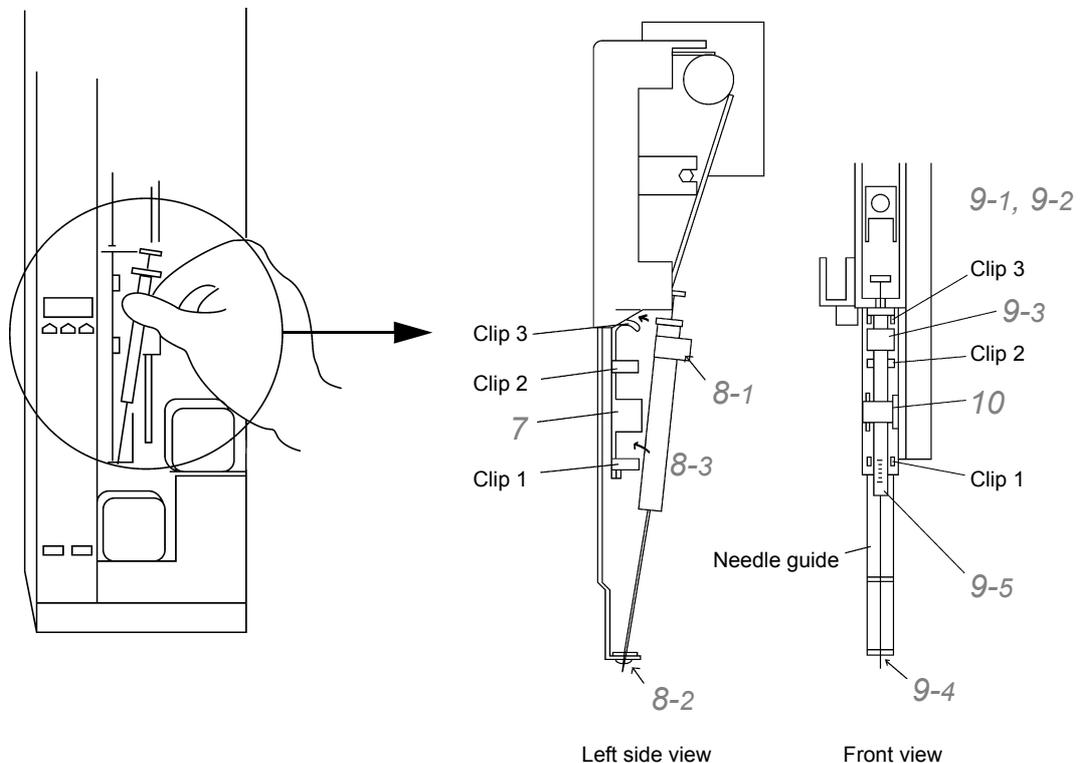


Figure 2-9

### NOTE

With the barrel holder and syringe flange placed in the direction specified in [Figure 2-9](#), install the syringe to the syringe drive unit until it is completely secured. If the placement direction is not correct or the syringe is not mounted securely, the needle may be bent during operation.

 **NOTE**

Be sure to close the syringe clip before operation. If the syringe drive unit operates with the syringe clip opened, the clip may fall off or be broken.

An extra syringe clip is supplied with the autoinjector as a standard accessory. To install the new syringe clip, follow the instructions in [Figure 2-10](#).

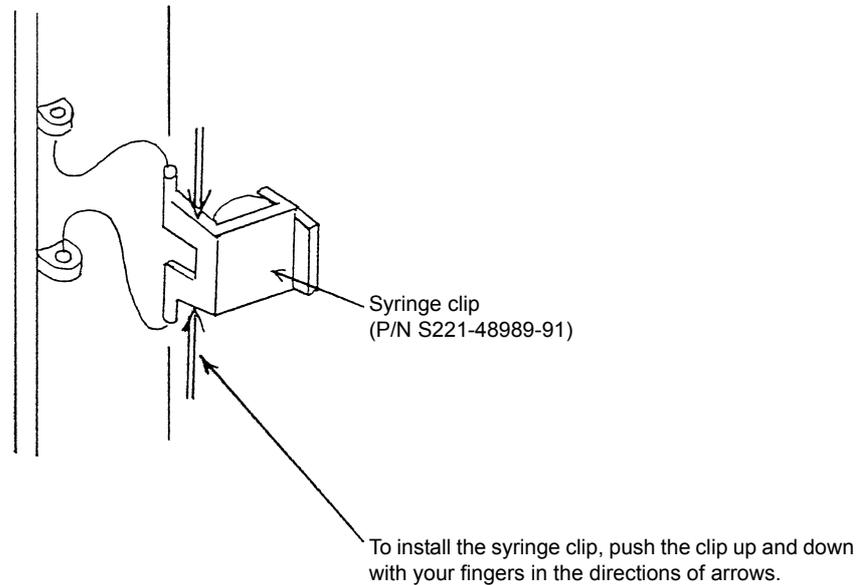


Figure 2-10

 **NOTE**

Before mounting the syringe, be sure to press down the syringe plunger to its lowest position. If the plunger is not completely pressed down, it may be bent by being caught on the plunger drive unit.

# 11

**Verify that the syringe is securely set to the syringe drive unit, and the syringe plunger pressed down to its lowest position. Attach the plunger holder to the plunger button.**

Be sure to insert the holder all the way until it contacts the plunger button.

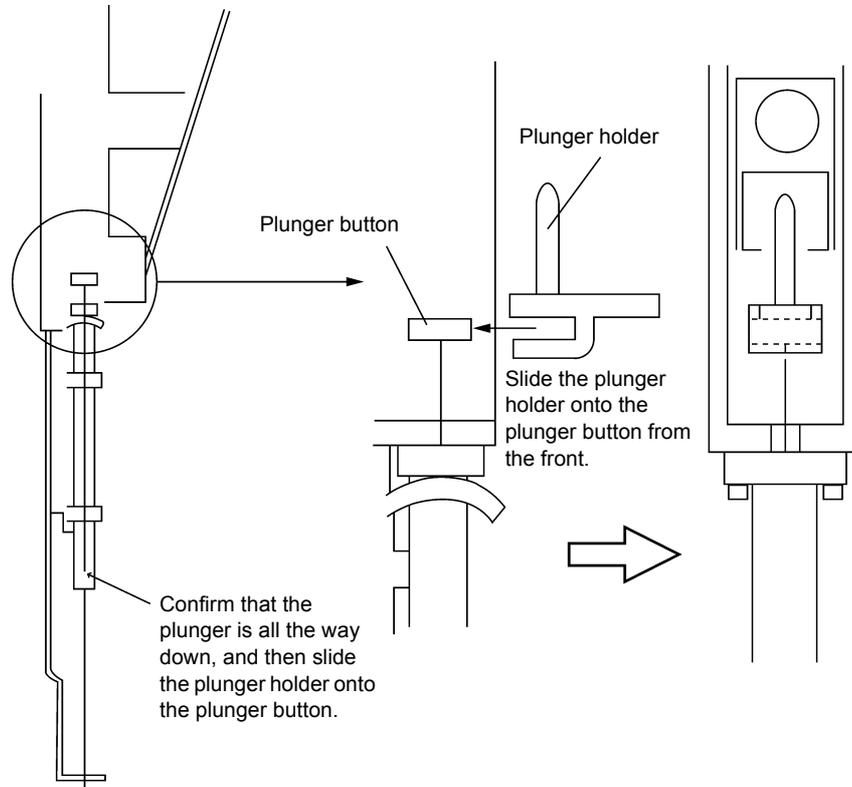


Figure 2-11

# 12

**Loosen the knurled screw on the plunger drive unit to create a gap of 7 mm or longer between the screw and the unit.**

## NOTE

Loosen the knurled screw on the plunger drive unit sufficiently. If the top of the plunger holder contacts the screw, you cannot fasten the screw properly and the plunger may be damaged.

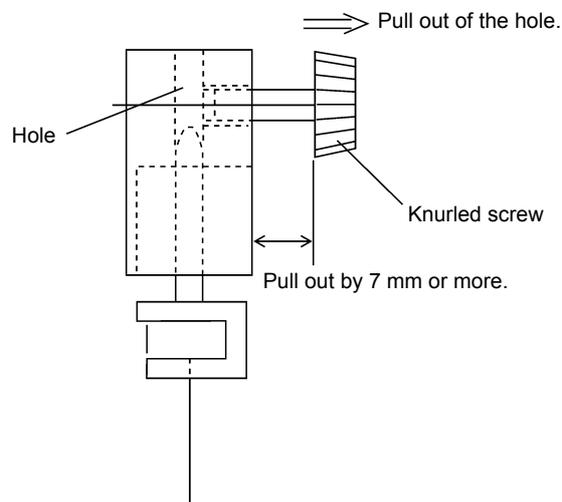


Figure 2-12

## 13 Pull down the plunger drive unit, which was lifted up 16 mm in procedure 6, until its bottom hole is set on the plunger holder top.

To pull down, place your fingers on the upper part of the plunger drive unit or the knurled screw. If it is hard to pull down, rotate the pulley of the plunger motor by hand.

- 1 Lower the plunger drive unit.
- 2 The top of the plunger holder fits into hole.

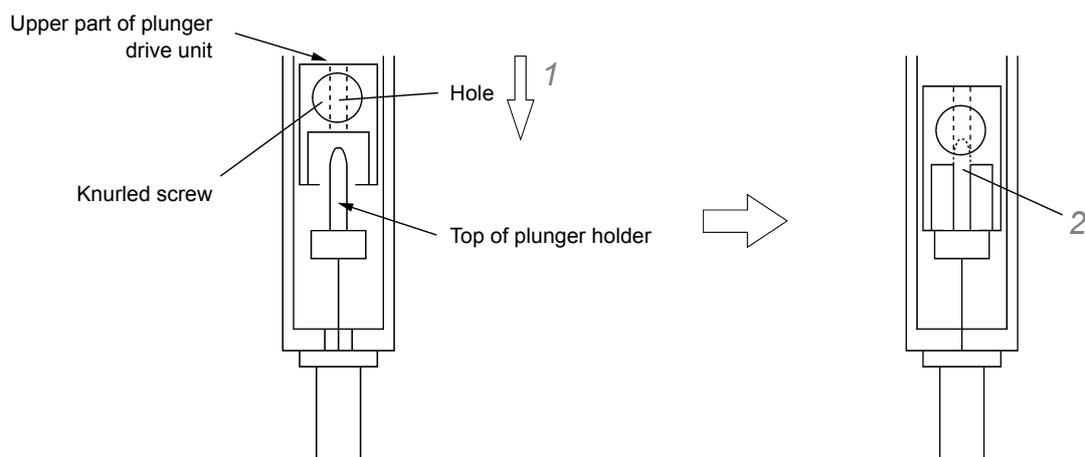


Figure 2-13

## 14 Press the [RESET] key (Orange).

The plunger drive unit moves to its home position.

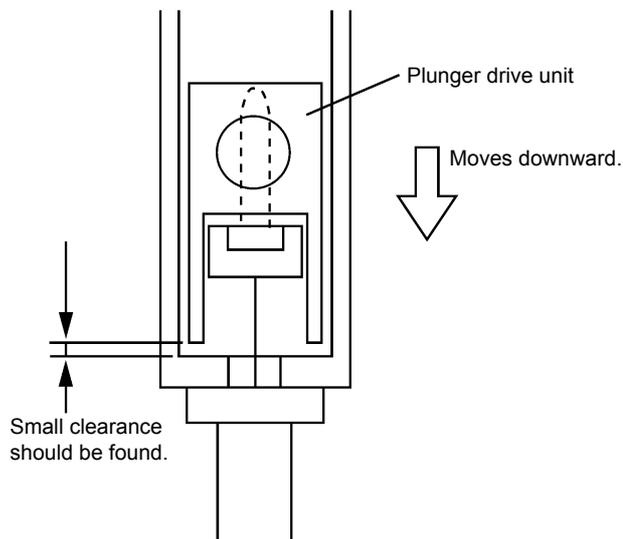


Figure 2-14

### ⚠ CAUTION

- DO NOT place your hand near the drive unit while the plunger drive unit is operating. The plunger drive unit will then stop, leaving a small gap between it and the syringe drive unit.

## 15 Lightly press down the plunger holder so that the syringe plunger tip contacts the syringe barrel bottom.

Check to be sure that the plunger tip is located at the barrel zero point.

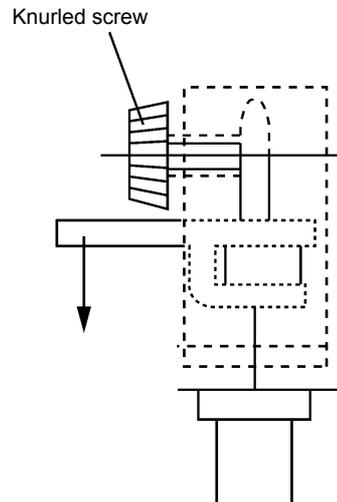


Figure 2-15

## 16 Tighten the knurled screw on the plunger drive unit to fix the plunger holder.

### NOTE

The plunger tip should already be in contact with the barrel bottom and located at the zero point upon completing procedure 8. Lightly press down the plunger holder hook with your fingers, and tighten the knurled screw securely.

DO NOT press down the plunger holder too strongly as you may bend the plunger.

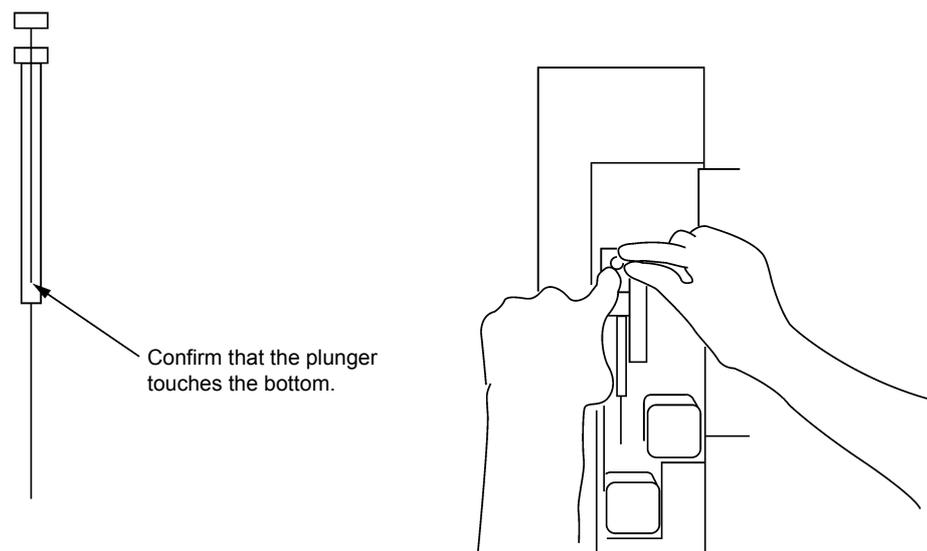


Figure 2-16

 **NOTE**

After fixing the plunger, make sure that the plunger tip is in contact with the syringe barrel bottom (i.e., the plunger tip is located at the zero point of the barrel). When the plunger is not in contact with the barrel bottom, replace the plunger holder and follow the syringe mounting procedure from the beginning.

Verify that there is a small gap between the plunger drive unit and the syringe drive unit as shown in [Figure 2-16](#), illustrating the plunger drive unit in its home position.

 **CAUTION**

- Always turn ON the instrument before mounting the microsyringe. If the power is OFF, the plunger drive unit cannot move to its home position, which may cause improper sample aspiration.

## 17 Close the autoinjector door.

This completes the installation of the microsyringe to the autoinjector.

For the procedures for injecting samples, see ["3 Operation" P.79](#).

 **NOTE**

Once the plunger holder is used, the knurled screw creates a small dent in it. Therefore, it is recommended to replace the plunger holder when replacing the microsyringe.

 **NOTE**

The plunger motion becomes constricted after repeated air aspiration/discharge, or when the syringe is left unused for a long time. Before mounting the microsyringe to the autoinjector, check to be sure that the plunger moves smoothly. Additionally, always maintain the plunger in good condition by rinsing it with solvents, etc.

If the plunger motion is too constricted, the autoinjector aborts the operation, displaying the error "-03". To avoid this, always maintain the plunger in good condition.

The motion of 50  $\mu\text{l}$  syringes and 250  $\mu\text{l}$  syringes (both optional) especially become constricted in shorter period of time than the standard 10  $\mu\text{l}$  syringes. After using these syringes, be sure to perform maintenance on them immediately.

 **NOTE**

Remember that syringes are consumables. The plunger and barrel become loose after long periods of use, which may cause sample leaks. The sample leaks will deteriorate analysis reproducibility. Periodically check that there is no leak when replacing the gas chromatograph injection port septum, etc.

**CAUTION**

- OCI Syringe (for only when using GC-17A (OCI-17))

Use the OCI syringe (P/N S221-37282-02: optional) when using the OCI as an injection port.

The needle of the OCI syringe thins towards its tip, allowing the introduction of samples directly to the capillary column. To set the OCI syringe to the autoinjector, use the same procedure as that for other syringes, except set the syringe injection position 3 mm higher than usual. If you use the autoinjector without the parameter change, you may break your syringe barrel.

When using a standard syringe again, be sure to reset to the original value, 0 mm. If you keep using the autoinjector with the injection position 3 mm higher, it may deteriorate analysis reproducibility.

- 1 Press the [FUNCTION] key.  
(The FUNCTION number set in the last operation is displayed.)
- 2 Access F27 using the arrow keys, and press the [ENTER] key.
- 3 Change the displayed value to "003", and press the [ENTER] key.

**NOTE**

This parameter can be set within the range from 0 up to 22 mm (upward direction).

2

**2.2.2 Removing the Microsyringe**

- 1 If the autoinjector power is ON, press the [RESET] key to lift up the syringe drive unit and to return the plunger to its home position.
- 2 Open the autoinjector door, and press the [STOP] key.

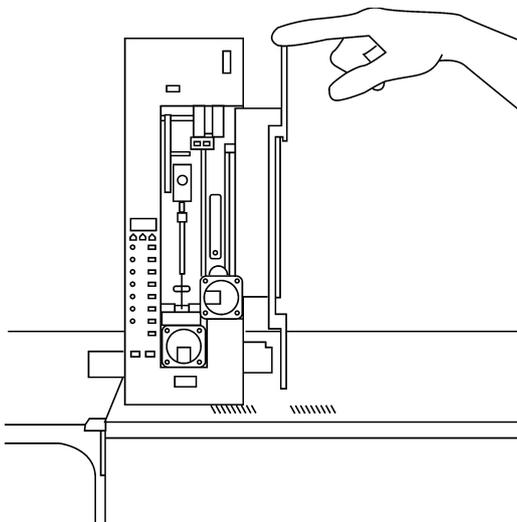


Figure 2-17

If the autoinjector power is OFF, open the door and verify that the syringe drive unit is located at its highest position. If not, lift the syringe drive unit up to its highest position with your fingers.

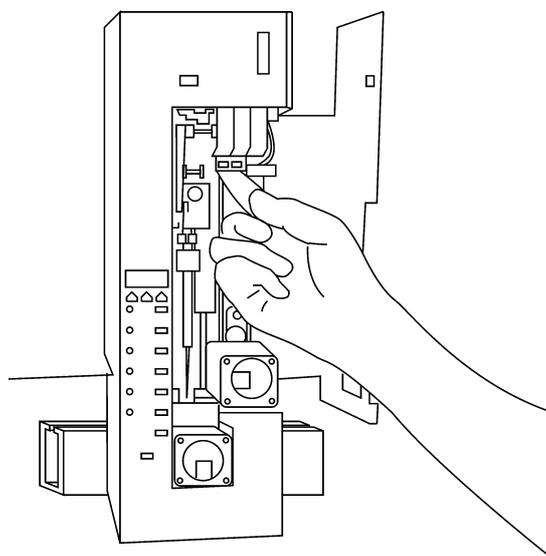


Figure 2-18

### 3 Loosen the knurled screw fixing the plunger, and lift up the plunger drive unit 16 mm or more.

If it is difficult to pull up the plunger drive unit, rotate the plunger motor pulley by hand. When the AOC power is OFF, even though the plunger drive unit is not located in its home (lowest) position, you can remove the syringe by lifting the plunger drive unit up 16 mm or more from the current unit position.

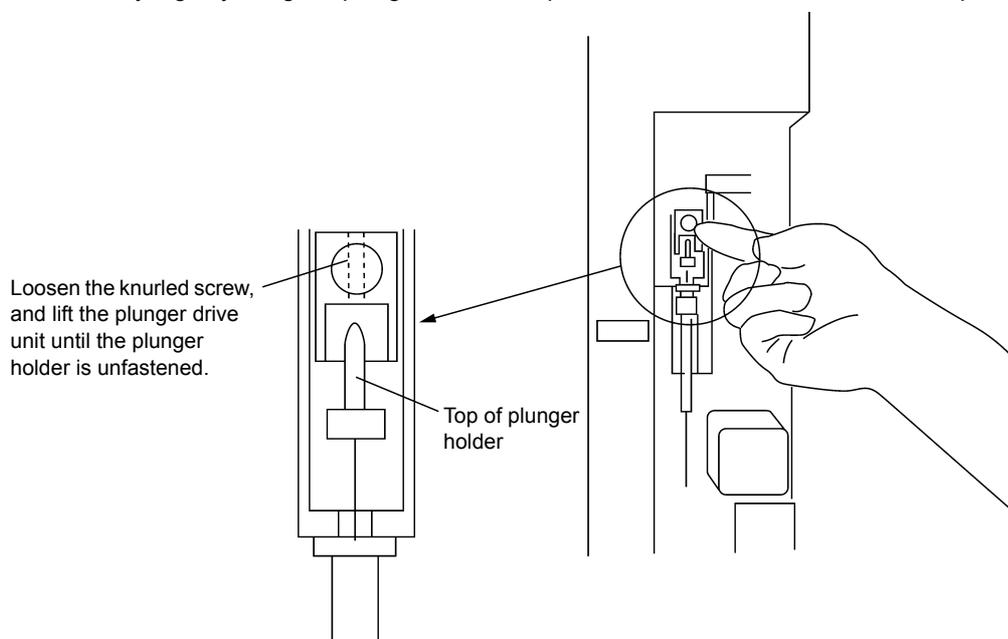


Figure 2-19

### 4 Remove the plunger holder from the plunger. Then, open the syringe clip.

- 5** Verify that the plunger is fully pressed down to its lowest position. Hold the barrel holder and tilt the barrel down toward you to remove the syringe from the syringe drive unit.

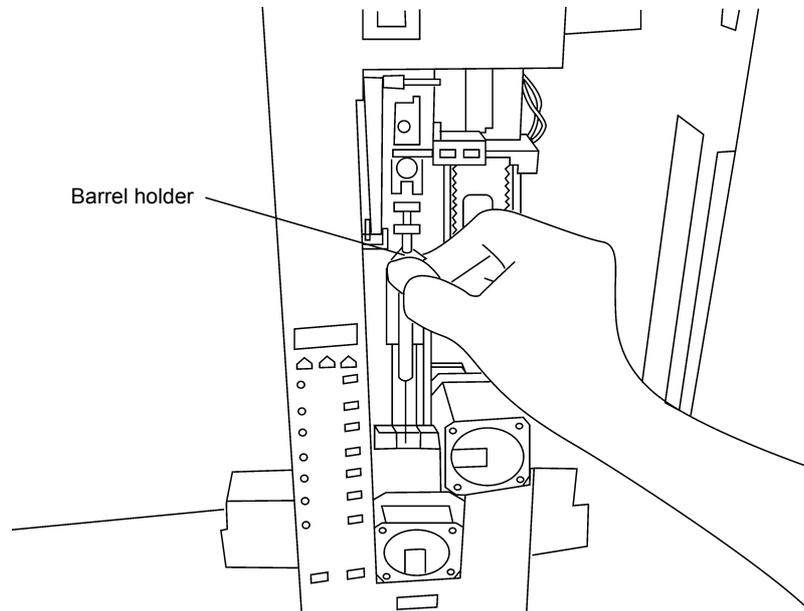


Figure 2-20

This completes the removal of the microsyringe from the autoinjector.

## 2.3 Setting Vial Racks to the Rack Guide, Loading Rack into the Autoinjector

### 2.3.1 Setting Vial Racks to the Short Rack Guide

The rack guide and vial rack, as shown in [Figure 2-21](#), are separate units which are combined according to the application requirements.

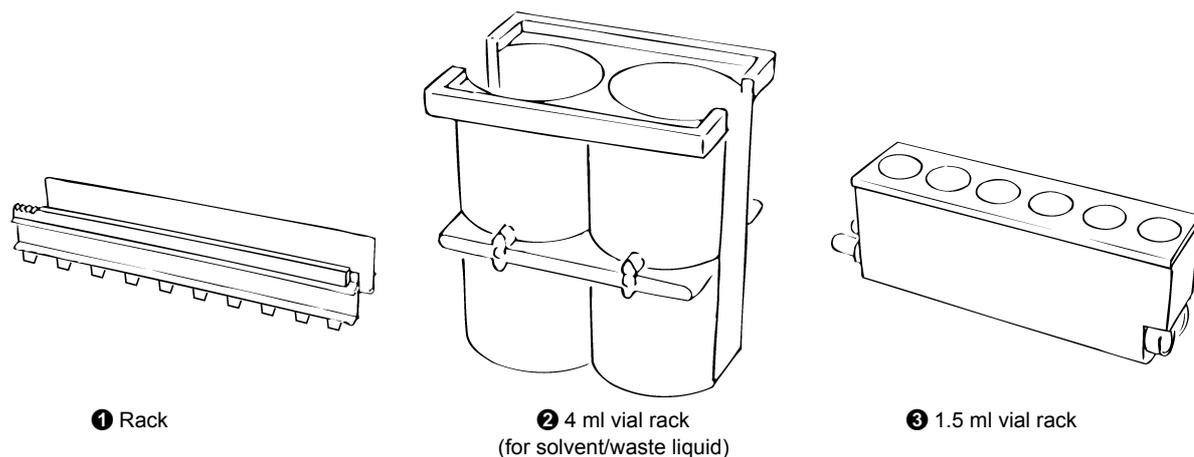


Figure 2-21

The standard accessories are: ① short rack guide (S221-45608-91), ② 4 ml vial rack (S221-32949-01) and ③ 1.5 ml vial rack (S221-45609-92) without sockets. The short rack guide accommodates 6 vials.

To load the vial racks, spread the rack guide slightly apart and insert both ③ 1.5 ml vial rack and ② 4 ml vial rack, so that the side pegs fit into the corresponding holes in each side of ① rack (as shown in [Figure 2-22](#)).

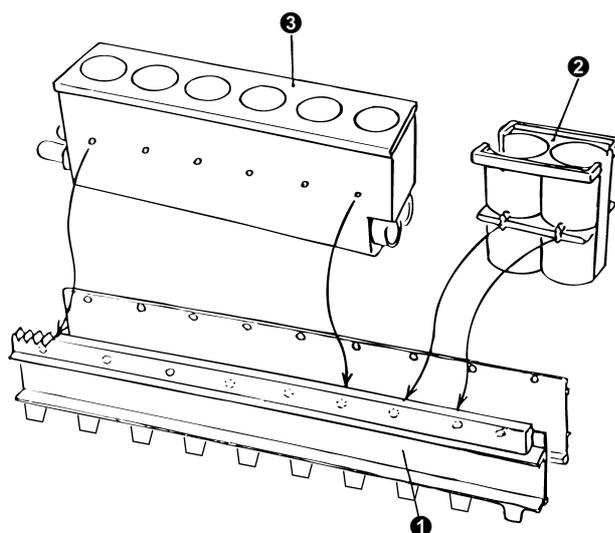


Figure 2-22

② and ③ are positioned as shown in *Figure 2-23* at shipment.

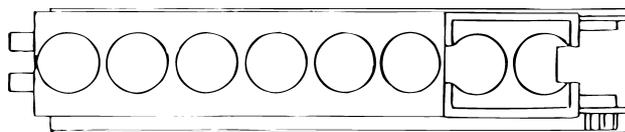
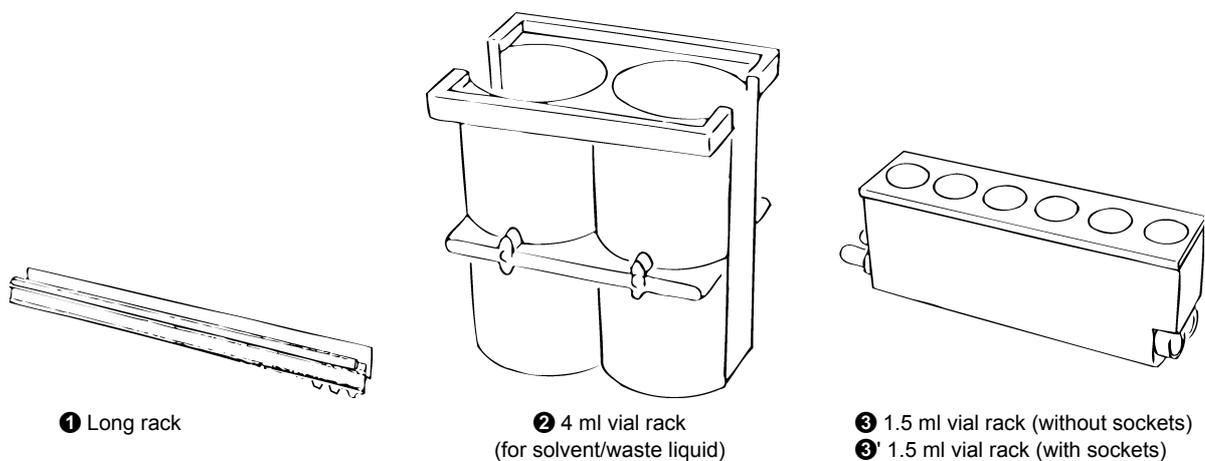


Figure 2-23

## 2.3.2 Setting Vial Racks to the Long Rack Guide (Optional)

The long rack guide and vial racks, shown in *Figure 2-24*, are separate units which are combined according to the application requirements.

2



① Long rack

② 4 ml vial rack  
(for solvent/waste liquid)

③ 1.5 ml vial rack (without sockets)  
③' 1.5 ml vial rack (with sockets)

Figure 2-24

To assemble the long vial racks, first connect two 1.5 ml vial racks, ③ and ③' end-to-end, by inserting the pegs of ③' vial rack into the sockets of ③ vial rack.

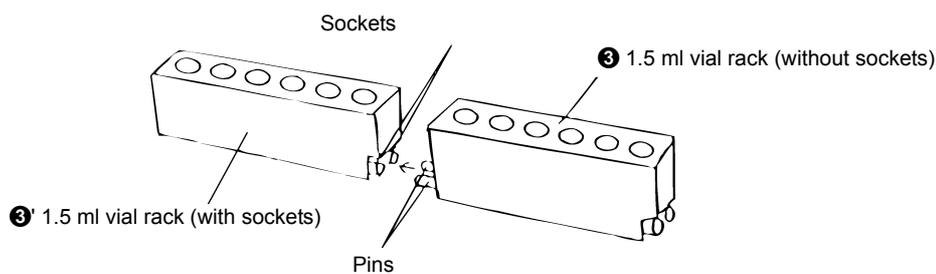


Figure 2-25

The assembled vial racks are inserted into the long rack guide along with **2** 4 ml vial rack (for solvent/waste liquid vials), as shown in *Figure 2-26*. This is the configuration at shipment.

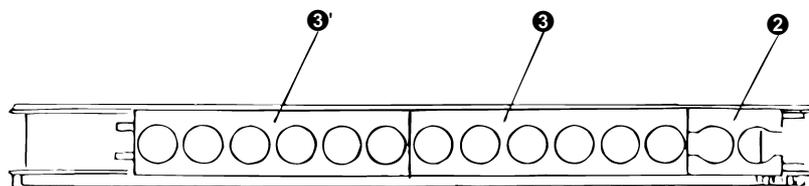


Figure 2-26

As for the short rack guide, the pegs of **2**, **3**, and **3'**, fit into the sockets of **1** long rack guide. Spread the rack guide apart slightly, and insert the vial racks.

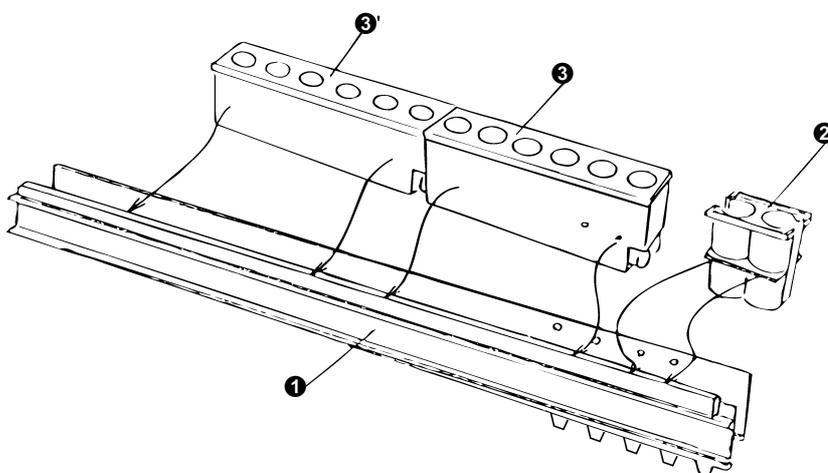


Figure 2-27

## 2.3.3 Loading Rack into the Autoinjector

Use the same procedure to load both the long and short rack guides into the autoinjector. However, the length of the rack guide used must be specified via the gas chromatograph, according to the procedure described below.

### NOTE

When using PC software such as GCsolution, be sure to perform this setting via the PC software. Otherwise, the set values will be erased. For details, refer to the system configuration section of the software instruction manual.

For GC-2010/2010Plus/2014/2025

- 1 Press the [OPTION] key on the gas chromatograph to display the [AOC Parameters] window.
- 2 Press [OtherPara (PF3)] of the PF menus to display the [AOC Other Parameters] window.
- 3 Change the rack guide setting according to the type of rack guide used.

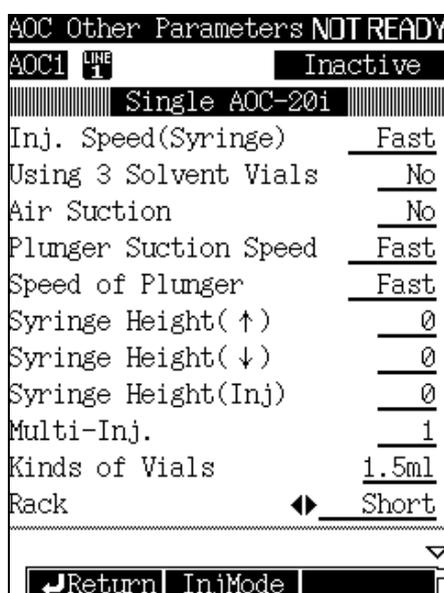


Figure 2-28

### NOTE

When using GC-2010/2010Plus/2014/2025, be sure to change the parameters via the gas chromatograph. DO NOT change the parameters by operating the autoinjector keypad, because when rebooting the instrument all parameters on the autoinjector are updated to the AOC parameters set on the gas chromatograph.

For details on the gas chromatograph operation, refer to the instruction manual of the gas chromatograph.

### NOTE

When the [AOC Parameters] window does not appear even if you press the [OPTION] key many times, press the [SET] key on the gas chromatograph and select [LineConfig] to check if the AOC is specified for the current analytical flow line.

### For Other Gas Chromatographs

- 1 Press the [FUNCTION] key.  
(The FUNCTION number set in the last operation is displayed.)
- 2 Access F93 using the arrow keys, and press the [ENTER] key.
- 3 Change the displayed value as follows, and press the [ENTER] key.  
Short rack guide: "000" (default)  
Long rack guide: "001"

This completes the long/short setting for rack guides to be used.

Follow the procedure below to install the rack guide and racks into the autoinjector.

## 1 The autoinjector power can be ON or OFF. Verify that the syringe drive unit is at its highest position.

If it is not all the way up, it will strike the rack when it is inserted. Turn OFF the power and be sure to lift up the syringe drive unit to its highest position.

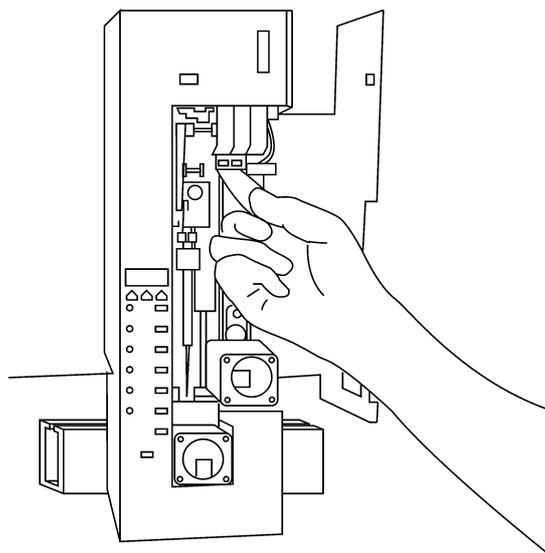


Figure 2-29

## 2 Insert the rack guide into the autoinjector track so that the rack gears catch on the motor pinion.

Once the gears catch, insert the rack guide a further 20 mm. The rack guide can be inserted from the left or right if no autosampler is installed. If an autosampler is in use, insert the rack guide from the right.

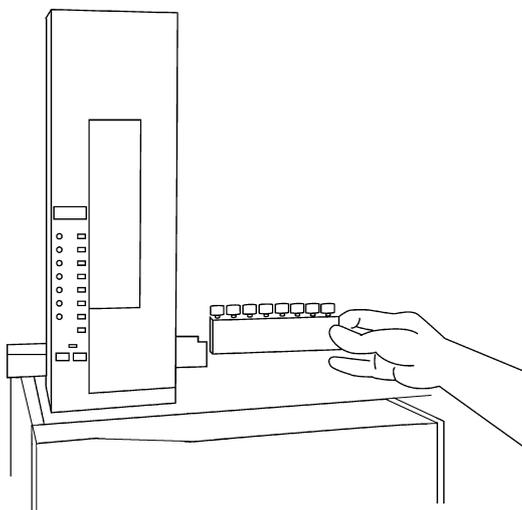


Figure 2-30

## 3 When the autoinjector power is turned ON, the rack moves to the home position (all the way to the left) as shown in [Figure 2-31](#).

If the power is already ON, press the [RESET] key to move the rack to the home position.

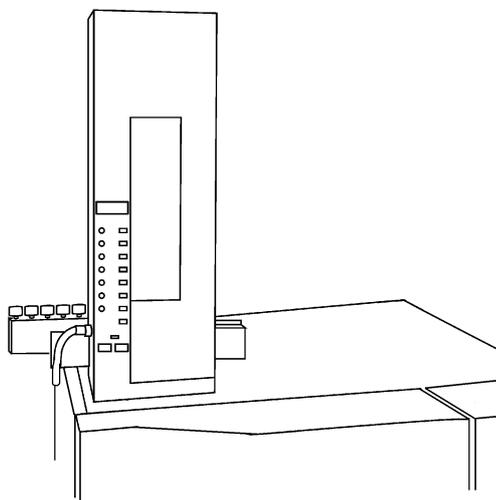


Figure 2-31

**NOTE**

When the rack is in the home position, the motor is released, and the rack can be removed.

**NOTE**

During analysis, when the GC is in the READY state, the motor is engaged. The rack can still be removed and inserted without pressing the [RESET] key; however, this will be more difficult because the motor has not been released. Remove the rack, if necessary, then re-insert as in step (2). Press the [START] key once to begin the analysis.

If the [RESET] key is pressed before removing or after inserting the rack, analysis will not be performed continuously. Once the [RESET] key is pressed, pressing the [START] key begins a new analysis, not a continued analysis.

## 2.3.4 Washing with 3 Different Solvents

By adding two of 4 ml vial racks, you can wash the syringe with 3 different solvents.

In this case, mount the racks as shown in the figure below. The short rack guide can measure a 1.5 ml sample vial, and the long rack guide can measure seven of the 1.5 ml sample vials. The position indicated with "1" is designated for 4 ml vials.

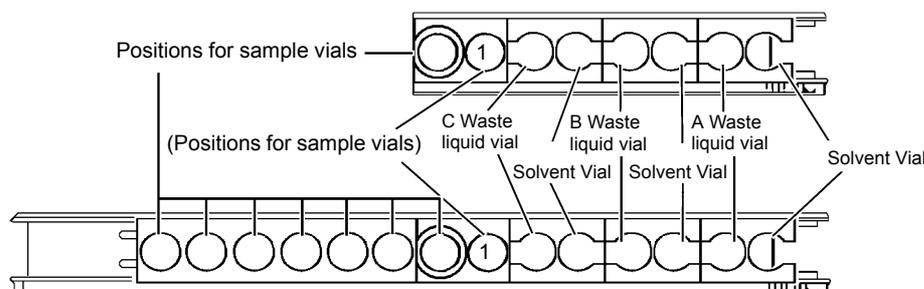


Figure 2-32

For GC-2010/2010Plus/2014/2025

- 1** Press the [OPTION] key on the gas chromatograph to display the [AOC Parameters] window.
- 2** Press [OtherPara (PF3)] of the PF menus to display the [AOC Other Parameters] window.
- 3** Set [Using 3 Solvent Vials] to [Yes].
- 4** Set [Solvent Select] to [All]. (Alternatively, select one out of 3 solvents.)  
For details on the gas chromatograph operation, refer to the instruction manual of the gas chromatograph.

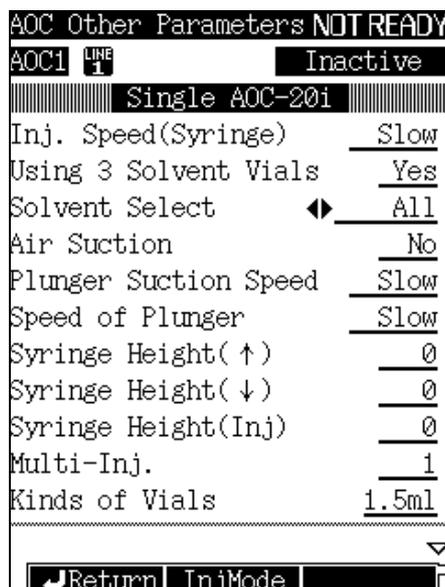


Figure 2-33

### For Other Gas Chromatographs

- 1 Press the [FUNCTION] key on the autoinjector main unit.**  
(The FUNCTION number set in the last operation is displayed.)
- 2 Access F28 using the arrow keys, and press the [ENTER] key.**
- 3 Change the displayed value to "001", and press the [ENTER] key.**  
The default value is "000" (Use one solvent).



#### NOTE

Compared to the solvent flush mode using the autosampler, this function has the following differences.

- You cannot add standard samples.
- You cannot use the solvent for solvent flush method in a designated vial.
- The wash solvent is used as the solvent for solvent flush method. (The 3rd wash solvent when three solvents are used)



#### NOTE

When FUNCTION 08 is set to the initial value ("000"), three solvents can be used (see ["3.2.8 FUNCTION Key" P.92](#), Solvent select F08).

## 2.4 Vial Types and Vial Mounting Procedure on Rack Guide

The rack can be loaded with vials either on or off the autoinjector.

### 2.4.1 Vial Types

The autoinjector can accommodate the two vial sizes shown in [Table 2-1](#).

Table 2-1

Type	Part No.	Use
Small vial 1.5 ml	S228-16550	Sample/standard
Large vial 4 ml	S228-21281-01	Solvent/Waste liquid



#### NOTE

Use the specified vials only. Use the vials for their intended purpose. 4 ml vial can be used for samples. But optional parts are required. See ["2.7.3 Using 4 ml Vials \(Option\)" P.70](#).

Be sure to use the septa and caps listed in [Table 2-2](#) according to the vial size.

Table 2-2

#### CAP TYPES

Type	Part No.	Color
Small cap For 1.5 ml sample vial	S221-41242	White
Large cap For 4 ml vial	S221-39951	White

#### SEPTUM TYPES

Type	Part No.	Remarks
Small septum For 1.5 ml sample vial	S221-41233	PTFE-coated silicon
Large septum For 4 ml vial	S221-15324	

Concerning the part numbers for above items, see ["1.5 Accessories List" P.6](#).

#### CAUTION

- The vial caps for use with the autoinjector must be white. If the vials have no caps or have caps of another color, the autoinjector may not recognize the vials. If a part other than that specified is used, the sensor will be unable to detect it, resulting in possible damage. Use only the specified caps.

## 2.4.2 Septum Replacement and Sample Volume in Vials

Securely tighten the cap over the septum, or the sample may evaporate.

### CAUTION

- A loose cap could damage the unit.



### NOTE

Pay attention to the septum direction. The PTFE side must be directed downwards.

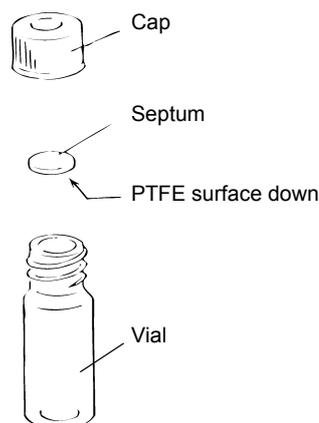


Figure 2-34

Throughout this manual, polytetrafluoroethylene is abbreviated PTFE.

Replace septa frequently. The effectiveness of the septum seal deteriorates over time, so avoid using the same septum repeatedly. Also, once the septum has been punctured, certain solvents can deteriorate the septum and release contaminants into the sample.

The minimum amount of sample needed in a vial is determined by the length of the syringe needle, which is 43 mm. At least approximately 3.5 mm of solvent is required for a 1.5 ml vial, as shown in [Figure 2-35](#). For a 4 ml vial, a minimum of approx. 7.5 mm is required.

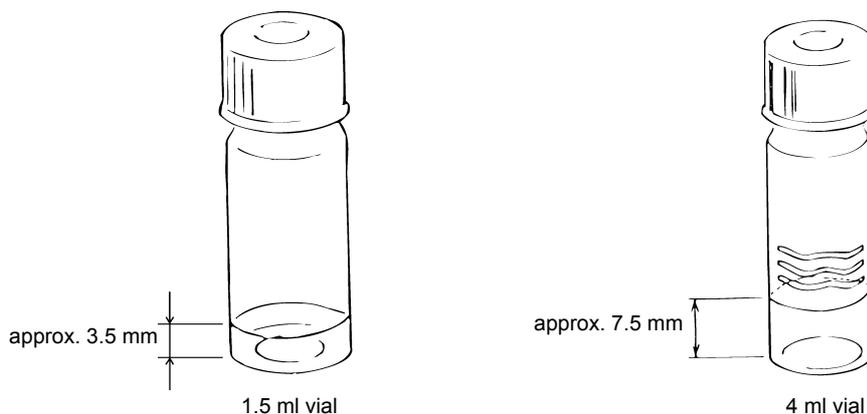


Figure 2-35

## ■ Changing the Depth of the Syringe Needle when Inserted into Sample Vials

### Reducing the depth of the syringe needle when inserted into sample vials

- For GC-2010/2010Plus/2014/2025  
Press the [SET] key on the gas chromatograph and select [LineConfg] to check if the AOC is specified for the current analytical flow line.
  - 1 Press the [OPTION] key on the gas chromatograph to display the [AOC Parameters] window.
  - 2 Press [OtherPara (PF3)] of the PF menus to display the [AOC Other Parameters] window.
  - 3 Set [Syringe Height (↑)] in millimeter (setting range: 0 - 20 mm).
  - 4 Set [Syringe Height (↓)] to [0].

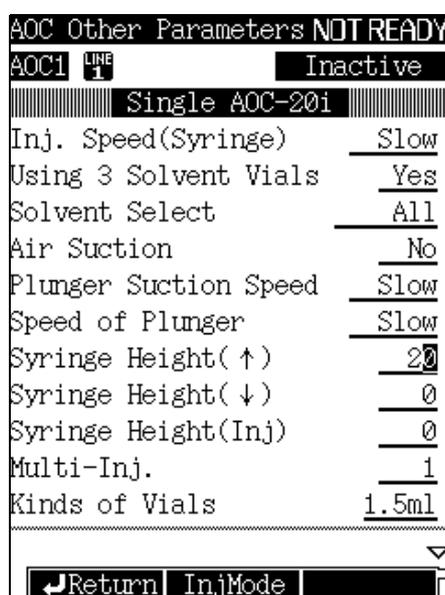


Figure 2-36

- For Other Gas Chromatographs  
Change the parameter of FUNCTION 25 on the autoinjector.  
"000" - "020" (0 - 20 mm) ..... Default "000"  
FUNCTION 26 ..... Leave as default value ("000").

### Increasing the depth of the syringe needle when inserted into sample vials

To increase the depth of the syringe needle when inserted into vials with small sample volume, perform the following procedure according to the vial types.

- (1) When using 1.5 ml vials

#### For GC-2010/2010Plus/2014/2025

- 1 Press the [OPTION] key on the gas chromatograph to display the [AOC Parameters] window.
- 2 Press [OtherPara (PF3)] of the PF menus to display the [AOC Other Parameters] window.
- 3 Set [Kinds of Vials] to [1.5 ml] (default).
- 4 Set [Syringe Height (↓)] in millimeter (setting range: 0 - 20 mm, default value: 0).
- 5 Set [Syringe Height (↑)] to [0].

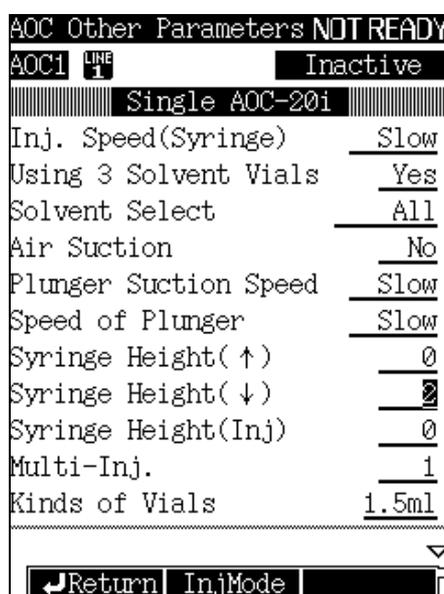


Figure 2-37

#### For Other Gas Chromatographs

Set the parameters as follows.

FUNCTION 29....."000" (Vial type 1.5 ml, default value "000")

FUNCTION 26....."000" - "002" (setting range: 0 - 2 mm, default value "000")

FUNCTION 25.....Leave as default value ("000").

## (2) When using 4 ml vials

Besides vial racks for solvents/waste liquid, prepare another 4 ml vial rack (S221-32949-01) separately.

You can set two 4 ml sample vials on the vial rack. See ["2.3 Setting Vial Racks to the Rack Guide, Loading Rack into the Autoinjector" P.38](#) for the procedure to mount the vial rack to the rack guide. Complete the following settings to aspirate larger amounts of samples in the vials, since 4 ml vials are deeper than 1.5 ml vials.

**For GC-2010/2010Plus/2014/2025**

- 1 Press the [OPTION] key on the gas chromatograph to display the [AOC Parameters] window.
- 2 Press [OtherPara (PF3)] of the PF menus to display the [AOC Other Parameters] window.
- 3 Set [Kinds of Vials] to [4 ml].
- 4 Set [Syringe Height (↓)] in millimeter (setting range: 0 - 10 mm).
- 5 Set [Syringe Height (↑)] to [0].

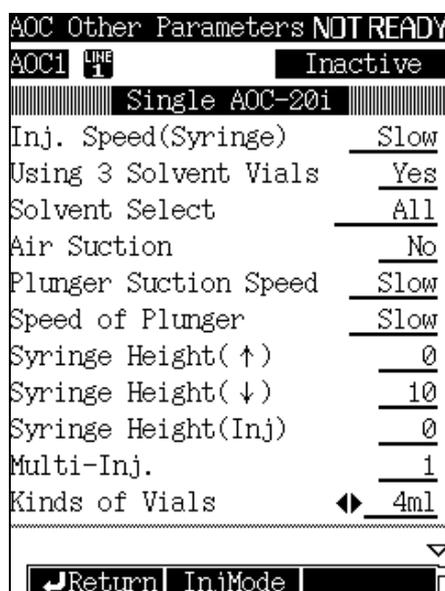


Figure 2-38

**For Other Gas Chromatographs**

Set the parameters as follows.

FUNCTION 29..... "001" (Vial type: 4 ml)

FUNCTION 26..... "000" - "010" (setting range: 0 - 10 mm)

FUNCTION 25..... Leave as default value ("000").

To change 4 ml vials to 1.5 ml vials, complete the parameter setting described below. If this is not done, the needle will hit the 1.5 vial bottom, breaking both the needle and vials.

**For GC-2010/2010Plus/2014/2025**

- 1 Press the [OPTION] key on the gas chromatograph to display the [AOC Parameters] window.
- 2 Press [OtherPara (PF3)] of the PF menus to display the [AOC Other Parameters] window.
- 3 Set [Kinds of Vials] to [1.5 ml].
- 4 Set [Syringe Height (↓)] to [0].
- 5 Set [Syringe Height (↑)] to [0].

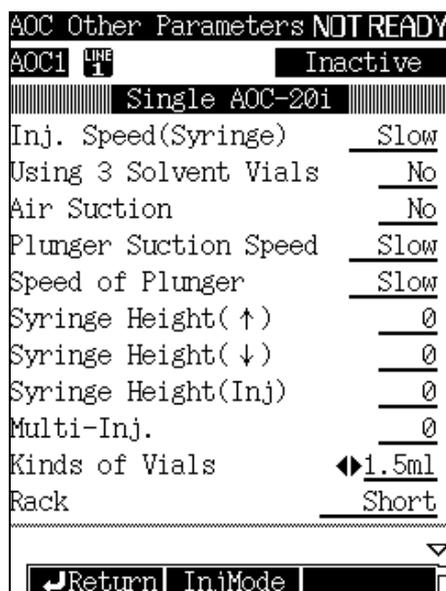


Figure 2-39

For details on the gas chromatograph operation, refer to the instruction manual of the gas chromatograph.

**For Other Gas Chromatographs**

Set the parameters as follows.

FUNCTION 29..... "000" (Vial type: 1.5 ml)

FUNCTION 26..... "000" (set to 0 mm)

## Maximum number of sample injections

The number of injections is limited by the capacity of the 4 ml rinse solvent and waste liquid vials. Assume that a 10  $\mu$ l syringe is used, with aspiration of 8  $\mu$ l per wash.

The rinse solvent vial volume limit refers to the maximum number of sample injections possible before a full solvent vial (4 ml) is emptied by aspirations.

For example, a maximum of 125 injections can be made when specifying 3 solvent washes (as indicated by dashed line (*Graph 2-1*)). Assuming 125 injections,  $3 \times 125$ , or 375 solvent washes will be performed. This will use all of the available solvent; even if more solvent washes are attempted, no solvent will be aspirated. (The actual solvent vial volume limit will be less than the amount indicated here due to loss by evaporation according to the solvent type.)

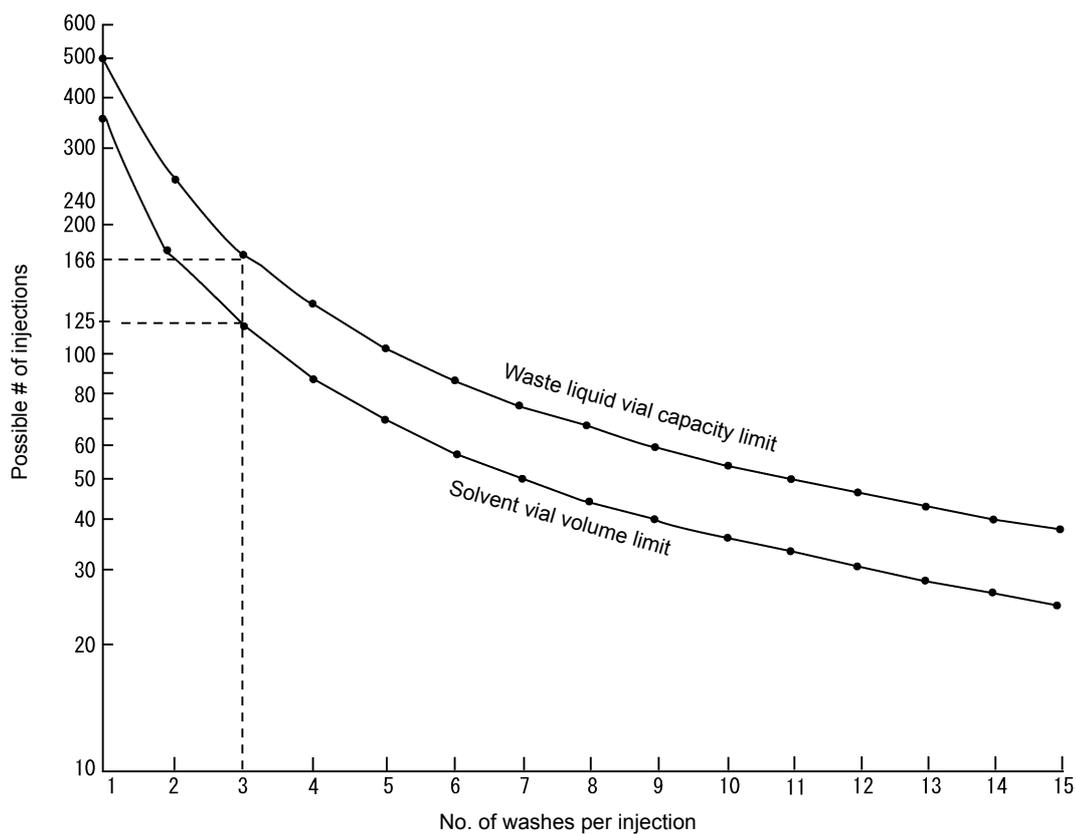
The other factor that must be considered is the waste liquid vial volume limit. This refers to the number of sample injections possible before the waste liquid vial overflows. Since the autoinjector performs sample washes and solvent washes, this limit value indicates the sum of both wash times.

There are several possible combinations of solvent and sample washes which yield a total of 3 washes, as shown in *Table 2-3*.

Table 2-3

	Frequency			
	0	1	2	3
Sample Wash	0	1	2	3
Solvent Wash	3	2	1	0

Use the graph to help determine whether the limiting factor is the solvent vial volume or the waste liquid vial capacity. Use the smallest number of injections indicated by the graph.



Graph 2-1

### Warning

- **USE CARE WHEN HANDLING FLAMMABLE SOLVENTS OR SAMPLES**

To prevent flammable solvents or samples (such as carbon disulfide) from evaporating and filling the installation site, securely tighten the cap that holds the septum in place on all vials (including rinse solvent and waste liquid vials).

### NOTE

#### Installation Precautions

Be sure to use the optional sample cooling fan when working with solvents with particularly strong flammability, such as carbon disulfide.

For other flammable solvents or samples, it is also recommended to use the sample cooling fan.

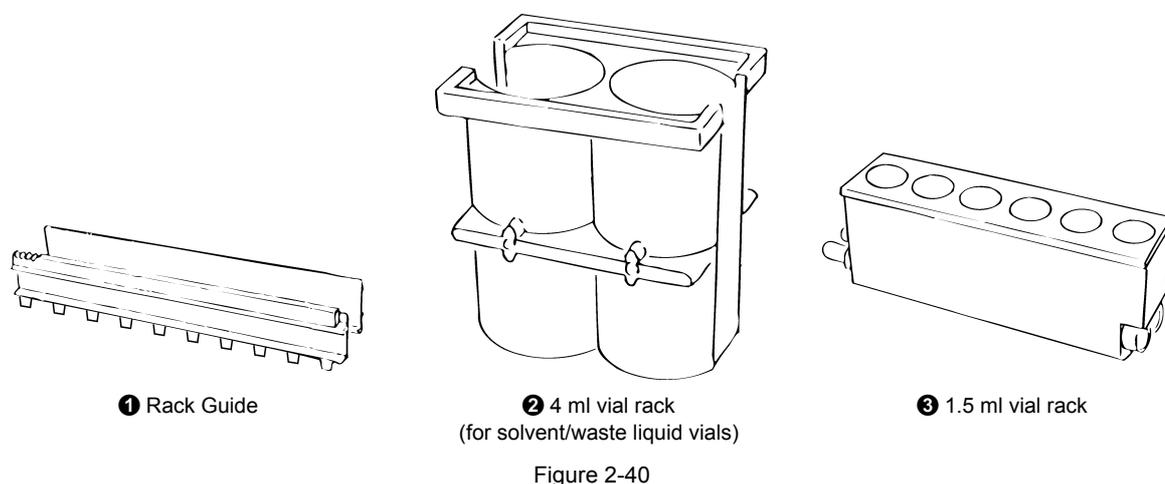
- **Prevent spills by never exceeding the waste liquid vial capacity.**

If the waste liquid vial overflows or the vapor fills the installation site, the heat from the injection port could ignite the liquid or vapor, causing a fire.

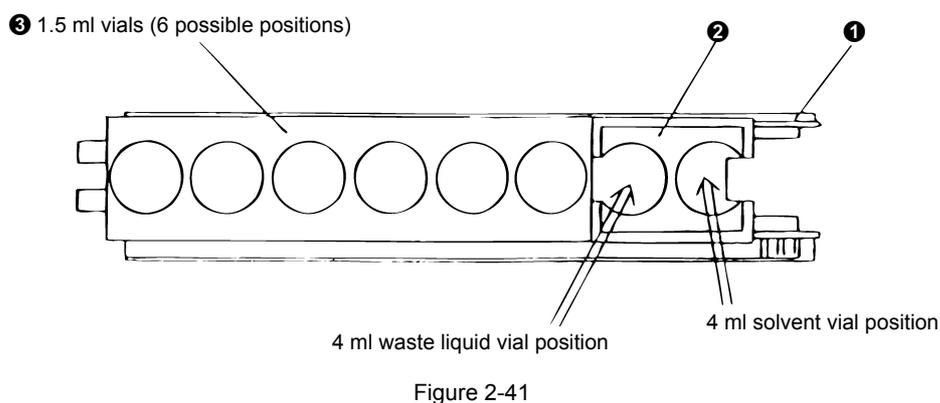
## 2.4.3 Vial Placement

In this section, the short rack introduced in "2.3 Setting Vial Racks to the Rack Guide, Loading Rack into the Autoinjector" P.38 is described in greater detail.

As shown in *Figure 2-40*, the rack guide and vial racks are separate components.



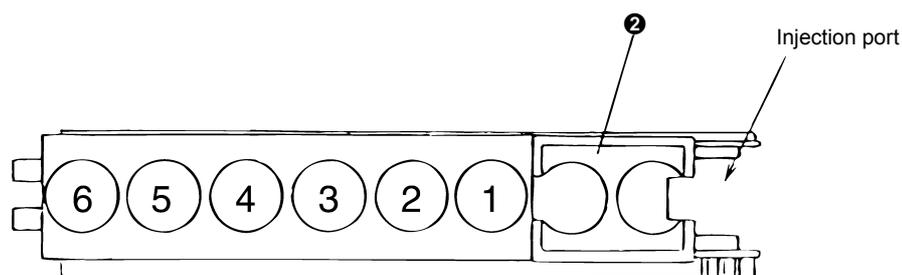
See *Figure 2-23* for the assembly of ② and ③. *Figure 2-41* shows the vial arrangement in the assembled rack.



1.5 ml vials can be placed in any position of ③. Injection starts from the vial closest to the injection port, and proceeds in numeric order, as shown in *Figure 2-42*.

### NOTE

Injection can proceed in an arbitrary order when performing an analysis schedule on GC-2010/2010Plus/2014/2025 or batch analysis on GCsolution, CLASS-GC10, and Chromatopac GC net.



**Example:**   ⊗: Positions where a vial is located  
                  ○: Positions with no vial

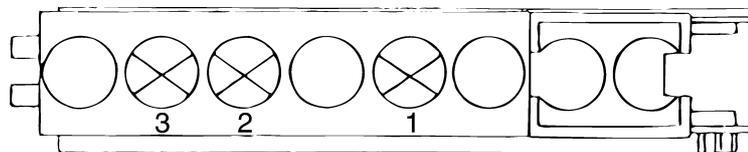


Figure 2-43

Place the samples in any position. The injection starts from the position closest to the injection port (1 → 2 → 3 in the example above).



**NOTE**

The vial mounting procedure and injection order is the same for the long rack, except that there are more 1.5 ml vial positions (12).



**NOTE**

Ensure that a waste liquid vial is in place. If not, a "-14" error message appears.

## 2.5 Replacing INJ Port Septum

### WARNING

- DO NOT perform septum replacement before the INJ cools down to 50 °C or lower. Attempting replacement work when the INJ is still hot will cause burn injuries.

### CAUTION

- To prevent the screw part from being burnt, DO NOT tighten the screw and nut when the INJ is still hot.

2

The injection port septa are durable for only approximately 100 injections. Exceeding this number of injections may cause gas leaks and deteriorate analysis reproducibility. Be sure to replace the septum before it exceeds its service life.



### NOTE

By setting the analysis counter function on GC-2010/2010Plus/2014/2025, GC-17A Ver.2,3, 1700, and 18A, a message informing you of the septum replacement time is displayed on the GC screen. For details, refer to the instruction manual of the gas chromatograph.

Remove the autoinjector and replace the injection port septum by the procedures described below. They are basically the same regardless of the gas chromatograph type, except for procedure 1.

1

### Turn OFF the power of the autoinjector.

#### For GC-2010/2010Plus/2014/2025

If the gas chromatograph power is ON, switch OFF the autoinjector as follows:

- 1 Press the [OPTION] key on the gas chromatograph to display the [AOC Parameters] window.

- 2 Set [AOC POWER] to [Off], and press the [ENTER] key.

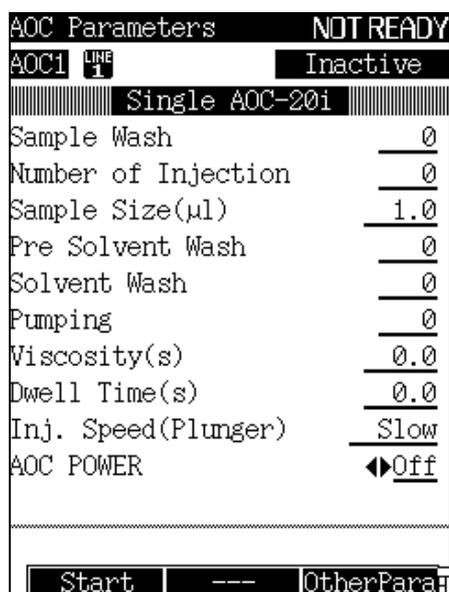


Figure 2-44

#### For Other Gas Chromatographs

- 1 Turn OFF the power switch on the power supply unit.
- 2 **Open the autoinjector door, and verify that the syringe drive unit is located at its highest position.**

If not, lift up the syringe drive unit as shown in [Figure 2-45](#).

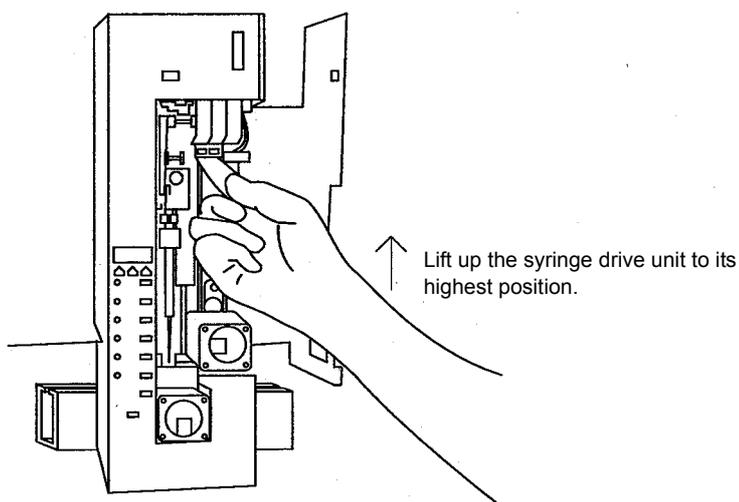


Figure 2-45

#### **CAUTION**

- If the autoinjector is removed when the syringe drive unit is not at its highest position, the syringe needle may be broken or damaged.

- 3** Lift the autoinjector straight up and set it aside during septum replacement. (e.g. on the back of the INJ/DET cover in the case of GC-2010/2010Plus or GC-17A)

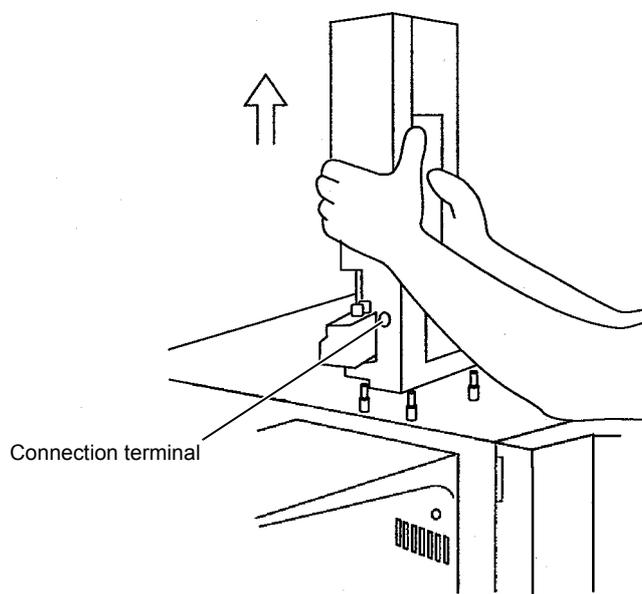


Figure 2-46

By unplugging the cable from the terminal, you can move the autoinjector to a place where the cable cannot reach.

- 4** Replace the injection port septum.

(For the detailed procedure, refer to the instruction manual of the gas chromatograph.)

**NOTE**

Be sure to use the needle guide as well as septum nut designated for the autoinjector.

(They are standard accessories for GC-2010/2010Plus/2014/2025.)

When using GC-14A/B, 15A, and 16A, pay extra attention to the shape of the septum nut. Differently shaped septum nut must be used according to the injection port types.

Note that the OCI-14 needle guide is designated only for OCI-14, unlike those for the other injection ports. This needle guide is longer than others. [Figure 2-47](#) below shows the shapes and dimensions of various autoinjector needle guides and septum nut.

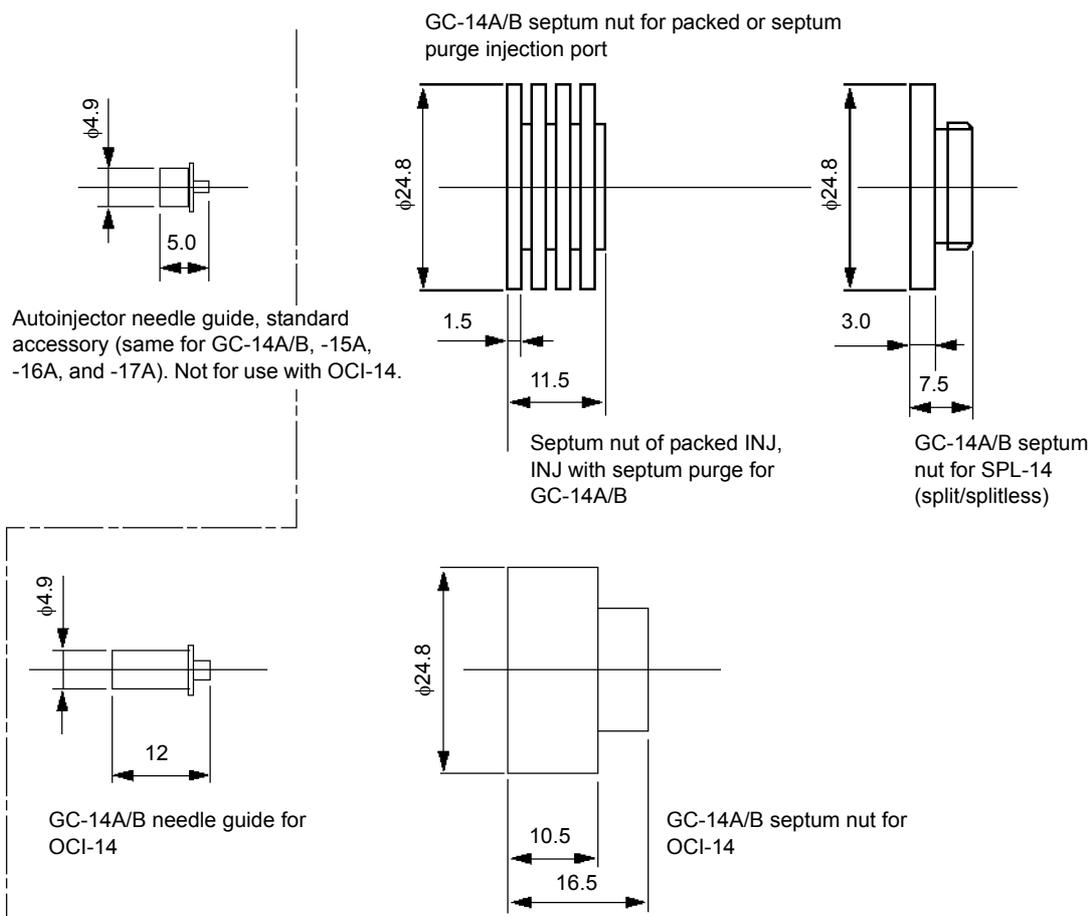


Figure 2-47

**NOTE**

In the case of GC-14A/B, 15A, or 16A:

When there are other INJ ports next to the one currently used (e.g. DUAL packed INJ), they also must have the septum nut and needle guide designated for the autoinjector.

If standard items (i.e., not those designated for the autoinjector) are mounted to the other INJ ports, the septum nut may obstruct the proper installation of the autoinjector due to its height.

You can install the autoinjector by removing the septum nut and needle guide, if those INJ ports are not used.

Note that the standard septum nut for GC-2014 does not obstruct the autoinjector installation.

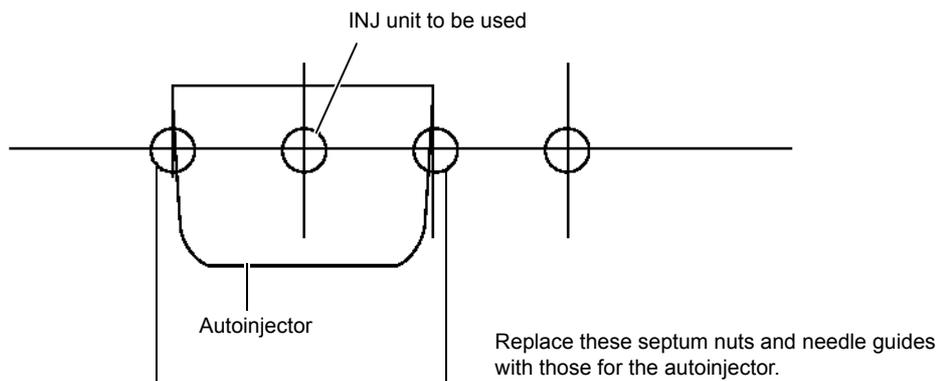


Figure 2-48

**5** Following the installation procedure described in ["2.1 Installing the Autoinjector to the Gas Chromatograph" P.21](#), reinstall the autoinjector to the original position.

**6** If you turned OFF the AOC power via GC-2010/2010Plus/2014/2025 in procedure [1](#), turn ON the autoinjector as follows.

- 1 Press the [OPTION] key on the gas chromatograph to display the [AOC Parameters] window.
- 2 Set [AOC POWER] to [On], and press the [ENTER] key.

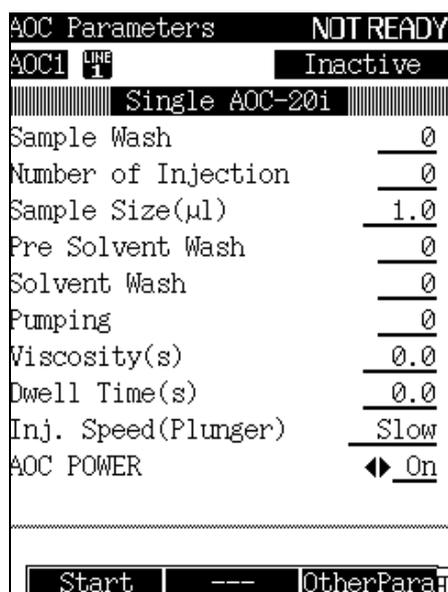


Figure 2-49

For details on the gas chromatograph operation, refer to the instruction manual of the gas chromatograph.

## 2.6 Available Options

This section explains about the optional parts attaching to the autoinjector main unit.

### 2.6.1 Sample Cooling Fan (P/N S221-44995-91)

When installed on the autoinjector, this fan cools the vials in the rack. The fan turns ON and OFF along with the autoinjector and can be moved along with the autoinjector.

### 2.6.2 Long Rack (P/N S221-45622-91)

The long rack is used for analyzing up to 12 sample vials (For details on the operation procedure etc., see ["2.3.2 Setting Vial Racks to the Long Rack Guide \(Optional\)" P.39](#)).

Additionally, when using GC-14A/B or GC-2014, install this part and the mounting bracket for GC14/2014 (for AOC-20s) (S221-46217-92), which allows mounting the autosampler to the injection ports other than the one at far left.

### 2.6.3 FPD Cooling Fan (P/N S221-44996-91)

This fan is a required accessory for the FPD detector and a GC-14, -15, and -16. The power is supplied from the GC, so even when the autoinjector is turned OFF, the fan continues to operate as long as power is supplied to the GC.

The cooling fan is installed on the autoinjector. Use care when removing the autoinjector with a cooling fan attachment, because the fan is not fixed to the autoinjector.

The FPD cooling fan cable can be disconnected if necessary (for example, when moving the autoinjector away from the GC). Be sure to turn the gas chromatograph power OFF before removing the cable.

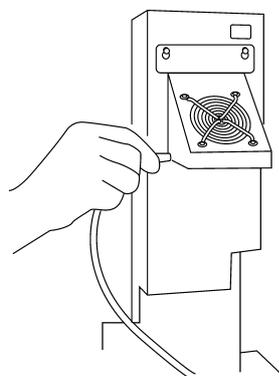


Figure 2-50

**NOTE**

When installing the autoinjector to the INJ located at the front of the FPD, use the FPD main unit cover attached to the standard cooling fan.

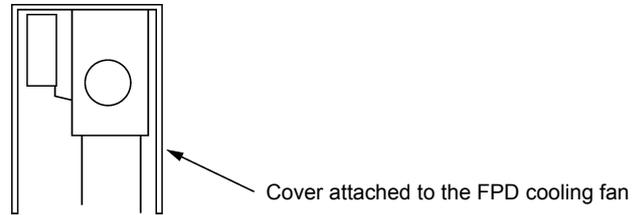


Figure 2-51

If the autoinjector is installed to an INJ other than that located at the front of the FPD, use the standard FPD cover (FPD main unit accessory). This prevents accidental contact with the FPD surface, which can cause burns.

## 2.7 Installing the Autosampler (AOC-20s) [Optional]

### 2.7.1 Installing the Vial Racks

Six 1.5 ml vial racks (each holding up to 25 vials) are provided. Additionally, 4 ml vial racks are available as optional parts. (See "[2.7.3 Using 4 ml Vials \(Option\)](#)" P.70.) Both rack sizes are installed in the same way.

- 1** The autosampler sample tray is divided into sections for positioning the vial racks. Seat the vial racks between the sections, in numerical order, as shown in [Figure 2-52](#).

An empty rack does not need to be placed in the autosampler for it to function.

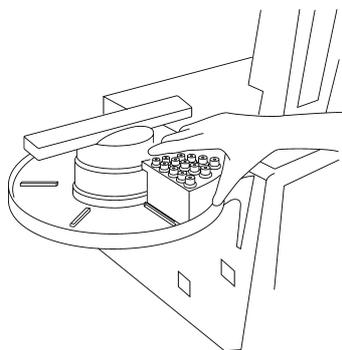


Figure 2-52

- 2** The arm of the autosampler can be rotated manually when the power is ON (unless the autosampler is operating). If necessary, the arm can be moved out of the way when placing a rack on the autosampler.

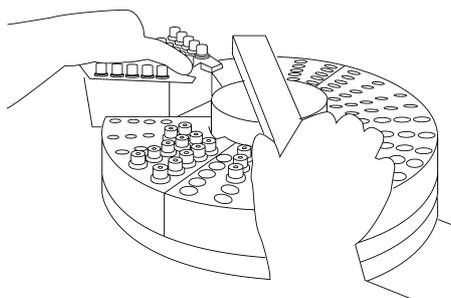


Figure 2-53

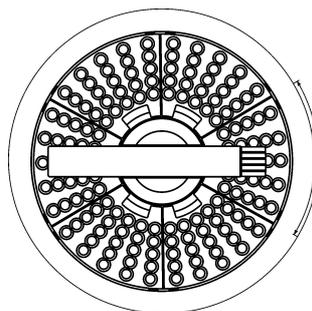


Figure 2-54

**CAUTION**

- Although the arm rotates manually, do not move it up and down or horizontally unless you need to do so. Do not attempt to rotate the arm beyond the movement range. When carrying the autosampler, do not hold it by its arm. Otherwise, it may be damaged.

To identify vial positions, the labels shown below are available. See [Figure 2-55](#) and [Figure 2-56](#) for the vial position numbers.

**NOTE**

When vial racks are not placed continuously, sample vial numbers are assigned sequentially skipping the places with no vial rack. For details, see ["3.4.1 Preparation"](#), ["\(3\) Placing vials in the autosampler tray" P.118](#).

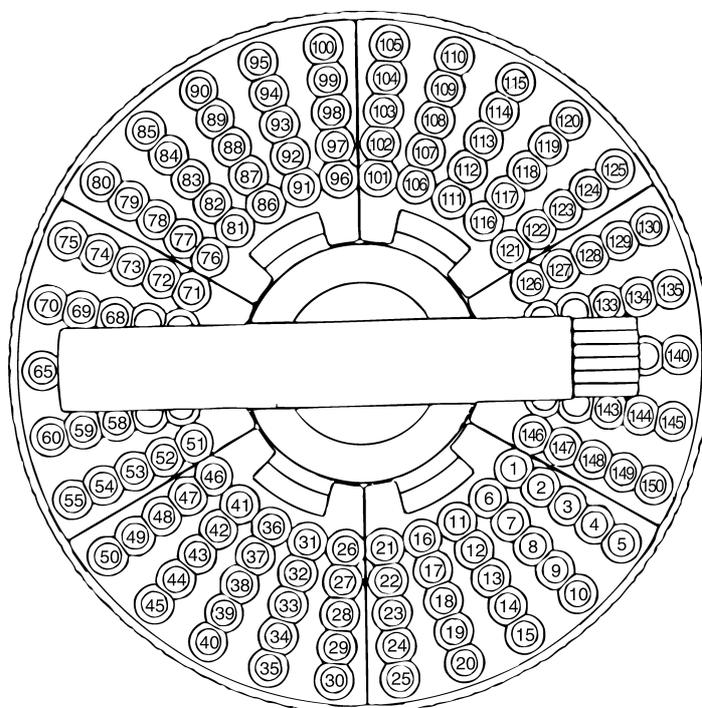


Figure 2-55 1.5 ml vials

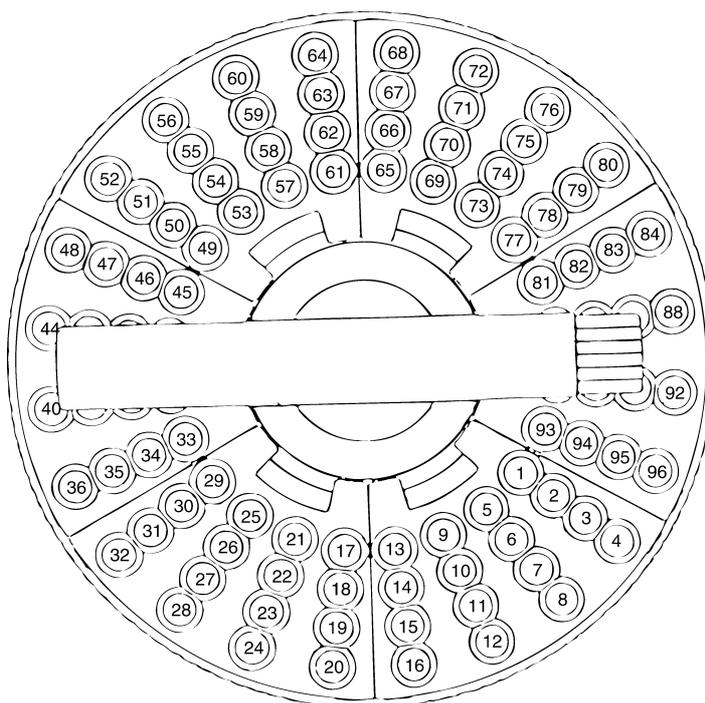


Figure 2-56 4 ml vials

1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6
1	1	1	1	1	1	26	26	26	26	26	26
25	25	25	25	25	25	50	50	50	50	50	50
51	51	51	51	51	51	76	76	76	76	76	76
75	75	75	75	75	75	100	100	100	100	100	100
101	101	101	101	101	101	126	126	126	126	126	126
125	125	125	125	125	125	150	150	150	150	150	150
1	1	1	1	1	1	17	17	17	17	17	17
16	16	16	16	16	16	32	32	32	32	32	32
33	33	33	33	33	33	49	49	49	49	49	49
48	48	48	48	48	48	64	64	64	64	64	64
65	65	65	65	65	65	81	81	81	81	81	81
80	80	80	80	80	80	96	96	96	96	96	96
1	1	1	1	1	1	7	7	7	7	7	7
6	6	6	6	6	6	12	12	12	12	12	12
13	13	13	13	13	13	19	19	19	19	19	19
18	18	18	18	18	18	24	24	24	24	24	24
25	25	25	25	25	25	31	31	31	31	31	31
30	30	30	30	30	30	36	36	36	36	36	36

Figure 2-57

## 2.7.2 Setting up Autoinjector Vial Racks

When using the autosampler, the standard autoinjector vial racks must be modified. The increased vial capacity of the autosampler means that additional solvent and waste liquid vials are necessary. Vial racks **1** and **3**, shown in [Figure 2-58](#), are standard autoinjector accessories. Two additional solvent/waste liquid vial racks **3** are provided with the autosampler. (Note that **2** 4 ml vial rack is available as an option).

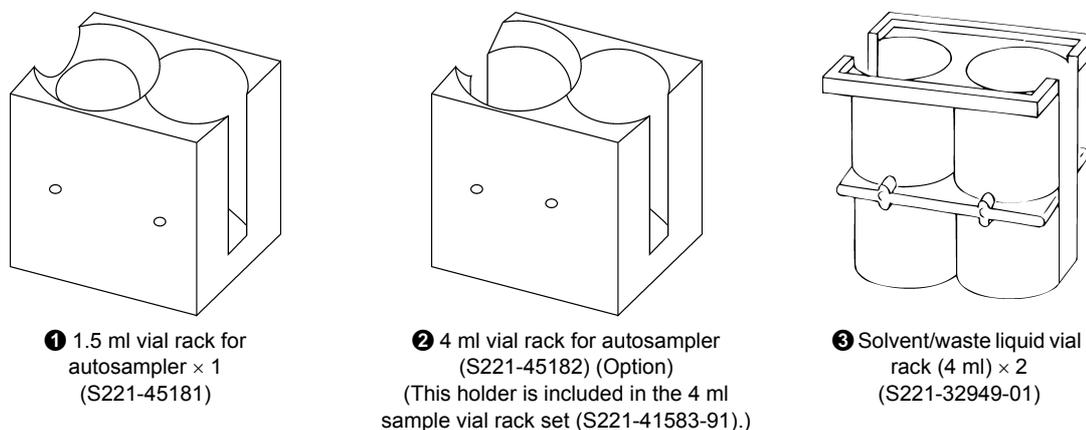


Figure 2-58

First, remove the current vial racks (for 6 vials) supplied with the autoinjector, by pulling them up. Then, insert the new vial racks in the arrangement shown in [Figure 2-59](#). Spread the rack guide apart slightly to insert the vial racks. See [Figure 2-60](#) and [Figure 2-61](#) for details on vial placement.

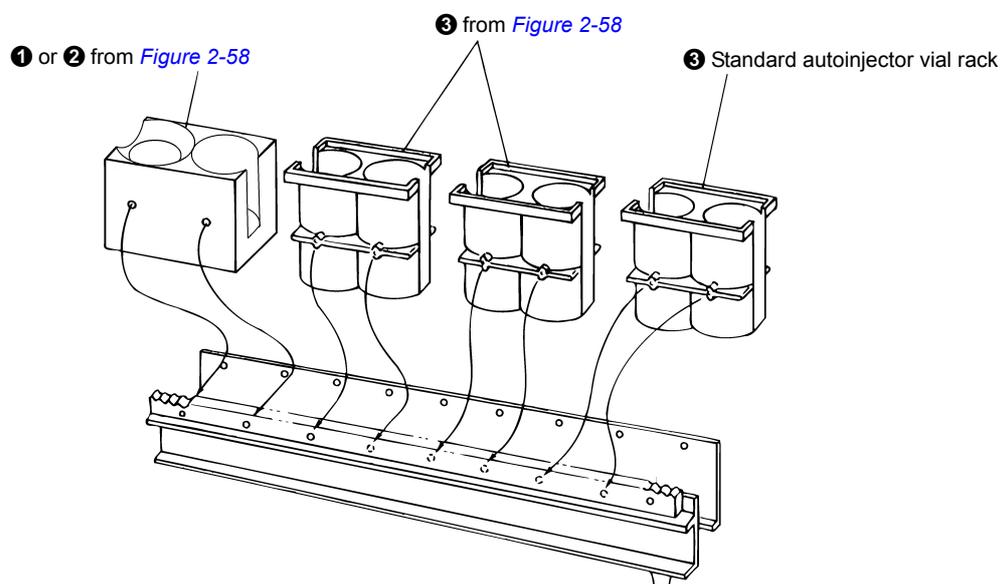


Figure 2-59

Arrange the 1.5 ml or 4 ml vials as shown in [Figure 2-60](#) or [Figure 2-61](#).

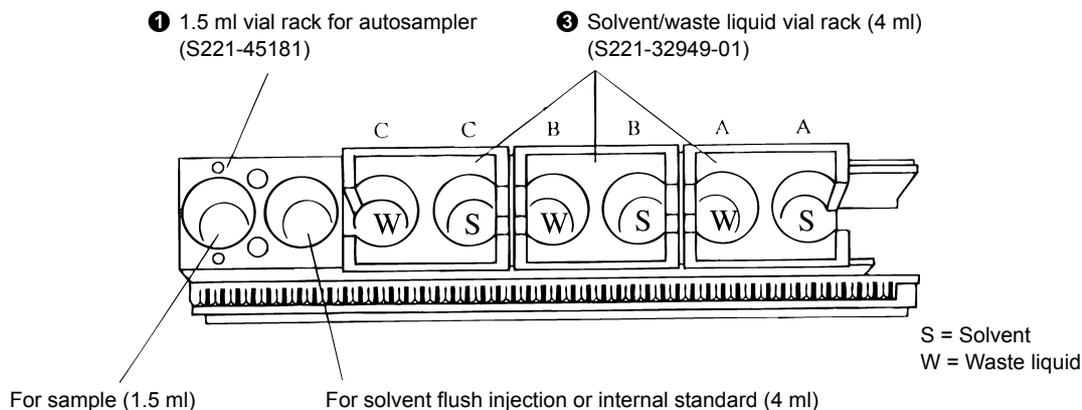


Figure 2-60 1.5 ml vial arrangement

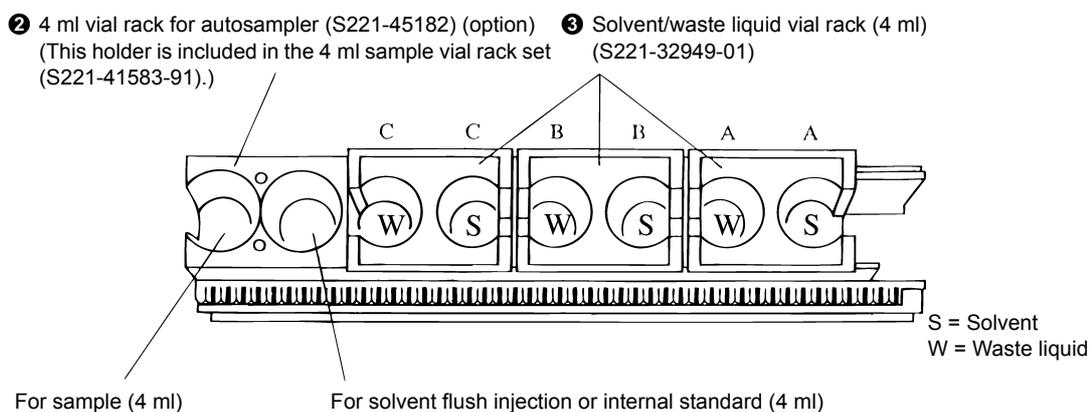


Figure 2-61 4 ml vial arrangement

As indicated in [Figure 2-60](#) and [Figure 2-61](#), solvent A (S) is discharged into the waste liquid A vial (W), and likewise for B and C. When washing with 3 solvents, each of the waste liquid is discharged into the waste liquid vials marked A to C. When washing with only one solvent, the waste liquid of sample wash is discharged into the waste liquid vial corresponding to the used wash solvent.

Both sizes of vial racks have pegs on the bottom. When inserting the racks, the pegs should appear at the end of the rack guide, as shown in [Figure 2-62](#).

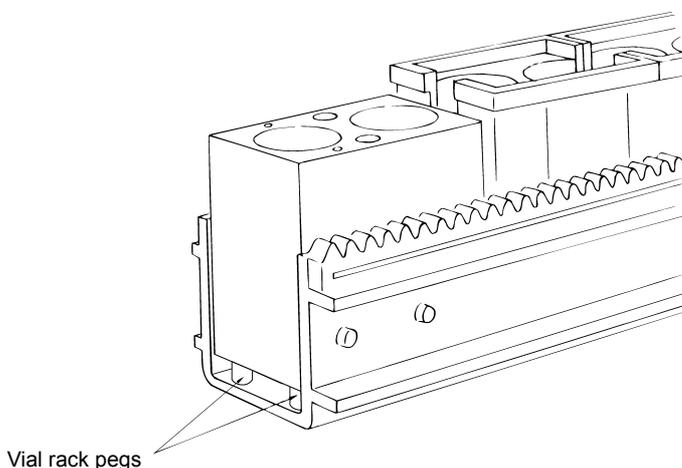


Figure 2-62

**NOTE**

Use the vial racks supplied with AOC-20s autosampler by mounting to AOC-20i rack guide. There are two types of AOC rack guides of gray or black material. There is no problem in using vial racks with colors different from that of a rack guide.

**NOTE**

To use the autosampler, complete the following settings.

- For GC-2010/2010Plus/2014/2025
  - 1 Press the [OPTION] key on the gas chromatograph to display the [AOC Parameters] window.
  - 2 Press the toggle key to display [Sampler] on the PF menu.
  - 3 Press the [Sampler] (PF1) to display the [Sampler] window.
  - 4 Set [Use of the Sampler] to [Use].

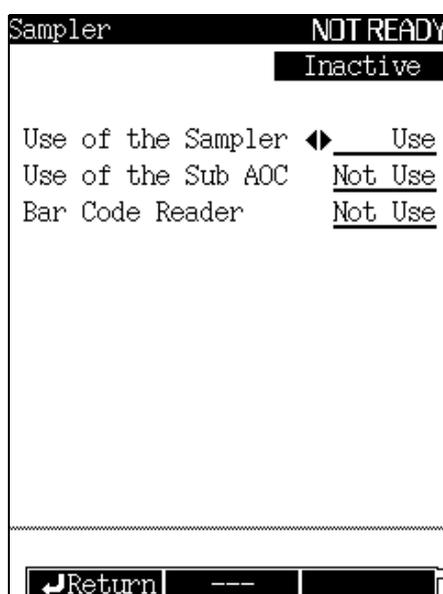


Figure 2-63

For details on the gas chromatograph operation, refer to the instruction manual of the gas chromatograph.

- For Other Gas Chromatographs
 

Set the parameter as follows.  
FUNCTION 40 ..... "001" (Use the sampler.)

A solvent or standard needs to be placed in the second vial position shown in [Figure 2-60](#) and [Figure 2-61](#) only in solvent flush injection mode.

The 4 ml vial for solvent flush injections is placed in the vial rack. The autosampler allows use of a different vial for solvent flush and solvent rinse to minimize cross contamination problems.

## 2.7.3 Using 4 ml Vials (Option)

4 ml vials can be used instead of 1.5 ml vials. A 4 ml vial rack assembly (S221-44878-91) includes the accessories described below.

Table 2-4 4 ml vial rack assembly (S221-44878-91)

	Name	Part No.	Q'ty	
❶	4 ml vial autosampler rack	S221-44710-91	6	
❷	4 ml vial rack for autoinjector	S221-45182 *	1	
❸	Large septum (for 4 ml)	S221-34266-92	2	1 set 50 each, Total 100 pieces
❹	4 ml vial	S221-34267-92	2	
❺	Large cap (for 4 ml)	S221-34268-92	2	

\* This holder is included in the 4 ml sample vial rack set (S221-41583-91).

When using 4 ml vials, both the vial racks for both the autosampler and autoinjector must be changed. For the installation procedure, see ["2.7.1 Installing the Vial Racks" P.64](#) and ["2.7.2 Setting up Autoinjector Vial Racks" P.67](#).

## 2.7.4 Precautions for Using the Autosampler

Please observe the following precautions when using the autosampler.

- (1) Make sure that the caps of the vials being used are securely fastened.  
If a cap is loose or is at an angle, the autosampler may not be able to grip the vial properly, resulting in an error.
- (2) If the autoinjector has been removed, in order to replace the septum or glass insert, make sure that the autoinjector is reattached in the correct position.  
If the autoinjector is at an angle, the autosampler may not be able to grip the vial properly, resulting in an error.
- (3) Set the position of the autosampler arm correctly (in [Rack position] for GC-2010/2010Plus/2014/2025, and in FUNCTION 94 for other GC). If the arm position is not adjusted correctly to the cap of the vial in the autoinjector rack, perform the following procedure to teach the autosampler the correct position (teaching function).

## 2.7.5 Adjusting Sample Gripping Position (Teaching)

- 1** Turn the autoinjector on while pressing both the [Function] and [Monitor] keys. (For GC-2010/2010Plus/2014/2025, set "AOC POWER" to "On" in the [AOC Parameters] window on the GC, and press the [ENTER] key.)
- 2** After the initialization process has completed, place a vial (1.5 ml or 4 ml vial) on the left side of the autoinjector turret.
- 3** Set the rack guide position for the autoinjector by the following procedure:

**For GC-2010/2010Plus/2014/2025**

- 1 Press the [OPTION] key on the gas chromatograph to display the [AOC Parameters] window.
- 2 Press [OtherPara (PF3)] of the PF menus to display the [AOC Other Parameters] window.
- 3 Specify the rack guide position.

[0] : GC-2014/2025 (All INJ positions)

[1] : GC-2010/2010Plus Front

[2] : GC-2010/2010Plus Rear = Standard position

Per factory default, the autosampler has been programmed so that the arm moves to the rack guide on the autoinjector mounted to the positions above (the far left INJ for GC-2014/2025). You can also specify the desired arm destinations by using "teaching" procedures.

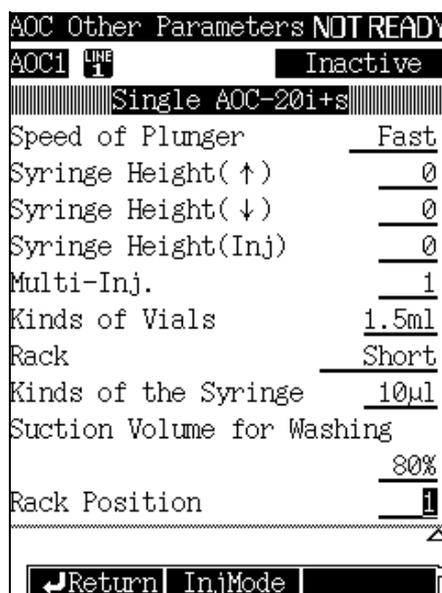


Figure 2-64

**For Other Gas Chromatographs**

Enter the sample gripping position ("000" - "002") for the FUNCTION 94 value.

"000": GC-14A/B, 15A, and 16A (All INJ positions)

"001": GC-17A (GC-1700, GC-18A) Front = Standard position

"002": GC-17A (GC-1700, GC-18A) Rear

Per factory default, the autosampler has been programmed so that the arm moves to the rack guide on the autoinjector mounted to the positions above (the far left INJ for GC-14A/B, 15A, and 16A). You can also specify the desired arm destinations by using "teaching" procedures.

To enter "001", perform the following key operation:

- 1 Press the [FUNCTION] key.
- 2 Set "094" using the arrow keys.
- 3 Press the [ENTER] key.
- 4 Set "001" using the arrow keys.
- 5 Press the [ENTER] key.

**CAUTION**

- When setting the rack guide position (FUNCTION 94), be sure to set the value for the correct rack position beforehand, and perform the teaching procedure.

## 4 Allow the FUNCTION 78 value ("000") to appear on the autoinjector display.

- [1] : Press the [FUNCTION] key on the autoinjector.
- [2] : Set "078" using the arrow keys.
- [3] : Press the [ENTER] key.

## 5 Place a vial on the turret. Gently move the autosampler arm so that it is positioned level with the vial.

To position the arm in the horizontal plane, first extend the arm slightly beyond the amount required and then align it to the correct position. (The teaching will not be performed properly when the arm is fully extended.)

To position the arm in the vertical plane, use the [SAMPLE WASH], [SOLVENT WASH], and [NUMBER OF INJECTIONS] keys to move the arm to the position shown in [Figure 2-65](#). (Never move the arm up or down while holding it near the end.)

### NOTE

There is a slight delay between when the keys are pressed and when the arm moves.

- [SAMPLE WASH] key: up
- [SOLVENT WASH] key: stop
- [NUMBER OF INJECTIONS] key: down

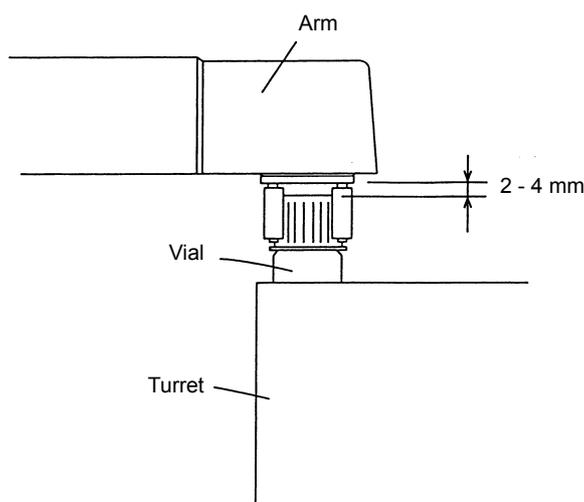


Figure 2-65

## 6 After the position is aligned, adjust the function value to "001", then press the [Enter] key.

The arm will grip the cap of the vial once, then return to the home position.

## 2.7.6 Mounting bracket for GC14/2014 (for AOC-20) (Optional)

Usually, when using the autosampler with GC-2014 or GC-14A/B, you can install the autoinjector only to the injection port at the far left INJ position, even if using the standard mounting bracket that comes with the autosampler. To make the autoinjector available at all INJ positions, use the mounting bracket for GC14/2014 (for AOC-20). Change the positions of the vial racks for autosampler on the long rack guide according to the selected INJ position.

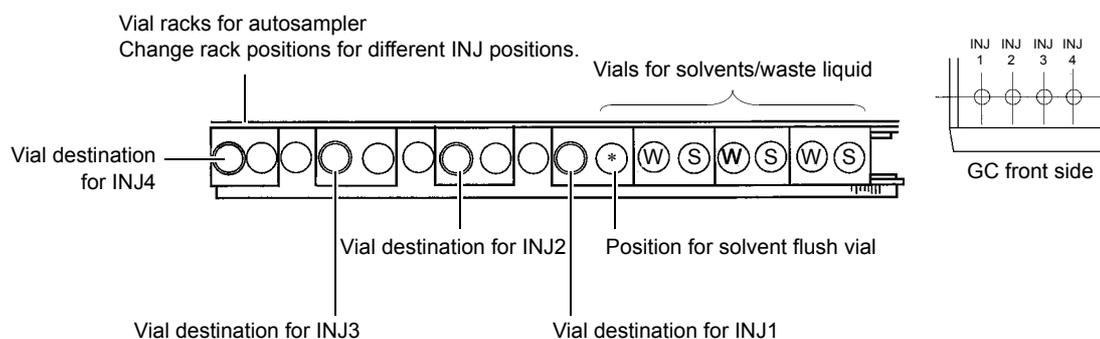


Figure 2-66

To use this option with GC-2014, press the gas chromatograph [OPTION] key to display the [AOC Parameters] window, and complete the following settings for each sub screen.

<Sampler sub screen>

Use of the Sampler: [Use]

<AOC Other Parameters sub screen>

Rack: [Long]

Rack Position: [0]

To use this option with GC-14A/B (GC-15A/16A), complete the following settings via the autoinjector.

FUNCTION 40..... "001" (Use sampler)

FUNCTION 93..... "001" (Long rack guide)

FUNCTION 94..... "000" (Rack guide position: 0)



### NOTE

Be sure to perform the teaching process.



### NOTE

DO NOT use the short rack guide when the autosampler is set for the long rack guide.

If you do, the vial racks will fall from the autoinjector gear, causing an error.



### NOTE

When using in the solvent flush injection mode

Regardless of the INJ position, the solvent vial for solvent flush method should be set at the position marked with (\*) in [Figure 2-66](#). Therefore, when using this option in the solvent flush injection mode, it is required to prepare another sampler vial rack for the solvent flush vial.

- 1.5 ml vial rack for autosampler P/N S221-45181
- 4 ml vial rack for autosampler P/N S221-45182

 CAUTION

- When using the solvent flush injection mode at INJ1

If the vial racks for autosampler are mounted as shown in [Figure 2-3](#), the autosampler gripper interferes with the solvent flush vial, making the vial transportation impossible.

To use the solvent flush injection mode at INJ1, perform the teaching procedure described below.

- 1 Mount the vial rack for autosampler to the "vial destination for INJ2" described in [Figure 2-66](#).
- 2 In the [AOC Other Parameters] window, set [Rack Position] to [1]. Then, perform the teaching procedure.

- When using the solvent flush mode at INJ1

Rack guide position: [1]

- In cases other than above

Rack guide position: [0]

## 2.8 Controlling via Workstation

### 2.8.1 Controlling AOC-20i,s via GCsolution/GCMSsolution (on GC-2010/2010Plus/2014/2025, GCMS-QP2010)

You can control the autoinjector AOC-20i/Autosampler AOC-20s by operating the computer via the gas chromatograph. When the parameters set on the GC and GCsolution/GCMSsolution are not identical, those on GCsolution/GCMSsolution are applied to the autoinjector operation.

Operate the GC-2010/2010Plus/2014/2025 keypad for the parameters not available via GCsolution/GCMSsolution. (Operate the autoinjector keypad only for the parameters not available even via gas chromatograph.)

For details on the setting procedure, refer to the instruction manual for each software.

### 2.8.2 Controlling AOC-20i,s Using CBM-101/102 (on GCs Other than GC-2010/2010Plus/2014/2025)

The AOC-20 can be controlled by CLASS-VP software, version 4.3 or later, CLASS-GC10 software, version 1.60 or later, and GCsolution, version 2.0 or later.

The AOC-20 series includes a fiber optic interface as standard equipment. Therefore, when controlling the gas chromatographs via GCsolution or CLASS-GC10, only a fiber optic cable (2 m) is required (P/N: S070-92025-52).

The fiber optic cable is connected to the 3-channel fiber optic CBM-101/102 interface equipped for GC control.

An example system configuration for a GC-17A Ver.3 + AOC-20i (+ AOC-20s) + CLASS-GC10 is described below.

Name	Part No.
GC-17A Ver.3	
AOC-20i (+AOC-20s)	
CLASS-GC10DOS/V	S223-04142-91
English version	S223-04142-92
CBM-101	S223-04243-91
3-channel fiber optic interface	S223-03727-91
Fiber optic cable (2 m)	S070-92025-52

Operate the autoinjector keypad for the parameters not available via GCsolution or CLASS-GC10. For details on the setting procedure, refer to the instruction manual for each software.

### 2.8.3 Installation for GCMS-QP5000

AOC control for GCMS-QP5000 is performed by CLASS-5000 software. Currently, CLASS-5000 software does not support all AOC functions, and should be operated in AOC-20 (AOC-17) mode.

The following restrictions apply when using AOC-17 mode:

- (1) The valid ranges for conventional parameters supported by CLASS-5000 are the same as those for AOC-17.

Conventional parameters	AOC-17 mode	AOC-20 mode
Number of sample washes	0 - 20	0 - 99
Number of solvent washes	0 - 20	0 - 99
Wait time after aspiration	0 - 9.9 sec	0 - 99.9 sec
Plunger injection speed	low/high	low/mid/high
Syringe injection speed	low/high	low/high
Wait time after injection	0.3 - 9.9 sec	0 - 99.9 sec
Solvent flush	0, 1, 2, 3	0, 1, 2, 3, 4 Settings 3 and 4 are used with Autosampler.
Number of pumpings	0 - 20	0 - 99
Solvent selection	0, 1, 2, 3	0, 1, 2, 3
Sample injection volume	0.1 - 8.0 µl	0.1 - 8.0 µl
Number of sample injections	1 - 100	1 - 10
Number of samples when autosampler is used	1 - 100	1 - 150 Note 1)

Note 1) For 4 ml vials, the number of samples is 96.

- (2) The CLASS-5000 software does not support new parameters introduced with AOC-20, such as Aspiration to needle tip, Needle lower position, etc. However, these functions can be controlled using the AOC-20i keys.

When connected to the GCMS-QP5000, a 2-m fiber optic cable (P/N S070-92025-52) is required, similar to that for CLASS-GC10 software. A conventional AOC-17 Link Kit is not required.

## 2.8.4 Chromatopac C-R7A Series GC Network Control

The following Rel. No. can be used to control an AOC-20 over a GC network.

- C-R7A (e)

C-R7A system disk	R3.61 or later (System V3.6 or later)
Utility disk	R3.61 or later
- C-R7A (e) plus

C-R7A system disk	R5.51 or later (System V5.5 or later)
Utility disk	R3.61 or later

A three channel optical interface (P/N S223-03727-91) is required on the C-R7A side.

A 2-m fiber optic cable (P/N S070-92025-52) is required to connect the C-R7A and AOC.

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# 3 Operation

## 3.1 Basic Operation

### 3.1.1 Loading Vials in the Rack

Place vials in the rack as shown in [Figure 3-1](#). (See ["2.4.3 Vial Placement" P.55](#).)

 **NOTE**

The vial rack can be removed when the autoinjector is in home position. When re-installing the rack, insert it into the rack guide until the gears catch, then at least 20 mm more, and press the [RESET] key. (See ["2.3.3 Loading Rack into the Autoinjector" P.41](#).)

To insert the rack during analysis, press the [STOP] key instead of the [RESET] key. (See [P.44](#).)

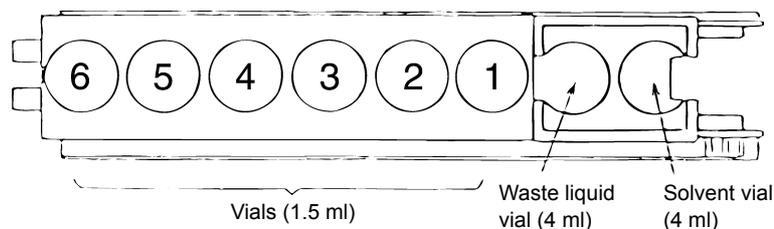


Figure 3-1

Vial positions are designated by numbers 1 - 6 (1 - 12 for the optional long rack), as shown in the figure above. A single vial can be placed in any of these positions; it will be automatically detected and injected. If there are two or more vials in the rack, injections occur from the lowest numbered position to the highest. For example, if vials occupy all 6 positions, injections will occur, in order, from position 1 to position 6.

## 3.1.2 Turning the Power ON/OFF

Turn ON the GC power when using GC-2010/2010Plus/2014/2025 (AOC built-in power type). Turn ON the autoinjector power when using the other gas chromatographs (AOC external power type).

After tuning ON the power, the autoinjector automatically performs the following operations, and moves to its home position:

- Plunger alignment
- Syringe alignment
- Moving the rack guide, plunger, and syringe to their home positions

### ■ Autoinjector Home Position

The home position refers to the autoinjector status in which the syringe, plunger, and rack are in their home positions.

Syringe: Highest position

Plunger: Lowest point

Rack: Far left position

The autoinjector stops its operation when the [STOP] key is pressed, or while the autoinjector is waiting for the GC READY status. However, this does not necessarily mean the autoinjector is at its home position.

The autoinjector is at its home position after the power is turned ON or the initialization process is completed. Otherwise, pressing the [RESET] key will set the autoinjector to its home position.

#### For GC-2010/2010Plus/2014/2025



#### NOTE

When using GC-2010/2010Plus/2014/2025 (AOC built-in power type), when the autoinjector does not operate even if turning ON the gas chromatograph:

- Verify that the AOC cable is connected properly.
- Press the [OPTION] key to display the [AOC Parameters] window, and verify that [AOC POWER] is set to [On].



#### NOTE

When the [AOC Parameters] window is not displayed even if pressing the [OPTION] key many times, perform the following procedure:

- 1 Press the [SET] key on the gas chromatograph to display the [Analysis Settings] window.
- 2 Select [LineConfig] (PF2 key) to display the [Line Configuration] window.
- 3 Specify the AOC for the analytical line.



#### NOTE

If the message "AOC link ok." is not displayed, check if the RS-232C cable is properly connected to the AOC power supply unit terminal on the GC back panel.

#### For Other Gas Chromatographs



#### NOTE

When using gas chromatographs other than GC-2010/2010Plus/2014/2025 (AOC built-in power type), turn OFF the autoinjector power supply unit first, then turn OFF the gas chromatograph. If the GC is turned OFF while the autoinjector is waiting for analysis, the autoinjector may start an injection. If it is necessary to turn OFF the gas chromatograph before the autoinjector, verify beforehand that the autoinjector is in the home position.

### 3.1.3 AOC-20i Keypad

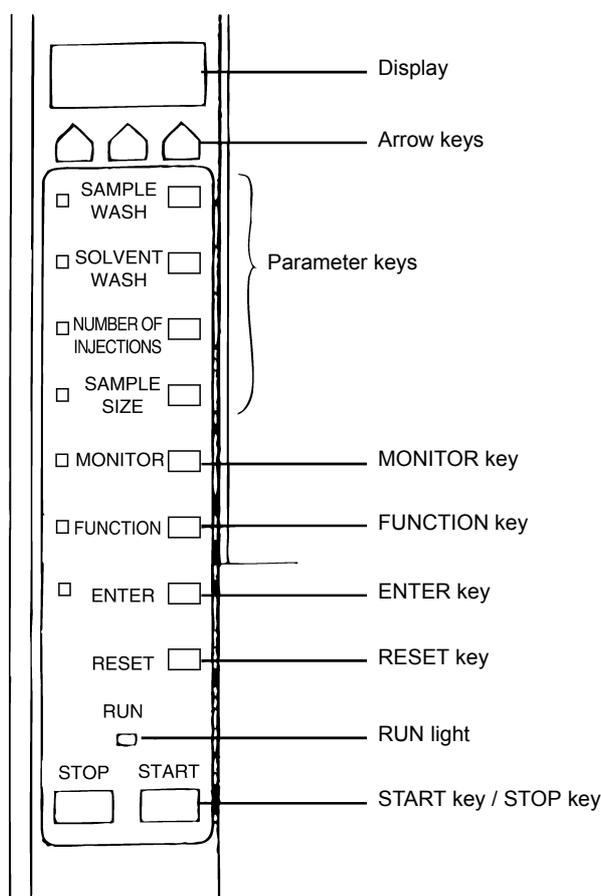


Figure 3-2

#### **CAUTION**

- GC-2010/2010Plus/2014/2025 [AOC Parameters] and AOC-20i Keypad

For GC-2010/2010Plus/2014/2025, operate the gas chromatograph when changing the AOC parameters accessible from the gas chromatograph. When you have set those parameters using the autoinjector keypad, perform the following procedure to change the AOC parameters set on the GC according to your change:

- 1 Press the [OPTION] key to display the [AOC Parameters] window.
- 2 Press [Upload] (PF menu) to upload the autoinjector parameters to the gas chromatograph.

The parameters not accessible from GC-2010/2010Plus/2014/2025 are indicated with "\*" in "Corresponding AOC Parameters/Other Parameters on GC" in the table shown in ["3.2.8 FUNCTION Key" P.92](#).

- Display  
All set values, sample numbers and error codes (numerical values displayed at an error occurrence) are displayed here. All parameter settings are either 000 or positive numbers. Error codes are negative numbers or numbers that begin with "E". When an invalid value is entered, "- -" is displayed.

**NOTE**

When using GC-2010/2010Plus/2014/2025, error messages also appear on the gas chromatograph display.

- Arrow keys  
These three keys change the values displayed. Each key corresponds to the right, center and left digit, respectively. Values changed with these keys do not become valid until the [ENTER] key is pressed.
- Parameter keys  
These display and set the various parameters. When one of these keys is pressed, the LED to its left illuminates.

**NOTE**

To set the parameters corresponding to these keys on GC-2010/2010Plus/2014/2025, be sure to operate via the gas chromatograph.

- MONITOR key  
During analysis, the [MONITOR] key is automatically activated, so that the current sample number is displayed. To display a parameter's current value, press the [MONITOR] key, then press the parameter key (within one second).
- FUNCTION key  
This key is used to set parameters (except for those parameters which have a parameter key, such as SAMPLE WASH), and for customizing or specifying optional accessories.  
When the [FUNCTION] key is pressed, a function number beginning with "F" is displayed (this is the most recently accessed function number). To view a different function, use the arrow keys to change the function number. Then press [ENTER] to display the current function value. To change the current value, use the arrow keys, then press [ENTER] to save the setting.

**NOTE**

When using GC-2010/2010Plus/2014/2025, use these keys only for setting the parameters not accessible via the gas chromatograph.

- ENTER key  
This saves the displayed numerical value as the current setting. When the [ENTER] key is pressed, the LED to its left illuminates momentarily.
- RESET key  
This key returns the autoinjector to the home position. All the parameter values remain in battery-powered reserve memory even if the [RESET] key is pressed.

**NOTE**

When using GC-2010/2010Plus/2014/2025, the same function can be accessed through [Reset] (PF menu) in the gas chromatograph [AOC Parameters] window.

- Run light  
This light is either on or blinking, according to the autoinjector status.  
Light on .....indicates that the autoinjector is performing a task.  
Light blinking .....indicates that the autoinjector is waiting for completion of the gas chromatograph analysis (waiting for the GC READY status).

- START key  
This initiates the injection process.

**NOTE**

When using GC-2010/2010Plus/2014/2025, the same function can be accessed through [Start] (PF menu) in the gas chromatograph [AOC Parameters] window.

- STOP key  
Pressing the [STOP] key causes the autoinjector to stop after completing the current operation. The process resumes where it left off when the [START] key is pressed.

**NOTE**

When using GC-2010/2010Plus/2014/2025, the same function can be accessed through [Stop] (PF menu) in the gas chromatograph [AOC Parameters] window.

### 3.1.4 Setting Parameters

The parameter default values have been preset to the autoinjector at the factory. Additionally, those autoinjector parameter default values have also been preset to the gas chromatograph GC-2010/2010Plus/2014/2025 at the factory. You can change these parameters as your analytical purposes dictate.

**NOTE**

When changing the parameters accessible from the gas chromatograph GC-2010/2010Plus/2014/2025, be sure to operate from the GC.

The parameters not accessible from GC-2010/2010Plus/2014/2025 are indicated with "\*" in "Corresponding AOC Parameters/Other Parameters on GC" in the table shown in ["3.2.8 FUNCTION Key" P.92](#).

To set autoinjector parameters when using GC-2010/2010Plus/2014/2025, turn ON the gas chromatograph to link it to the autoinjector. The parameter values in the file loaded on the GC are automatically transmitted and set to the autoinjector. You can also change parameters in the GC [AOC Parameters] window (including sub screens). After changing the parameters, press the [ENTER] key on the GC. The changed parameters will be transmitted to the autoinjector.

Note that even though you can change the parameters by pressing the [ENTER] key on the autoinjector, the AOC parameters set on the gas chromatograph remain unchanged.

This means that the next time the GC is linked to the autoinjector (e.g. when the GC is restarted, etc.), the autoinjector parameters (accessible via the GC) are overwritten by all the AOC parameters transmitted from the GC.

#### Example: Changing SAMPLE WASH from 2 times to 3 times

For GC-2010/2010Plus/2014/2025

**1**

Press the [OPTION] key to display the [AOC Parameters] window.

**2**

Use the [] or [] keys to move the cursor to [Sample Wash].

### 3 Enter [3] from the gas chromatograph keypad and press the [ENTER] key.

#### NOTE

DO NOT change the parameter by pressing the [SAMPLE WASH] key on the autoinjector.

AOC Parameters		NOT READY
AOC1	LINE 1	Inactive
Single AOC-20i		
Sample Wash		<u>3</u>
Number of Injection		<u>1</u>
Sample Size(ul)		<u>1.0</u>
Pre Solvent Wash		<u>0</u>
Solvent Wash		<u>1</u>
Pumping		<u>5</u>
Viscosity(s)		<u>0.2</u>
Dwell Time(s)		<u>0.0</u>
Inj. Speed(Plunger)		<u>Fast</u>
AOC POWER		<u>On</u>
-----		
Start	---	OtherPara

Figure 3-3

#### NOTE

When setting parameters, the [ENTER] key must be pressed for the new parameter to take effect. Otherwise, the old parameter value will be used. If an invalid value is entered, the autoinjector does not process it. "Input parameter out of range" is displayed, and the previously set value remains in effect.

#### For Other Gas Chromatographs

### 1 Press the [SAMPLE WASH] key.

The LED to the left of the key illuminates and the display shows the current setting. ("002", as the initial value)



### 2 Press the [Right arrow] key once.

The value on the display increases to "003".



### 3 Press the [ENTER] key.

SAMPLE WASH is now set for 3 washes. (The [ENTER] key LED blinks once.)



**Example: Changing solvent aspiration volume for solvent flush mode**

Even for GC-2010/2010Plus/2014/2025, you cannot set this parameter via the gas chromatograph. Press the autoinjector [FUNCTION] key to change the F35 parameter.

**NOTE**

When setting parameters, the [ENTER] key must be pressed for the new parameter to take effect. Otherwise, the old parameter value will be used. If an invalid value is entered, the autoinjector does not process it. "--" is displayed, and the previously set value remains in effect.

**NOTE**

Pressing any of the parameter keys causes its current value to be displayed. However, the SAMPLE NUMBER parameter displays automatically without pressing the key. (See "3.1.6 Operation Precautions", "Vial Detection" P.88.) Therefore, if an injection sequence is started while setting a parameter, the SAMPLE NUMBER may be displayed. In this case, reset the parameter.

### 3.1.5 Basic Injection Procedure

The parameters required for sample injection are already set as default values in the autoinjector. (See "3.2.2 Parameter Keys" P.89 and "3.2.8 FUNCTION Key" P.92.) Therefore you can easily perform sample injections by (1) setting vials on the rack guide, (2) turning ON the power, and (3) pressing the [START] key (alternatively for GC-2010/2010Plus/2014/2025, [Start] (PF menu) in [AOC Parameters] on GC.)

Create the desired injection conditions by changing the following 4 parameters, etc.: SAMPLE WASH (Default: 2 times), SOLVENT WASH (Once), NUMBER OF INJECTIONS (Once), and SAMPLE SIZE (1.0  $\mu$ l). (See "3.2.2 Parameter Keys" P.89.)

The changed parameters are saved to the autoinjector even after the power is turned OFF.

Table 3-1

Key Name	GC-2010/2010Plus/ 2014/2025 Item Name	Description	Setting Range	Default Value
SAMPLE WASH	Sample Wash	Sample washing times of the syringe before injection	0 - 99 times	2 times
SOLVENT WASH	Solvent Wash	Solvent washing times of the syringe after injection	0 - 99 times	Once
NUMBER OF INJECTIONS	Number of Injection	Injection times for the same samples	1 - 99 times	Once
SAMPLE SIZE	Sample Size ( $\mu$ l)	Sample injection volume	0.1 - 8.0 $\mu$ l	1.0 $\mu$ l

If the [START] key is pressed on the autoinjector (For GC-2010/2010Plus/2014/2025, [Start] (PF menu) in [AOC Parameters]), the injection is performed by the following procedure:

## (1) Start

If the GC is READY when the [START] key is pressed, the autoinjector immediately starts injection sequences. If not, the autoinjector starts the sequences after the GC becomes READY. However, an injection cannot be started if an error code (-01 to -04: see "6.1 Error Codes" P.151) is displayed. In such a case, identify and remove the cause of the error, press the [RESET] key to return the AOC to its home position (the indication returns to "000".), and press the [START] key again.

If the GC is not READY when the [START] key is pressed, the autoinjector stands by until the GC becomes READY, blinking the RUN light. If the [START] key is pressed again during the stand-by, the injection process begins, regardless of the GC status.

## (2) Wash before injection

When "PRE SOLVENT WASH" [FUNCTION 01] is set, the syringe is washed with solvent. The initial setting is [0] (no solvent wash before injections).

During a sample wash, the syringe aspirates the sample then discards it. Using sample washes increases injection reproducibility. Specify the washing times by the parameter [Sample Wash]. For example, if the value is set to [2], two sample washes will be performed before injection.

 **NOTE**

When pumping and washing the syringe with sample or solvent, the plunger rises to aspirate the designated amount (8  $\mu$ l using 10  $\mu$ l syringe in the default setting), then holds that position for a certain time. The plunger is then pushed down to expel the contents into the waste vial. When aspirating high viscosity samples, increase the plunger hold time, since it takes some time for the sample to enter the syringe after the plunger is raised.

**For GC-2010/2010Plus/2014/2025**

Set the waiting time during sample wash with the parameter of [Viscosity(s)]. For example, if the set value is [0.2], the wait time is 0.2 seconds.

**For Other Gas Chromatographs**

Set the wait time with FUNCTION 03 (VISCOSITY). For example, if the set value is "00.2", the wait time is 0.2 seconds.

## (3) Pumping

If bubbles are included in aspirated samples, the reproducibility of the sample aspiration quantity is deteriorated. The autoinjector performs "pumpings" to pump out the bubbles from the samples.

The default value is 5 times. The number of pumpings can be changed.

For GC-2010/2010Plus/2014/2025: Pumping

For other gas chromatographs: FUNCTION 02

After the pumping is complete, the autoinjector aspirates samples with the specified volume. For example, if the value is set to [1.0] ("01.0") when using 10  $\mu$ l syringe, the autoinjector aspirates 1  $\mu$ l of the sample.

 **NOTE**

The set value of [Viscosity(s)] or VISCOSITY also applies for the wait time during pumping. For example, if the value is set to [0.2] ("00.2"), the wait time is 0.2 seconds. After aspirating the sample for the actual injection, however, the autoinjector always waits for 4 seconds, even if the value is set to 4 seconds or smaller. If the value is set to 4 seconds or longer, the autoinjector waits as long as the set value.

## (4) Sample injection

After the pumping is complete, the autoinjector aspirates the sample and injects it to the GC injection port. First the syringe is lifted down and the needle is inserted into the INJ port. Then the plunger is pressed down and the sample is injected.

**For GC-2010/2010Plus/2014/2025**

Select the plunger speed at injections from [Slow], [Middle], and [Fast] in [Inj. Speed(Plunger)] in the [AOC Parameters] window. Select the syringe up/down speed from [Slow] and [Fast] in [Inj. Speed(Syringe)] in the [AOC Other Parameters] window.

**For Other Gas Chromatographs**

Select the plunger speed at injections from Low ("000"), Medium ("001"), and High ("002") with FUNCTION 05. Select the syringe up/down speed from Low ("000") and High ("001") with FUNCTION 06.

(5) Wash after injection

The solvent wash rinses the syringe following injection to minimize contamination problems.

**For GC-2010/2010Plus/2014/2025**

The wash times can be set in [Solvent Wash] in the [AOC Parameters] window. For example, if the value is set to [1], one solvent wash is performed.

**For Other Gas Chromatographs**

Set the number of washes with the [SOLVENT WASH] key. For example, if the value is set to "001", one solvent wash is performed.



**NOTE**

The wait time for solvent wash is fixed to 0.2 seconds regardless of the [Viscosity(s)] and [VISCOSITY] settings.

(6) Return to home position

After the sequence above is complete, the syringe, plunger, and rack return to their home positions. The autoinjector then waits for the gas chromatograph to complete the analysis (the autoinjector RUN lamp blinks, and the gas chromatograph [AOC Parameters] displays [Wait]). When the analysis is complete and the GC becomes READY, the autoinjector begins the next injection process.

If 2 or more vials are set in the rack, the process described above is performed on each of the samples.

If a value higher than [1] is set to [Number of Injection] in [AOC Parameters] for GC-2010/2010Plus/2014/2025, or "NUMBER OF INJECTIONS" for other gas chromatographs, the process is repeated on each sample according to the value.

## 3.1.6 Operation Precautions

### ■ Parameter Settings

When an invalid parameter value is entered, the previous set value remains unchanged. (When using GC-2010/2010Plus/2014/2025, "Input parameter out of range" appears in the GC display, and when the value is entered with the autoinjector keypad, "- - -" is displayed.)

If a parameter is changed after an injection sequence has begun, the previous value is applied to the current sequence. For example, if a SAMPLE WASH value is changed from 2 to 3 during a sample wash, only two sample washes will be performed. The new setting will take effect upon the next injection, when sample wash will be performed three times.

### ■ Reset and Stop

The "STOP" refers to pausing an injection process temporarily; the "RESET" refers to stopping the injection entirely.

If an injection process is stopped while the autoinjector is actively functioning, the injection process pauses after completing the current operation. If the injection process is started, it resumes from the sequence next to the interrupted sequence.

If an injection process is reset while the autoinjector is actively functioning, the autoinjector promptly returns to home position. (However, if the autoinjector is in operation, it is better to first stop the procedure before resetting it.)

If the injection process is restarted (after it is reset), it will start from the beginning. If an error ("-01" to "-04") is displayed, reset the injection process to return the injector to the home position, clearing the error.

Reset the injection process to return the autoinjector to the home position in the following situations:

- To re-start the injection process after the process has started.
- To terminate analyses during an analysis sequence (see ["3.3 Sequential Analyses and Injection Modes" P.104](#)).
- To clear an error code ("-01" to "-04": see ["6.1 Error Codes" P.151](#)) which appeared when attempting to start an injection process.

Stop the injection process to pause the autoinjector temporarily in the following situation:

- To temporarily pause the injection process (for confirming the presence of sample in the syringe or to change parameter settings, for example).

### ■ Vial Detection

The autoinjector uses a photo-sensor to automatically detect vials in the rack. If there are no sample vials, the injection process is not performed; if there are no solvent vials, the solvent wash procedure is not performed.

A vial can be placed in any position of the rack to start injection. When vials are placed in several positions, injections are made in ascending order from the lowest position number.



#### NOTE

If the autoinjector detects no waste vial, an error occurs and the autoinjector stops operating as the contents of the syringe cannot be expelled. Always place a waste liquid vial in the rack.



#### NOTE

To allow error-free vial detection, use only white vials and caps. Avoid allowing strong light to shine directly on the vial detection sensor, as this can cause detection errors.

## 3.2 Display and Keypad Functions

### CAUTION

- For GC-2010/2010Plus/2014/2025, operate the following keys only for setting the parameters not accessible via the gas chromatograph.  
The parameters not accessible via GC-2010/2010Plus/2014/2025 are indicated with "\*" in "Corresponding AOC Parameters/Other Parameters on GC" in the table shown in ["3.2.8 FUNCTION Key" P.92](#).

3

### 3.2.1 Display and Arrow Keys

- The display shows parameter values and errors.  
When an invalid parameter value is entered, "--" is displayed and the LED to the left of the [ENTER] key remains on.
- Use the arrow keys to increase the displayed value when setting parameters. The displayed value cannot be lowered; to enter a lower number, cycle through to the highest value and start again.  
Each digit is increased by the corresponding arrow key below it. This means that as the right digit increases (even past 9), the center digit is not affected.

### 3.2.2 Parameter Keys

#### (1) SAMPLE WASH

Sets the number of times the syringe is rinsed with sample before sample injection.

Default Setting: Twice ("002")

Valid Range: 0 - 99 times ("000" - "099")

Change set values as required, considering the carry-over of the previous sample or solvent wash.

#### (2) SOLVENT WASH

Sets the number of times the syringe is rinsed with solvent after the sample is injected.

Default Setting: Once ("001")

Valid Range: 0 - 99 times ("000" - "099")

Change set values as required, considering the carry-over of the previous sample or solvent wash.

#### (3) NUMBER OF INJECTIONS

Sets the number of times to inject each sample. If this number is changed during an injection process, the new value will be used for the remaining samples in the sequence.

Default Setting: Once ("001")

Valid Range: 1 - 99 times ("001" - "099")

This value applies for all samples.

#### (4) SAMPLE SIZE

Sets the volume of sample to be injected, in  $\mu\text{l}$  [Set value (%)  $\times$  Syringe volume].

Default Setting: 1  $\mu\text{l}$  ("01.0") [when using 10  $\mu\text{l}$  syringe]

Valid Range: 0.1  $\mu\text{l}$  - 8.0  $\mu\text{l}$  ("01.0" - "08.0") [when using 10  $\mu\text{l}$  syringe]

**NOTE**

Be sure to set these parameters on the gas chromatograph. Otherwise, the autoinjector parameters between the autoinjector and GC become inconsistent.

Table 3-2

Corresponding AOC Parameters on GC	Key Name	Description	Setting Range	Default Value
Sample Wash	SAMPLE WASH	Sample washing times of the syringe before injection	0 - 99 times	2
Solvent Wash	SOLVENT WASH	Solvent washing times of the syringe after injection	0 - 99 times	1
Number of Injection	NUMBER OF INJECTIONS	Injection times of identical samples	1 - 99 times	1
Sample Size	SAMPLE SIZE	Sample injection volume	*	*

* Syringe Volume	Setting Range	Default Value (μl)
0.5	0.01 - 0.50	0.10
5	0.1 - 4.0	0.5
10	0.1 - 8.0	1.0
50	0.5 - 40.0	5
250	5 - 200	25

### 3.2.3 MONITOR Key

- The [MONITOR] key automatically displays the number of the sample currently being analyzed. This key is not used for setting values.

The number of the sample being analyzed is automatically entered by vial detection.

- Default value: 0 ("000")
- Possible display range: 1 - 6 ("001" - "006")..... With short rack  
1 - 12 ("001" - "012")..... With long rack  
1 - 150 ("001" - "150")..... With autosampler

When no vial is detected, "000" is displayed. When the autoinjector starts, the rack moves and the vial is detected. When a vial is detected, its position number (the smallest value if multiple samples are placed) is read and displayed.

- The current value of a parameter can also be monitored. Parameters that can be monitored are:
  - SAMPLE WASH, SOLVENT WASH, NUMBER OF INJECTIONS (analysis count), analysis time, analysis start time, and pumping.
  - To display the current number value of the first three parameters, press the [MONITOR] key, then immediately press the corresponding parameter key (within one second).
  - Both the [MONITOR] and the parameter key LEDs will illuminate.
  - To see the analysis start time (FUNCTION 32) and the analysis time (FUNCTION 31), press the [MONITOR] key, then the [FUNCTION] key.
  - To see the number of pumpings, press the [MONITOR] key, then the [SAMPLE SIZE] key.

### 3.2.4 ENTER Key

- This key saves parameters values. When this key is pressed, the LED to its left lights momentarily, and the displayed value is saved.  
When a displayed value is changed, it will not be saved until the [ENTER] key is pressed.
- If an invalid parameter value is entered, it cannot be saved even if the [ENTER] key is pressed. The display shows "- - -", and the LED at the left of the [ENTER] key remains on.

### 3.2.5 RESET Key

- This key forcibly aborts the injection process and returns the autoinjector to the home position. The [RESET] key also clears errors ("-01" to "-04"), and returns the autoinjector to the home position.



#### NOTE

- That if the [RESET] key is pressed during a sequence of analyses, all information on the number of completed analyses and injections is lost.
- For GC-2010/2010Plus/2014/2025, [Reset] (PF menu) in the [AOC Parameters] window on GC has the same function.

### 3.2.6 START Key

- This key initiates the injection procedure.  
If, for some reason, the syringe, plunger or rack did not return to home position, causing an error, the autoinjector cannot be started. (To clear the error, press the [RESET] key, then the [START] key.)
- If the [STOP] key was pressed to pause the injection process, press the [START] key to resume the injection process from the sequence next to the interrupted sequence.
- Press the [START] key after the [RESET] key to begin the injection procedure from the first sample.
- Once the [START] key has been pressed, the autoinjector waits until the gas chromatograph becomes READY. During this wait time, the RUN light blinks.  
The autoinjector can be forced to start injection before the GC is READY; press the [START] key again, and the injection process starts immediately.
- For GC-2010/2010Plus/2014/2025, [Start] (PF menu) in the [AOC Parameters] window on GC has the same function.

### 3.2.7 STOP Key

- This key pauses the injection process. Unlike the [RESET] key, the [STOP] key does not return the autoinjector to the home position. Therefore, pressing [START] after [STOP] resumes the injection process from the sequence next to the interrupted sequence.
- When the [STOP] key is pressed, the current action is completed before the autoinjector stops operation. For example, if the [STOP] key is pressed while the plunger is rising, the plunger will not stop midway, but will continue until it has reached its highest point.
- For GC-2010/2010Plus/2014/2025, [Stop] (PF menu) in the [AOC Parameters] window on GC has the same function.

## 3.2.8 FUNCTION Key

- The [FUNCTION] key is used to change and check the status of all the functions. When the [FUNCTION] key is pressed, the most recently used function number is displayed with an "F", and the function key LED illuminates. Change the numerical value to the desired FUNCTION number and press the [ENTER] key. The current value for the function is displayed. Change the numerical value and press the [ENTER] key to change the value.

### Example: FUNCTION 03 (Viscosity): Changes [Viscosity(s)]

Table 3-3

	Key operation	Display	
1	FUNCTION	F02	Displays the last FUNCTION No. (In this example, FUNCTION 02 was the last function used.)
2	Right arrow key	F03	Press the arrow key once; the display becomes "F03".
3	ENTER	00.2	The current value of FUNCTION 03 is displayed. (In this example, the hold time is set to 0.2 sec.)
4	Right arrow key	00.5	Press the arrow key three times, and the display becomes "00.5".
5	ENTER	00.5	Sets the plunger hold time to 0.5 sec.

- The function setting will display, and the FUNCTION LED stays on, until a key other than an arrow key or [ENTER] is pressed.
- For GC-2010/2010Plus/2014/2025, use the autoinjector keypad only when setting the FUNCTIONS not accessible via the GC. (i.e., FUNCTIONS indicated with "\*" in the following table, "Corresponding AOC Parameters/Other Parameters on GC")

## (1) FUNCTION 01 - 08

The FUNCTION 01 - 08 are the parameters for injection sequence.

Table 3-4

Corresponding AOC Parameter on GC	FUNCTION	Name	Description	Setting Range	Default Value
Pre Solvent Wash	F01	PRE SOLVENT WASH	Solvent washing times of the syringe before injection (Note 1)	0 - 99 times	0
Pumping	F02	PUMPING	Pumping times of the syringe	0 - 99 times	5
Viscosity	F03	VISCOSITY	Plunger waiting time after sample aspiration (Note 2)	0 - 99.9 sec.	0.2
Dwell Time	F04	DEWELL TIME	Waiting time after sample injection	0 - 99.9 sec.	0
Inj. Speed (Plunger)	F05	INJ SPEED-PLUNGER	Injection speed of the plunger	0: Low 1: Medium 2: High	2

Corresponding AOC Other Parameter on GC	FUNCTION	Name	Description	Setting Range	Default Value
Inj. Speed (Syringe)	F06	INJ SPEED-SYRINGE	Injection speed of the syringe	0: Low 1: High	1
Inj Mode	F07	INJECTION MODE	Injection mode	0 - 4 (Note 3)	0
Solvent Select	F08	SOLVENT SELECT	Solvent selection (Valid only when using the autosampler, or F28 = 1)	0 - 3 (Note 4)	0

Note 1) FUNCTION 01 is available only in Normal injection mode (when FUNCTION 07 is set to [0]).

Note 2) Wait times vary, depending on the injector operation. The wait time for both sample wash and pumping is the FUNCTION 03 set time. When aspirating a sample for injection, the plunger holds either the set time, or 4 sec, whichever is longer. The wait time for solvent washing is fixed at 0.2 sec.

Note 3) 0: sample + (air) --- Normal injection mode  
 1: Solvent + air + sample + (air) --- standard solvent flush mode } (See [Figure 3-14.](#))  
 2: Solvent + sample + (air)  
 3: Solvent + air + standard (internal standard) + air + sample + (air)  
 4: Solvent + standard (internal standard) + sample + (air)  
 Settings 3 and 4 are available only when an autosampler is connected.  
 The option of drawing air last is set with FUNCTION 20.

Note 4) 0: 3 vials of solvent are used.  
 1: Only solvent A is used. } (See [Figure 3-18.](#))  
 2: Only solvent B is used.  
 3: Only solvent C is used.

FUNCTION 08 is available only when the autosampler is connected and when FUNCTION 28 is set to [1].

## (2) FUNCTION 10 - 13

These functions designate priority samples.

For details, see "[3.3.2 Priority Analysis](#)" P.111 when not using the autosampler, or "[3.4.5 Priority Analysis](#)" P.123 when using the autosampler.

**NOTE**

For GC-2010/2010Plus/2014/2025, the [Priority] PF menu is displayed in the gas chromatograph [AOC Parameters] window, only when the autoinjector is operating.

Table 3-5

Corresponding AOC Parameter on GC	FUNCTION	Name	Description	Setting Range	Default Value
Priority	F10	PRIORITY SAMPLE	Priority sample No.	No. 1 - 6 No. 1 - 12 No. 1 - 150 (Note 1)	0
(Note 2)	F11	INJECTION SAMPLE	Number of priority injections	No. 1 - 6 No. 1 - 12 No. 1 - 150 (Note 1)	0
(Note 2)	F12	FINAL SAMPLE	Final priority sample No.	No. 1 - 6 No. 1 - 12 No. 1 - 150 (Note 1)	0
(Note 2)	F13	INJECTION SAMPLE2	Number of priority injections (for Sub-AOC)	No. 1 - 6 No. 1 - 12 No. 1 - 150 (Note 1)	0

Note 1) Without autosampler, short rack ..... 1 - 6  
long rack ..... 1 - 12  
With autosampler..... 1 - 150

When an autosampler is used, the valid range varies, depending on the vial size and racks installed.  
The default value, "0", indicates that there is no priority sample.

Note 2) F11, F12, and F13 do not have corresponding AOC parameters for GC-2010/2010Plus/2014/2025 on the gas chromatograph.  
Use the gas chromatograph batch schedule function, which allows a similar operation.

## (3) FUNCTION 20 - 35

These functions customize the instrument.

Table 3-6

Corresponding AOC Other Parameter on GC	FUNCTION	Description	Setting Range	Default Value
Air Suction	F20	Specifies whether to aspirate air to the syringe (Note 1)	0: No 1: Yes	0
F21	F21	Specifies wash solvent before injections in solvent flush mode (Note 2)	0, 1 (, 2)	0
Plunger Suction Speed	F22	Specifies the plunger speed at sample aspiration (Note 3)	0: Low 1: Medium 2: High	2
Speed of Plunger	F23	Specifies the speed of pressing down the plunger during sample wash and pumping	0: Low 1: Medium 2: High	2
Suction Volume for Washing	F24	Specifies the aspiration amount for sample wash and pumping	0: 80% 1: 60% of the F34 set value	0
Syringe Height (↑)	F25	Specifies the syringe height in vials (upper direction).	0 - 20 mm	0
Syringe Height (↓)	F26	Specifies the syringe height in vials (lower direction).	0 - 2 mm (1.5 ml vial) 0 - 10 mm (4 ml vial)	0
Syringe Height (Inj)	F27	Specifies the syringe height at injections (upper direction).	0 - 22 mm	0
Using 3 Solvent Vials	F28	Specifies whether to use 3 solvents in the system without the autosampler.	0: 1 solvent 1: 3 solvents	0
Kinds of Vials	F29	Selects the vial size.	0: 1.5 ml 1: 4 ml	0
*	F30	Specifies whether to check the position when returning a vial to the autosampler.	0: No 1: Yes	0
*	F31	Specifies the analysis time (time before the next injection).	0 - 655 min.	0
*	F32	Specifies the analysis start time (delay to start operation after the [START] key is pressed).	0 - 99.9 hour	0
Multi-Inj.	F33	Specifies the number of injections per analysis.	1 - 99	1
Kinds of the Syringe	F34	Specifies the syringe size.	0: 10 µl 1: 50 µl 2: 250 µl 3: 0.5 µl 4: 5 µl	0
*	F35	Specifies the solvent aspiration volume for solvent flush mode. (Note 4)	0: 10% 1: 5% of the F34 set value	0

Note 1) Specify whether to aspirate 1 µl of air after sample has been drawn. This helps to avoid discrimination for sample components with a wide boiling point range.

### CAUTION

- When using a high initial column temperature or a column with high polarity (such as polyethylene glycol (PEG) phase), injecting air may shorten the column service life.

- Note 2) The parameter settings for solvent wash before sample injection in SOLVENT FLUSH mode (when FUNCTION 07 is set to [1] - [4].)  
 0: Number of times set by the SOLVENT WASH key (the same number before and after injection)  
 1: Number of times set by the SAMPLE WASH parameter  
 2: Number of times specified in F01 (PRE SOLVENT WASH). (This is invalid for GC-2010/2010Plus/2014/2025.)  
 If the solvent flush mode is set for GC-2010/2010Plus/2014/2025, the GC [AOC Parameters] window does not display [Pre Solvent Wash], and the solvent wash is performed the same number of times before and after injections. If the F21 is set to [1], however, [Pre Solvent Wash] is displayed in the solvent flush mode, which allows specifying different sample wash times before and after injections.
- Note 3) The aspiration speed for sample wash and sample aspiration is variable. The aspiration speed for pumping and solvent wash is fixed at HIGH speed.
- Note 4) [5%] can be selected when Injection mode (FUNCTION 07) is set to [3] or [4]. Otherwise, a value of [10%] is applied regardless of the setting.

#### (4) FUNCTION 40 - 42

These functions specify whether or not to use optional units.

Table 3-7

Corresponding AOC Other Parameter on GC	FUNCTION	Description	Setting Range	Default Value
Use of the Sampler	F40	Autosampler	0: Not Use, 1: Use	0
Use of the Sub AOC	F41	Sub-injector	0: Not Use, 1: Use	0
Bar Code Reader	F42	Bar code reader	0: Not Use, 1: Use	0

#### (5) FUNCTION 50 - 51

These functions set the dual injector parameters. For details, refer to the Dual Injector User's Manual (P/N 221-40483).

Table 3-8

Corresponding AOC Parameter on GC	Corresponding AOC Other Parameter on GC	FUNCTION	Description	Setting Range	Default Value
	Alloc	F50	Specifies the sample allocation in DUAL mode. (Note 1)	0 - 8	0
Use the Same Param		F51	Specifies how to set the parameters for the SUB injector in DUAL mode.	0: Set on SUB injector. 1: Use MAIN parameters.	0

Note 1) This FUNCTION uses the same sample vial for both the MAIN and SUB injectors in DUAL mode.

## (6) FUNCTION 60 - 63

These functions specify events such as RAM initialization.

Table 3-9

Corresponding AOC Other Parameter on GC	FUNCTION	Description	Setting Range	Default Value
*	F60	Initializes the RAM (executed when "1" is set). (Note 1)	0, 1 (Initialize)	0
*	F61	Displays the ROM version (XX.X).	Cannot be modified.	Ver No.
*	F62	Specifies which injector keyboard to operate for setting the SUB injector parameters.	0: Set on SUB 1: Set on MAIN	0
*	F63	Specifies which injector receives transmitted commands.	0: Receive on MAIN 1: Receive on SUB (via MAIN injector)	0

After normal start-up, setting F60 to "001" initializes the values for FUNCTION 01 - 13. To initialize all the values, turn on the autoinjector while pressing the [SAMPLE WASH] key and set F60 to "001".

 **NOTE**

For GC-2010/2010Plus/2014/2025, when the gas chromatograph and autoinjector are linked after the F60 initialization, the autoinjector parameters are updated to those set on the GC.

## (7) FUNCTION 80 - 86

These functions set the transmission parameters.

 **NOTE**

Except FUNCTION 84, all changed parameters become effective after restarting the autoinjector.

Table 3-10

Corresponding AOC Other Parameter on GC	FUNCTION	Description	Setting Range	Default Value
*	F80	CH1 baud rate	0: NOT USE 1: 1200 2: 2400 3: 4800 4: 9600	2
*	F81	CH1 parity during simple procedure transmission	0: NON 1: EVEN	0
*	F82	CH1 stop bit (1/2) during simple procedure transmission	0: 1bit 1: 2bit	1
*	F83	CH1 protocol	0: Simple procedure 1: LEVEL2	1
*	F84	Simple procedure transmission format (Note 1)	0: Normal 1: AOC-17 compatible	1
*	F85	CH2 baud rate (Note 2)	0: NOT USE 1: 1200 2: 2400 3: 4800 4: 9600	0
*	F86	(DO NOT change this parameter.)		0

Note 1) The AOC-20 can be used in AOC-17 mode. AOC-17 compatible mode is selected by setting FUNCTION 84 to "001" (the default value). Then set FUNCTION 83 to "000" (transmission protocol: "simple procedure"). When AOC-17 compatible mode is selected, valid parameter ranges for the AOC-20 become the same as those of the AOC-17. This is useful when upgrading from an AOC-17 autoinjector, because injection conditions created for the AOC-17 from software that supports only the AOC-17, can still be used.  
0: Normal mode ..... numerical values consist of three digits.  
1: AOC-17 compatible mode ..... numerical values consist of two digits.

Note 2) CH2 is fixed at LEVEL 2, EVEN, STOP 1. Only the baud rate can be changed.

## (8) FUNCTION 90 - 97

These functions specify features not categorized above.

Table 3-11

Corresponding AOC Other Parameter on GC	FUNCTION	Description	Setting Range	Default Value
*	F90	Specifies ON/OFF of the auto-stop function (Note 1)	0: OFF 1: ON	1
*	F91	Specifies the READY signal polarity.	0: OPEN 1: CLOSE	0
*	F92	Specifies the number of injector automatically. (DO NOT change this parameter.)	0: Single 1: Dual	0
Rack	F93	Specifies the rack type.	0: Short 1: Long	0
Rack Position	F94	Specifies the rack position when using the autosampler. (Note 2)	0 - 2	1
*	F95	Specifies the injector in DUAL mode automatically. (DO NOT change this parameter.)	0: MAIN 1: SUB	0
*	F96	(DO NOT change this parameter.)		0
*	F97	(DO NOT change this parameter.) (Note 3)	0, 1	0

- Note 1) Stops the second and subsequent injections, when the GC READY signal is "OPEN" even though the GC is not READY (e.g. when the READY signal cable is cut).
- Note 2) When using the autosampler, specifies which injection port on the GC the autoinjector is installed. (See [Figure 3-4](#).)  
GC-14A/B, GC-15A, GC-16A, GC-2014, and GC-2025 .....Position "0"  
GC-17A ver.1/2/3, GC-1700, GC-18A, GC-2010, and GC-2010Plus .....Position "1" or "2"
- Note 3) Set to [1] only when using the DUAL injector without the autosampler, which disables the autosampler regardless of the "Use of the Sampler" (F40) setting.

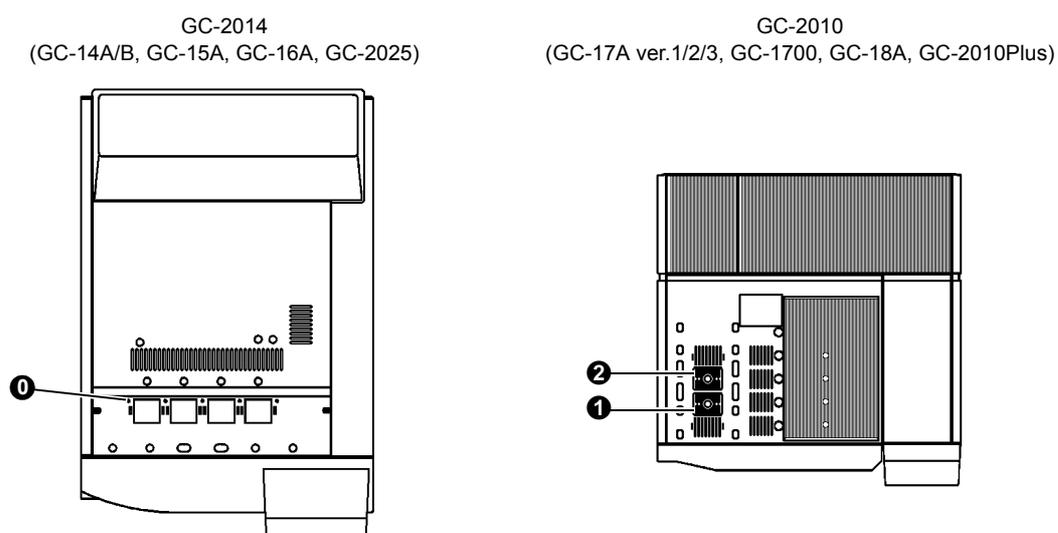


Figure 3-4

 **NOTE**

The figure above shows the INJ port positions under the factory default setting.

Change the positions using the teaching function.

(See ["2.7.4 Precautions for Using the Autosampler" P.70.](#))

The GC-2010/2010Plus with single injection port should be installed so that ② INJ can be used when "Rack Position" (FUNCTION 94) is set to [1] ("001").

## 3.2.9 GC-2010/2010Plus/2014/2025 Menus and Autoinjector Parameters

The following note the relationships between the autoinjector parameters and the AOC parameters displayed with the GC-2010/2010Plus/2014/2025 [OPTION] key.

### AOC Parameters

Sample Wash	SAMPLE WASH (When the injection mode F07 is "0")
Number of Injection	NUMBER OF INJECTIONS
Sample Size	SAMPLE SIZE
Pre Solvent Wash	F01 (When the injection mode F07 is "0") SAMPLE WASH (When the injection mode F07 is other than "0", and F21 is "1")
Solvent Wash	SOLVENT WASH
Pumping	F02
Viscosity	F03
Dwell Time	F04
Inj. Speed (Plunger)	F05
Use the Same Param	F51
(Only for MAIN injector in Dual injection mode)	
AOC POWER	None (Use the power switch on the external power supply unit.)

### PF Menus

Start	START
Stop	STOP
Priority	F10
OtherPara	None (window switching key)
Sampler	None (window switching key)
Reset	RESET
Upload	None (Used for data transfer from AOC to GC.)
Print	None (Used for outputting AOC parameters on Chromatopac.)
Next	None (window switching key)

### AOC Priority Analysis

Injection Sample	F10
PF Menus	
Set	[ENTER] key after setting F10

**AOC Other Parameters**

Inj. Speed (Syringe)	F06
Using 3 Solvent Vials	F28
Solvent Select	F08
Air Suction	F20
Plunger Suction Speed	F22
Speed of Plunger	F23
Syringe Height (↑)	F25
Syringe Height (↓)	F26
Syringe Height (Inj)	F27
Multi-Inj.	F33
Kinds of Vials	F29
Rack	F93
Kinds of the Syringe	F34
Suction Volume for Washing	F24
Rack Position	F94

PF Menus

Inj Mode	F07
----------	-----

**Injection Mode**

0 Sample + (Air)

1 Solvent + Air + Sample + (Air)

2 Solvent + Sample + (Air)

3 Solvent + Air + Standard (Internal standard) + Air + Sample + (Air)

4 Solvent + Standard (Internal standard) + Sample + (Air)

PF Menus

F21	F21
-----	-----

**Autosampler**

Use of the Sampler	F40
--------------------	-----

Use of the Sub AOC	F41
--------------------	-----

Bar Code Reader	F42
-----------------	-----

PF Menus

Alloc	F50
-------	-----

<Items which do not have corresponding AOC parameters, etc. on GC-2010/2010Plus/2014/2025>

### Key

MONITOR

### FUNCTION

F11	INJECTION SAMPLE
F12	FINAL SAMPLE
F13	INJECTION SAMPLE2
F30	Checking vial return position
F31	Analysis time (time before the next injection)
F32	Analysis start time
F35	Aspiration volume of the solvent in solvent flush mode
F60	RAM initialization
F61	ROM version display
F62	Setting the SUB injector parameter by the MAIN injector key operation
F63	Transmit commands to the SUB injector via the MAIN injector
F80	CH1 baud rate
F81	CH1 parity during simple procedure transmission
F82	CH1 stop bit (1/2) during simple procedure transmission
F83	CH1 protocol
F84	Simple procedure transmission format
F85	CH2 baud rate
F90	Auto-stop function
F91	READY polarity
F92	Injector: Single/Dual
F95	In Dual mode: MAIN/SUB



### NOTE

Specifying batch schedules allows the same operations as FUNCTION 11 to 13. To use other functions, operate the autoinjector keypad.

---

## 3.3 Sequential Analyses and Injection Modes

The autoinjector can be used as a sample injector for sequential analyses. It also supports various injection modes, where you can freely change the parameters to create the optimum injection conditions for different samples. This section describes the operation for various injection modes, such as sequential analyses and solvent flush method.

## 3.3.1 Sequential Analyses

### 3.3.1.1 Preparation

Before performing sequential analyses, it is first necessary to configure the instrument, GC, and peripherals as shown in [Figure 3-5](#) to [Figure 3-8](#). For more information on the connection procedure, refer to the appropriate operation manuals.

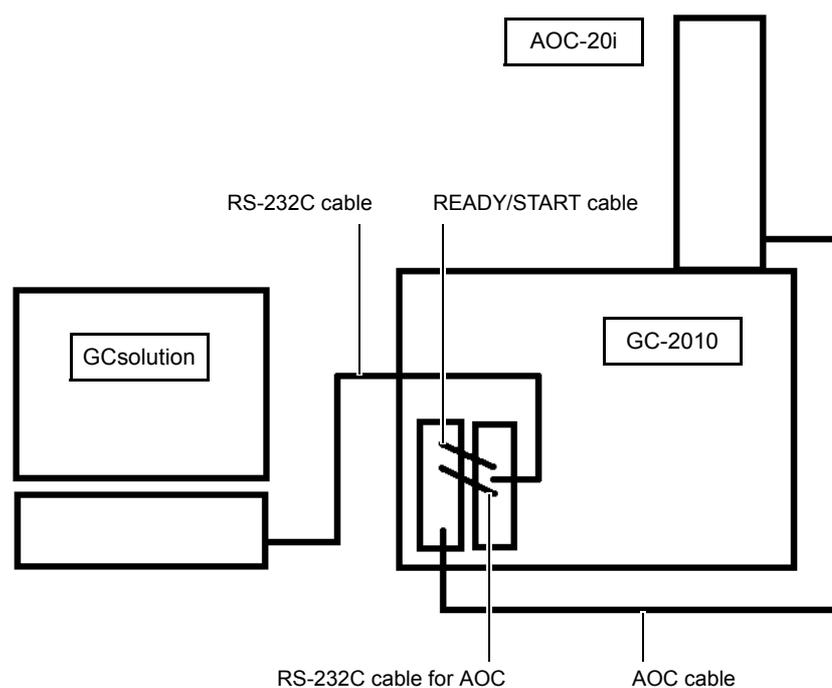


Figure 3-5 Connection Example (Using GCsolution): Built-in Power Type (Back view)

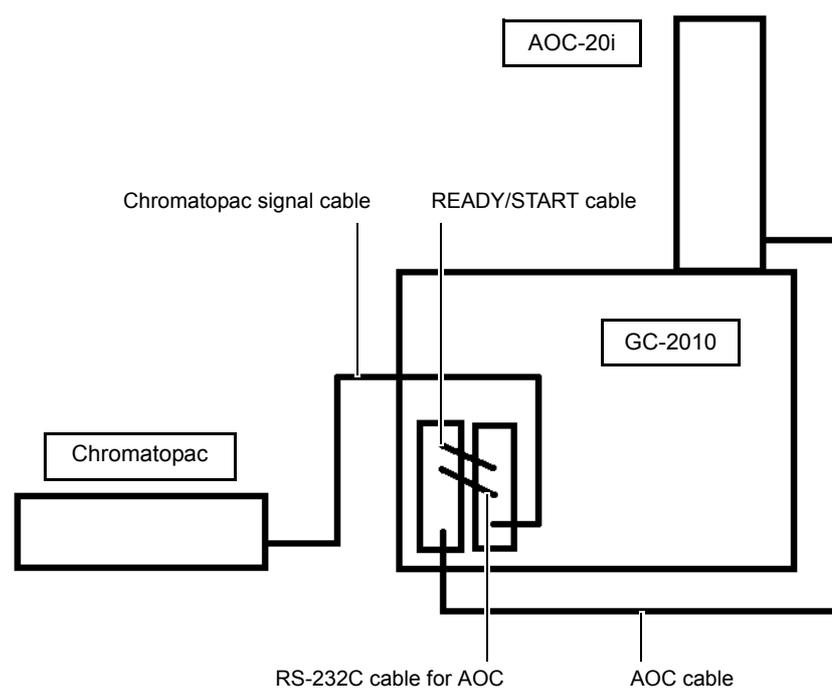


Figure 3-6 Connection Example (NOT Using GCsolution): Built-in Power Type (Back view)

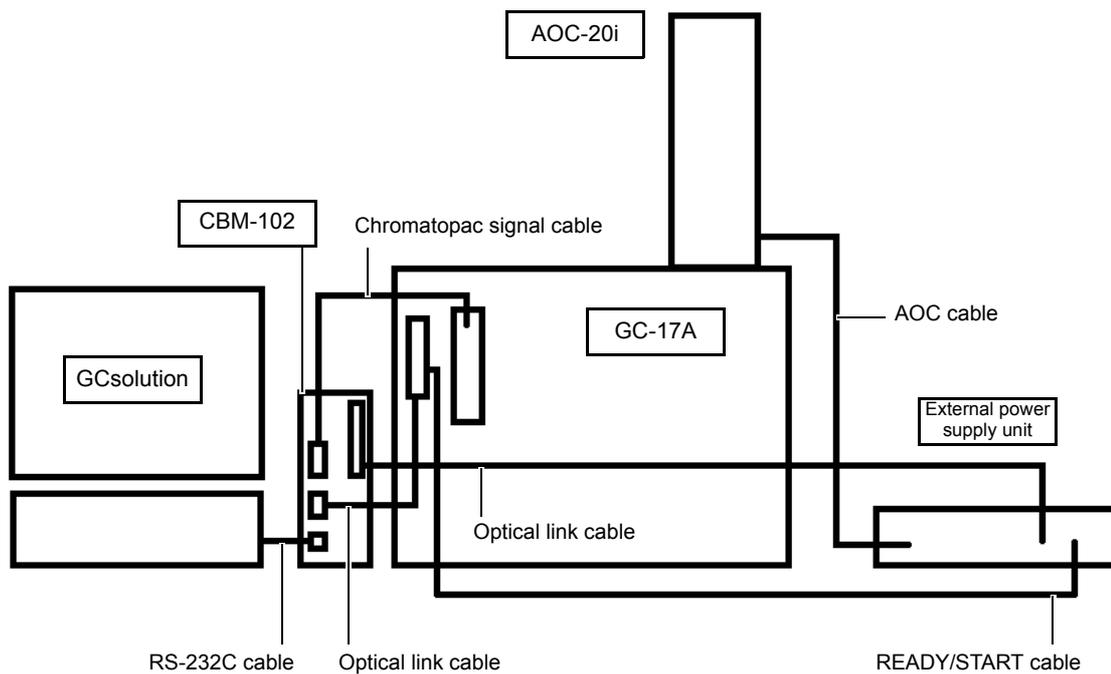


Figure 3-7 Connection Example (Using GCsolution): External Power Type (Back view)

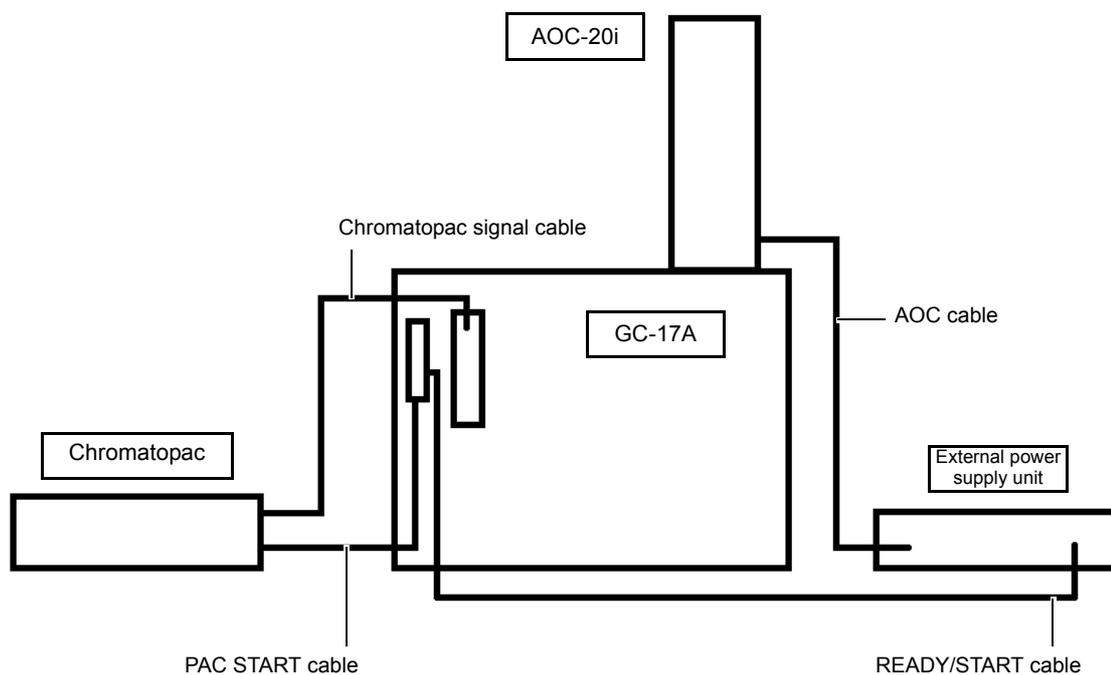


Figure 3-8 Connection Example (NOT Using GCsolution): External Power Type (Back view)

If the autoinjector is connected as shown in [Figure 3-5](#) to [Figure 3-8](#), two-way communication is made possible. A START signal is sent to the gas chromatograph when the sample is injected, starting the gas chromatograph and data processor. When the analysis is complete and the gas chromatograph becomes READY, the GC sends a READY signal to the autoinjector, which then begins its next injection.

If the READY cable connecting the gas chromatograph and the autoinjector is not connected, the injector will not perform the subsequent injections.

Additionally, the autoinjector will not perform the subsequent injections if the gas chromatograph was not programmed correctly. A GC temperature program or time program is required for a READY signal to be sent.

- Temperature Programmed Analysis

The GC temperature programmed analyses are performed in the following sequence:

- 1 The gas chromatograph goes into the READY status, when the column oven temperature decreases to the initial temperature after the temperature program is complete.
- 2 The READY signal is output to the autoinjector.
- 3 The autoinjector starts the next injection operation.

For GC-2010, 2010Plus, 2014, 2025, 17A, 1700 and 18A, specify an equilibration time (EQUIB TIME). After completing the temperature program, the GC pauses to generate a READY signal for the specified time after the column oven temperature decreases to the initial temperature. This allows the autoinjector to start injections when the column temperature is stable at its initial temperature, which improves the repetition reproducibility. (Default value on GC: 3 min.)

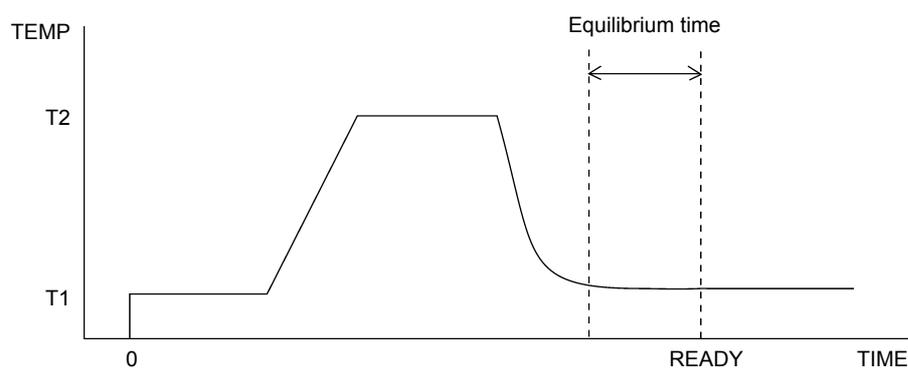


Figure 3-9 Temperature program with equilibration time

Note that the equilibration time cannot be set for GC-14A/B, 15A, and 16A. To improve the reproducibility as mentioned above, change the temperature program as shown in [Figure 3-10](#) to that in [Figure 3-11](#). In this case, set the second stage temperature rate to a value larger than "0". This allows the GC to become READY when the column oven temperature is stable at its initial temperature, at which point the autoinjector starts the next injection.

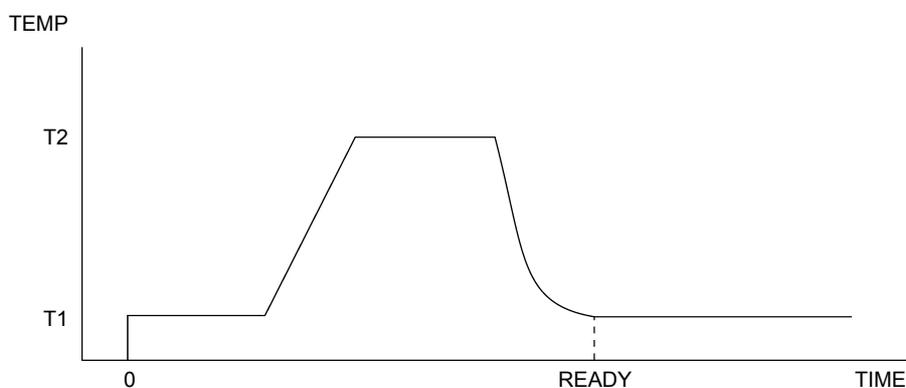


Figure 3-10 1-step temperature program

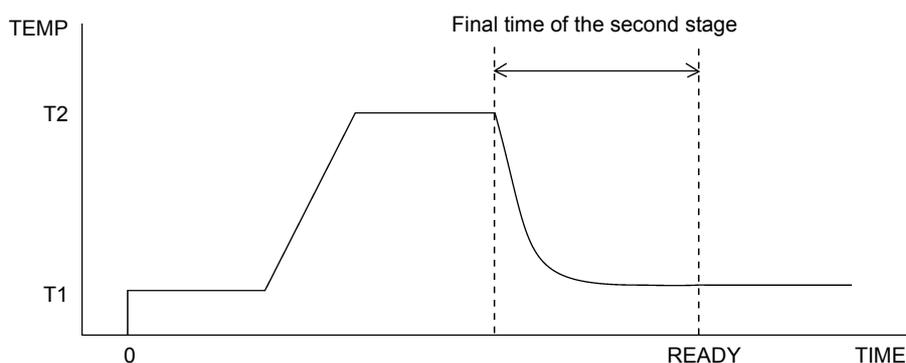


Figure 3-11 2-step temperature program (Final Temp is T1)

- Isothermal Analysis

When using GC-17A, 1700, 18A, 2010, 2010Plus, 2014, and 2025, an isothermal program can be set by specifying initial temperature and time in the column temperature program, and setting the first stage temperature rate to "0". ([END] is displayed for GC-2010/2010Plus/2014/2025.) By doing so, the GC does not generate a READY signal at the set initial time since the temperature program is running, and the autoinjector does not start the next injection.

Note that for GC-14A/B, 15A, and 16A, the isothermal program cannot be set only by specifying the initial temperature and time. Be sure to set the first stage temperature rate to a value other than [0], and set the first stage end temperature to the same value as the initial temperature. Additionally, the time values must be set to satisfy the next equation: [Initial time + End time] = [Analysis time].

When using GC-14A/B, 15A, and 16A, a time program with a STOP time must be used to specify the analysis run time. The GC becomes READY after the specified time for the time program elapses, and generates a READY signal to trigger the next injection.

For example, to set 5 minutes of analysis time for the GC-14A or -14B, perform the following key operations on the GC keypad:

Table 3-12

	Key Operation	Display	
①	SHIFT.D	CITP	Display continues to show the previous parameter (in this case, column oven temperature). S.DOWN light on.
②	7 PROG	TIME?	Program time requested. DIALOG light on (dialog in progress). S.DOWN light out.
③	5	5	Function set to 5 minutes after analysis start.
④	ENT	FUNCVL?	Function requested.
⑤	STOP	0	Time program parameter (STOP time) set.
⑥	0		
⑦	ENT	TIME?	Program time requested for next step.
⑧	SHIFT.D		S.DOWN light on.
⑨	ESCP		Program complete. S.DOWN, DIALOG lights off.

When using GC-17A, 1700, 18A, 2010, 2010Plus, 2014, 2025, the analysis run time can also be specified using the time program. For details, refer to the instruction manual of the gas chromatograph.

 **NOTE**

When both a temperature and time program are loaded, the gas chromatograph reverts to the READY state when the longer of the two programs ends. For example, if STOP time settings for the temperature program and time program are five minutes and ten minutes, respectively, the READY signal is not generated until the end of the time program (ten minutes), even though the oven temperature has already returned to the initial temperature.

 **NOTE**

When the gas chromatograph is READY, the autoinjector starts injection. The data processor should also be READY when injection starts. For this reason, the gas chromatograph STOP time setting should be longer than the STOP time setting for the data processor. (For Chromatopac, add the time to finish printing results to the STOP.TIME setting.)

### 3.3.1.2 Operation

**NOTE**

When using GCsolution, CLASS-GC10, or Chromatopac GC network, operate the computer or chromatopac to start the autoinjector.

**1****Place the vials in the rack.**

Since all of the samples placed in the rack will be analyzed, remove any samples not requiring analysis. Then, turn the power on and set the parameters.

**2****Start the autoinjector.**

Each of the samples is injected the number of times specified by the NUMBER OF INJECTIONS parameter (For GC-2010/2010Plus/2014/2025 [Number of Injection] in [AOC Parameters] on GC). If the [RESET] key (For GC-2010/2010Plus/2014/2025, [Reset] (PF menu) in [AOC Parameters] on GC) is pressed during the analysis, all information regarding number of analyses completed on the samples is reset. When [START] is then pressed, the analysis restarts from the first sample. If the [STOP] key (For GC-2010/2010Plus/2014/2025, [Stop] (PF menu) in [AOC Parameters] on GC) is pressed during an analysis, the autoinjector suspends operation, but no information is reset. Pressing the [START] key resumes the injection process from the sequence next to the interrupted sequence.

**NOTE**

During GC analysis, the autoinjector RUN light blinks. The autoinjector pauses until the GC sends its READY signal. If the [STOP] key is pressed, the injection process is interrupted, and the RUN light goes out. To restart the process, press [START].

**3****When all of the samples have been analyzed, the autoinjector returns to the home position.****NOTE**

When the NUMBER OF INJECTIONS parameter is changed during a sequence, the new setting will take effect starting with the next sample. For example, if the setting is changed from 2 to 5 while sample No. 1 is being analyzed, sample No. 1 will be analyzed twice. The new setting will take effect on the analysis of the next sample, and sample No. 2 will be analyzed 5 times.

## 3.3.2 Priority Analysis

During continuous analysis, the autoinjector injects samples in ascending sample number order. The order of analysis is determined by the placement of the sample vials. However, the following settings allow you to skip to a certain sample or analyze preferentially only certain samples.

### For GC-2010/2010Plus/2014/2025

#### Priority Analysis

When the autoinjector is operating, [Priority] (PF menu) is displayed in the gas chromatograph [AOC Parameters] window.

Press this menu to display the window for specifying priority samples.

Enter the sample No. to preferentially inject, then [Set] (PF menu) to start the priority analysis.

After the priority analysis, the autoinjector resumes analyses from the next sample to the priority samples.

For example, if the analysis of sample No. 2 is interrupted for the priority analysis of sample No. 4, sample No. 5 will be analyzed after completing the analysis of sample No. 4.

For details on the procedure, refer to the section "AOC priority analysis" in the instruction manual of the gas chromatograph.



#### NOTE

If a parameter for priority analysis is changed before its execution, the new parameter is applied to the priority analysis. If "0" is set, the priority analysis will be canceled.



#### NOTE

If a priority analysis is set during a repeated analysis of the same sample (i.e., "Number of Injection" is set to 2 or more), the priority analysis will be executed after the current injection.



#### NOTE

DO NOT set a priority sample while the autoinjector is actively functioning.

If you do, a new injection sequence for the specified priority sample is started during the current sequence, which may cause a problem in that the syringe is not washed by the priority sample. To avoid this, be sure to set a priority analysis after the autoinjector completes the current injection sequence (i.e., during standby for the next injection).

### For Other Gas Chromatographs

- (1) FUNCTION 10 (PRIORITY SAMPLE)

#### Example: Sample in rack position No. 2 is analyzed before

Table 3-13

	Key operation	Display	
①	FUNCTION	Example) F03	Displays the last setting. (In this example, FUNCTION 03.)
②	Arrow key	F10	Press the arrow keys until "F10" displays.
③	ENTER	000	The current FUNCTION 10 set value is displayed. (A value of 0 indicates no PRIORITY SAMPLE.)
④	Arrow key	002	Pressing the right arrow key twice displays "002".
⑤	ENTER	002	Sample No. 2 is set as a PRIORITY SAMPLE.

- In this example, the priority sample is set up before the [START] key is pressed. Sample No. 2 will be the first sample injected, even if a sample vial is in position 1. Once executed, the PRIORITY SAMPLE setting returns to "000".

- If a priority analysis is executed during a repeated analysis, the autoinjector resumes analyses from the next sample to the priority samples.

 **NOTE**

Once a PRIORITY SAMPLE setting has been made, it can be overridden before it is executed by making another setting. For example, once sample No. 3 has been set as a PRIORITY SAMPLE, the setting can be canceled by then specifying 0 as the PRIORITY SAMPLE.

 **NOTE**

When a PRIORITY SAMPLE is scheduled during repeated analysis of the same sample (NUMBER OF INJECTIONS set to 2 or more), the PRIORITY SAMPLE will be executed at the next injection.

 **NOTE**

Do not set a priority sample when the autoinjector is actively functioning. Otherwise, all the rinses may not be completed before the syringe moves to the priority sample. Make the priority setting during an analysis or when the injector is not in use.

(2) FUNCTION 11 (INJECTION SAMPLE)

Set this parameter to analyze only the sample number specified, and no other samples. After the priority sample is analyzed, the sequence ends.

Then, the set value of FUNCTION 11 automatically returns to "000".

(3) FUNCTION 12 (FINAL SAMPLE)

Set this parameter to analyze a priority set of samples. The sample number specified will be the last sample analyzed. The sequence continues until the specified sample number is reached. That sample is injected, and the sequence stops.

 **NOTE**

When using GC-2010/2010Plus/2014/2025, batch schedules can be substituted for the FUNCTION 10-12 (features available when the autoinjector is on hold). For details, refer to the section "Batch Schedule" in the instruction manual of the gas chromatograph.

### 3.3.3 Injection Modes

#### ■ Solvent Flush Mode

When FUNCTION 07 is set to "001" - "004" (For GC-2010/2010Plus/2014/2025, when [Inj Mode (PF menu)] is set to [1] - [4] in [AOC Other Parameters] on GC), the autoinjector uses the solvent flush injection method. (FUNCTION "003" and "004" are available only when using an autosampler.)

First set FUNCTION 07 ([Inj Mode] for GC-2010/2010Plus/2014/2025), and then set other injection parameters.

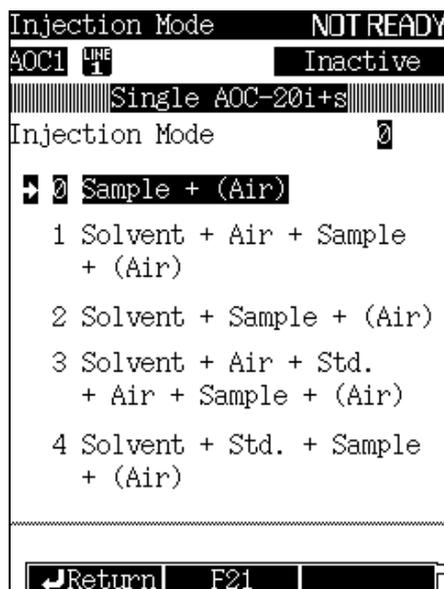


Figure 3-12

In the solvent flush method, as shown in [Figure 3-13](#), the autoinjector draws solvent, air, and sample, in that order, into the syringe. After injection, solvent, not sample, is left in the syringe needle. Since the plunger completely expels the sample, all of the sample vaporizes at the same time, reducing discrimination.

The solvent flush method is recommended when analyzing compounds with a wide boiling point range.

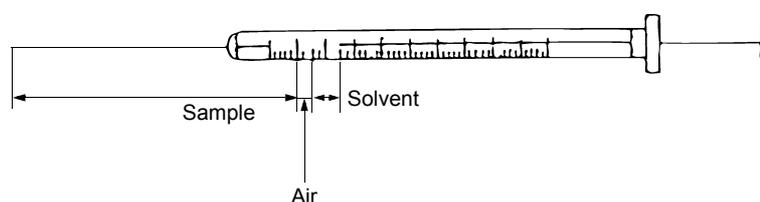


Figure 3-13

The following Figures show the sample aspiration patterns in 3 injection modes with FUNCTION 07.

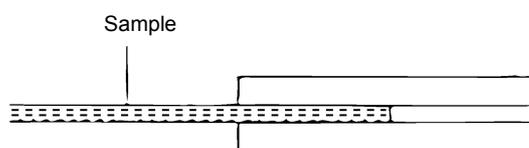


Figure 3-14 FUNCTION 07 "000" (Inj Mode: "0") (Normal method)

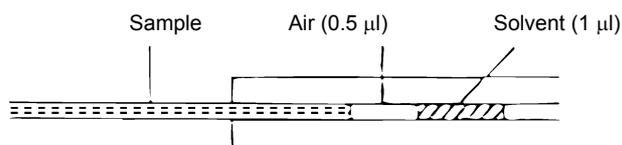


Figure 3-15 FUNCTION 07 "001" (Inj Mode: "1")

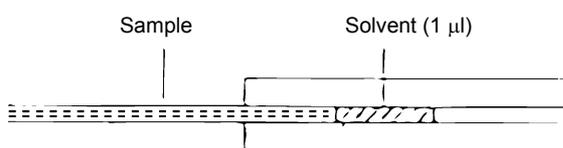


Figure 3-16 FUNCTION 07 "002" (Inj Mode: "2")

**NOTE**

It is recommended to select 10% (i.e., 1 µl of solvent) since the needle volume of the standard 10 µl syringe is 0.6 µl.

The wash solvent is used for solvent flush, normally. However, when FUNCTION 28 is set to "001" (three solvent positions are used), or for GC-2010/2010Plus/2014/2025, when [Using 3 Solvent Vials] is set to [Yes] in the GC [AOC Other Parameters] window, the solvent at position C (the least contaminated) will be used for solvent flush. (See [Figure 3-17](#).) In this mode, the maximum number of samples that can be analyzed is 1 for the short rack, and 7 for the long rack. (Position 1 in [Figure 3-17](#) is only for 4 ml vials. When 4 ml vials are used as sample vials, the maximum number of sample vials is 2 for the short rack and 8 for the long rack). However, 4 ml vial rack for autosampler (optional, P/N S221-45182) is separately required.

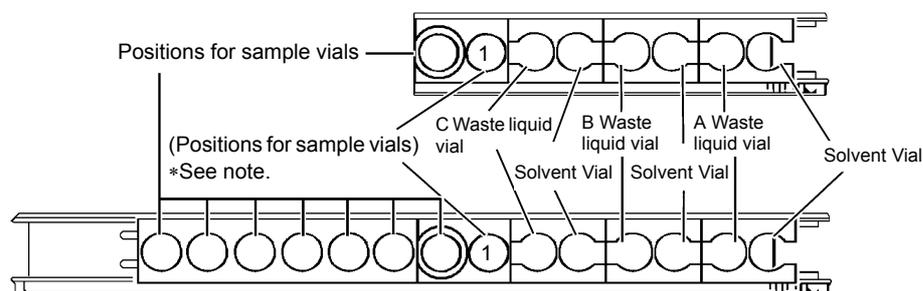


Figure 3-17

When using the solvent flush injection mode (FUNCTION 07 is set to "001" - "004", or [Inj Mode] is set to [1] - [4] for GC-2010/2010Plus/2014/2025), the parameter upper limit and set items change as follows:

- (1) SAMPLE SIZE ([Sample Size] for GC-2010/2010Plus/2014/2025)

The upper limit of sample size is reduced to 50% of the syringe volume specified in [Kinds of the Syringe] in [AOC Other Parameters]. (Normally, 80%)

- (2) For GC-2010/2010Plus/2014/2025

The following parameters in the [AOC Parameters] window become invalid.

Sample Wash

Pre Solvent Wash

In the solvent flush mode, the sample wash of the syringe is not performed.

The solvent wash of the syringe is performed before and after injections the number of times set in "Solvent Wash".

However, if F21 (PF2) value is set to [1] with FUNCTION 21 (Injection Mode), it also becomes possible to specify "Pre Solvent Wash".

- (3) For Other Gas Chromatographs

SAMPLE WASH and SOLVENT WASH

The sample wash of the syringe is not performed regardless of the set value in SAMPLE WASH.

The solvent wash before injections is performed as specified number of times in SOLVENT WASH.

However, if FUCNTION21 is set to "001", the solvent wash is performed before injections the number of times set by SAMPLE WASH, and after injections the number of times set by SOLVENT WASH.

3

### Large Volume Injection Mode (Low-speed Injection Method)

If used with the optional PTV (Programmed Temperature Vaporizer) injection port, GC-2010/2010Plus and GC-17A Ver.1/2/3 can handle injection volumes of several thousand microliters; however, it is necessary to slow down the speed of injection as the amount of sample increases. In this method, quartz wool or column packing material is placed in a PTV glass insert and used as a "pre-column". The target compounds are trapped and concentrated in the pre-column, while the solvent elutes. After the solvent has eluted from the pre-column, the target compounds are introduced onto the column.

When using the optional large volume syringe (50  $\mu$ l or 250  $\mu$ l), set FUNCTION 34 (For GC-2010/2010Plus/2014/2025, [Kinds of the Syringe] in [AOC Other Parameters] on GC) as follows to set its suitable plunger/syringe speed. The plunger speed during syringe wash and pumping is thus automatically optimized for the large volume syringe. In addition, the plunger injection speed [High] is shifted to [Medium] for 10  $\mu$ l syringe when using 50  $\mu$ l syringe, and to [Low] when using 250  $\mu$ l syringe. To set even slower speeds for particular solvents and analysis conditions, use FUNCTION 05 (For GC-2010/2010Plus/2014/2025, [Inj. Speed (Plunger)] in [AOC Parameters] on GC) to set [Medium] and [Low] speed on each syringe size.

Table 3-14

Syringe	FUNCTION 34 setting
50 $\mu$ l syringe (P/N S221-45243)	001
250 $\mu$ l syringe (P/N S221-45244)	002

To inject volumes larger than the syringe capacity, use FUNCTION 33 (For GC-2010/2010Plus/2014/2025, [Multi-Inj.] in [AOC Other Parameters] on GC) to increase the number of syringe injections after which the GC receives the START signal from the autoinjector. For example, when using the large volume 250  $\mu$ l syringe, although 200  $\mu$ l (80% of full scale) is the maximum volume for a single injection, setting FUNCTION 33 to "005" (For GC-GC-2010/2010Plus/2014/2025, [Multi-Inj.] to [5]) starts the GC analysis after five injections, so that a total of 1000  $\mu$ l is injected (200  $\mu$ l  $\times$  5 = 1000  $\mu$ l).

**NOTE**

Possible injection volumes for CLASS-GC10 range from 0.1 µl to 8 µl. When using a large volume syringe, injection volumes need to be converted as follows:

10 µl syringe: 0.1 µl - 8 µl (1 - 80% of 10 µl)



50 µl syringe: 0.5 µl - 40 µl (1 - 80% of 50 µl)

250 µl syringe: 2.5 µl - 200 µl (1 - 80% of 250 µl)

**Example: When injecting 20 µl with the 50 µl syringe:**

$$20/50 \times 100 = 40\%$$

Therefore, set the injection volume to [4]. (40% of 10 µl)

**NOTE**

When using the standard syringe (10 µl), be sure to set FUNCTION 34 to "000" ([Kinds of the Syringe] to [10 µl] for GC-2010/2010Plus/2014/2025). Otherwise, poor reproducibility may result.

### ■ Aspirating Air after Drawing Sample

To aspirate 1 µl of air after drawing the sample, set FUNCTION 20 to "001". (For GC-2010/2010Plus/2014/2025, set [Air Suction] to [Yes] in [AOC Other Parameters] on GC.) Using this injection method decreases the amount of time the sample remains in the hot injection port, compared to the regular injection method. This method reduces discrimination when analyzing components with a wide boiling point range.

## 3.4 Autosampler Operation

In principle, control the autosampler via the gas chromatograph main unit. (Use the autoinjector keypad occasionally.) The procedure for setting parameters is the same as for the autoinjector. This section describes the autosampler parameter settings which differ from those of the autoinjector.

### 3.4.1 Preparation

- (1) Setting sample gripping position

#### For GC-2010/2010Plus/2014/2025

Using [Rack Position] in the [AOC Other Parameters] window, specify the position of the GC injection port where the autoinjector is installed.

GC-2010/2010Plus Rear (=Standard position): 2 (The autosampler can be adjusted for use under the setting of "1".)

GC-2010/2010Plus Front: 1

GC-2014/2025: 0 (Specify [1] when using the optional mounting bracket (for AOC-20) to use the injection port located at far left. See ["2.1.2 Mounting Spacers on GC-2014/GC-14A/B" P.23.](#))

Then set [Use of the Sampler] to [Use] in the [Sampler] window.

When using only the autoinjector (without the autosampler), set [Use of the Sampler] to [Not Use].

#### For GC-17A Ver.1/2/3, GC-1700, or GC-18A

Using FUNCTION 94, specify the position of the GC injection port where the autoinjector is installed. When the autoinjector is installed over the injection port behind the standard position, set FUNCTION 94 to "002". (See [Figure 3-4.](#))

Then set FUNCTION 40 to "001". This places the autoinjector in autosampler mode. (This setting is saved when the power is turned OFF.)

When using only the autoinjector (without the autosampler), set FUNCTION 40 to "000" (The autosampler is not used).

#### For GC-14A/B

When using the autosampler with a GC-14A/B, set FUNCTION 94 to "000".

For both the GC-14 and -17 series, set FUNCTION 40 to "001". This places the autoinjector in autosampler mode. (This setting is saved when the power is turned OFF.)

The autoinjector can be used without the autosampler; set FUNCTION 40 to "000".



#### NOTE

If the position of the autosampler arm in relation to the vial is not correct at gripping position, teach the autosampler the correct position (teaching function). (See ["2.7.5 Adjusting Sample Gripping Position \(Teaching\)" P.70.](#))

## (2) Placing solvent vials in the autoinjector rack

When the autosampler is in use, a maximum of 150 sample vials can be used. This allows for 3 vials each for solvent and waste liquid. The vials are transferred to position 2 during every analysis, so do not place vials in this position. (See [Figure 3-18](#).)

Place the solvent for solvent flush or standard sample vial in the position 1. (See ["3.4.6 Solvent Flush Injection Mode" P.124](#).)

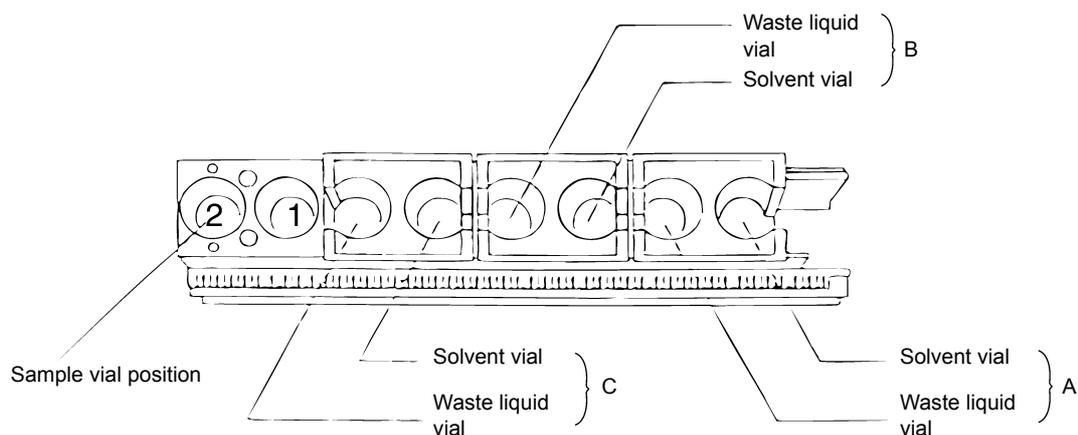


Figure 3-18

## (3) Placing vials in the autosampler tray

The autosampler tray consists of 6 vial racks (which can each hold twenty-five 1.5 ml vials or sixteen 4 ml vials). Place the vials in the vial rack(s) to be used. Numbers are assigned to the vial positions as shown in [Figure 2-55](#) and [Figure 2-56](#).

To specify the sample vial size, use FUNCTION 29. ("000" for 1.5 ml and "001" for 4 ml.)

When using GC-2010/2010Plus/2014/2025, set [Kinds of Vials] to 1.5 ml or 4 ml in the [AOC Other Parameters] window.

It is not necessary to place empty racks in the sample tray. Place only the racks with samples. The racks do not have to be in sequential order. For example, when 1.5 ml vials are placed as shown in [Figure 3-19](#), the vial rack at position 1 holds vial numbers 1 to 25. At position 4, the rack holds vial numbers 26 to 50, and at position 5, numbers 51 to 75. If a rack is loaded for different size vials than the size set by FUNCTION 29 ([Kinds of Vials] for GC-2010/2010Plus/2014/2025), the rack is ignored.

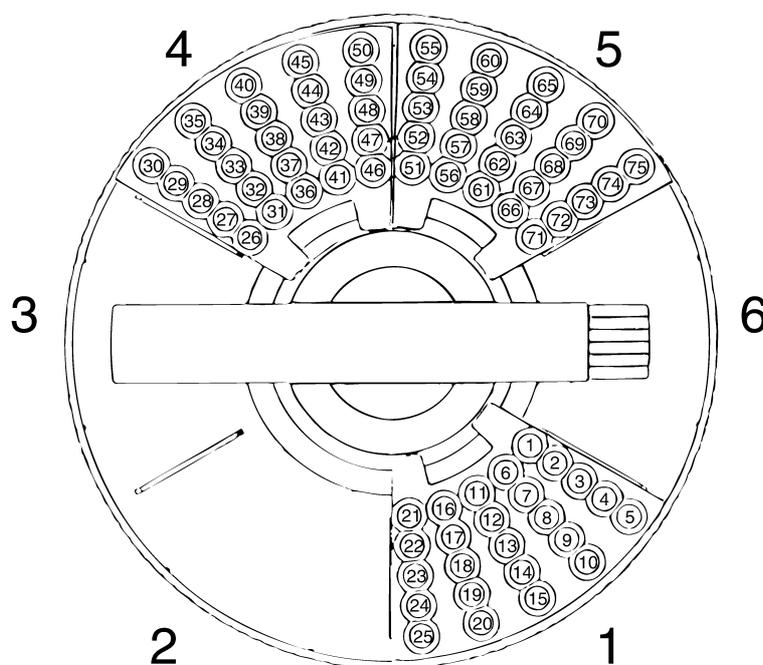


Figure 3-19

Set vials in the sample rack in sequential order from position 1. The first vial used for analysis is the vial at position 1. See [Figure 3-20](#) for a diagram of the position of the sample vials.

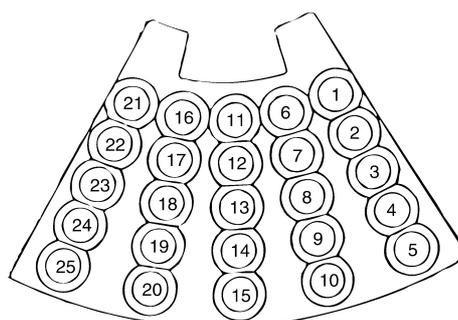


Figure 3-20

**NOTE**

- 1 After pressing the autoinjector [START] key, the autosampler detects the position of the sample rack on the tray. In this case, vial numbers are assigned to only vials in that sample rack. To avoid malfunction, DO NOT remove the rack after sample vial numbers are assigned.
- 2 If you want to add racks after analysis has been started, add them behind the rack containing the vial currently being analyzed. Numbers will be reassigned to the vials. Racks added in front of the current rack will be ignored.

As shown in the following examples, if a position in the rack is left empty, analysis on that rack ends, and the autosampler starts analysis on the next vial rack. If no vial is placed in the starting position of that rack, operation stops.

For example, when 1.5 ml vials are positioned as shown in [Figure 3-21](#) (the black circles indicate vials), samples 1 through 18 are analyzed. Next, the autosampler searches for, but does not detect, a vial in position 19. It then searches for a vial in position 26 (the first vial of the next rack). If the autosampler does not detect a vial there, it stops operation.

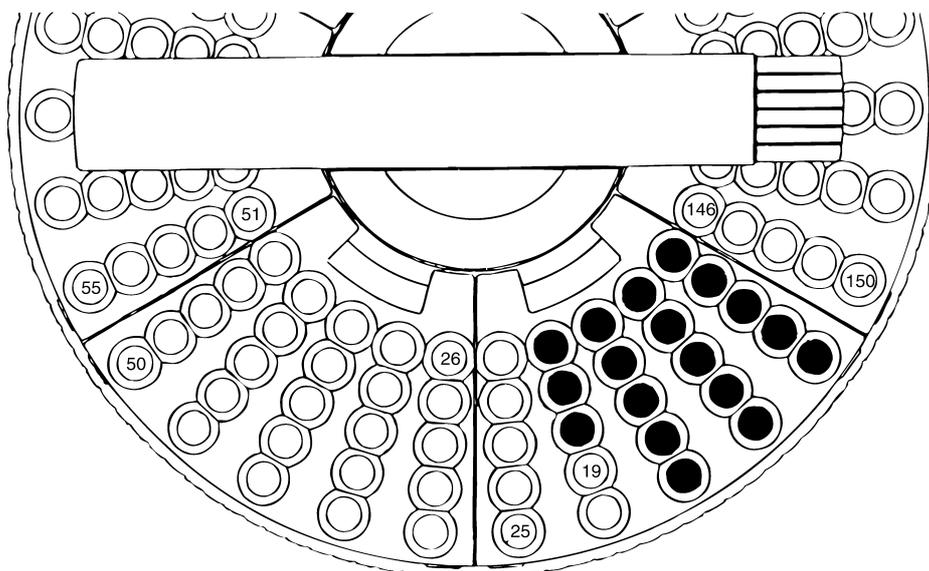


Figure 3-21

When the vials are positioned as shown in [Figure 3-22](#), after analyzing samples in positions 1 to 18, the autosampler does not detect a vial in position 19. It checks in position 26, finds a vial there, and analyzes the samples in positions 26 to 31. The autosampler finds no vial in position 32, detects no vial in position 51, then stops.

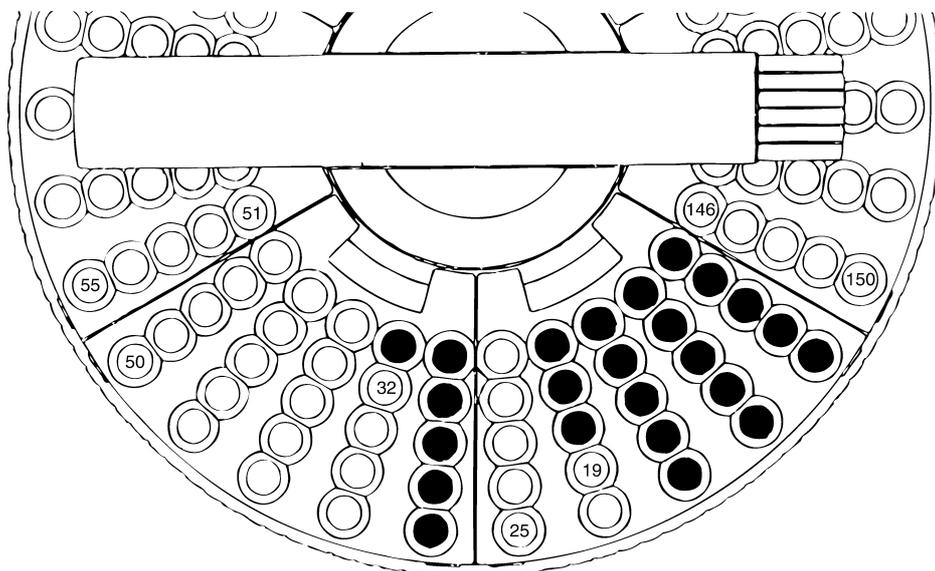


Figure 3-22

When the vials are placed as shown in [Figure 3-23](#), after analyzing samples in positions 1 to 18, the autosampler does not detect a vial in position 19. It skips the vials in positions 20 to 25, and searches for a vial at position 26. Detecting no vial in this position, the autosampler stops operation, skipping the samples in positions 51 to 53. Only the samples in positions 1 to 18 are analyzed.

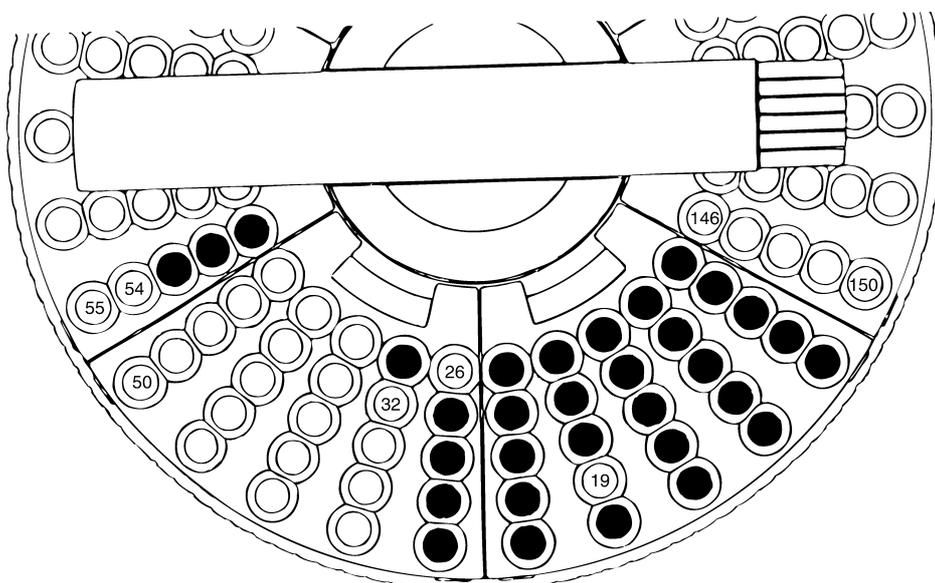


Figure 3-23

As shown in the examples above, if a position in the rack is left empty, analysis on that rack ends, and the autosampler starts analysis on the next vial rack. If no vial is placed in the starting position of that rack, operation stops.

## 3.4.2 Power ON

The autosampler shares the power supply with the autoinjector.

Turn ON the switch on the power supply unit.

For GC-2010/2010Plus/2014/2025, you can toggle the power ON/OFF in [AOC POWER] in the gas chromatograph [AOC Parameters] window. When the power is turned ON, the power light starts blinking green, the initial operation is performed (illuminates orange), the autosampler arm moves to its home position, and the autosampler goes into stand-by.

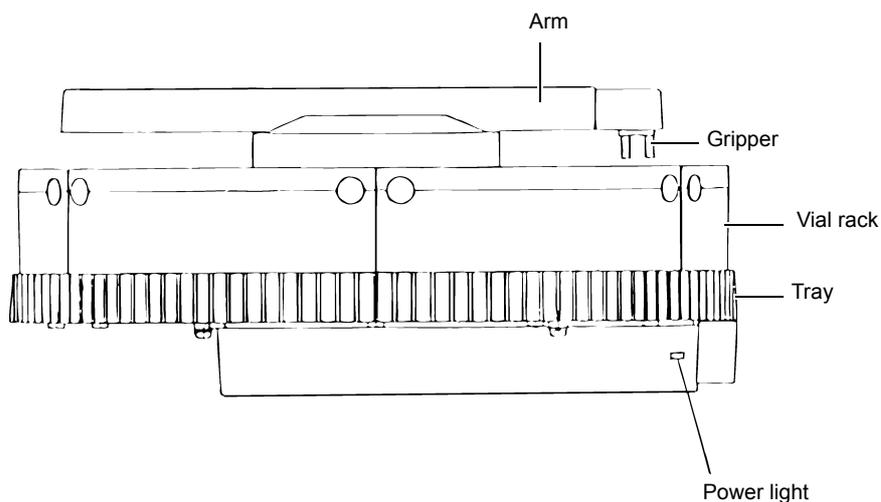


Figure 3-24

## 3.4.3 Power Light

The color of the power light indicates the operational status of the autosampler. When power is supplied and the arm moves to its home position, the light blinks green. In home position, the light is steady green. While the autosampler is operating, the light is orange, and when an error occurs, it is red.



### NOTE

When the light is orange, the autosampler is operating, so do not touch the arm. Applying excessive force may break the motor.



### NOTE

Perform all key operations when the autosampler is standing by after initial operations are completed. (Except if an error occurs.)

### 3.4.4 AOC Parameters

The parameters for controlling the autosampler are given below. For the setting procedure, see ["3.2.8 FUNCTION Key" P.92](#).

- Injection Mode FUNCTION 07/ AOC Other Parameters PF2 (Inj Mode)  
In solvent flush mode, the internal standard mode (3 and 4) is available. (See ["3.4.6 Solvent Flush Injection Mode" P.124](#).)
- Solvent Selection FUNCTION 08 Solvent Select  
Specify which of the three solvents to use for solvent wash.
- Sample Vial Size FUNCTION 29/ AOC Other Parameters Kinds of Vials  
Specify the sample vial size from 1.5 ml and 4 ml. This setting cannot be changed once analysis has begun. The change made after START will be ignored. To change the size, press the [RESET] key and set the parameter.  
You can START and RESET analyses via the gas chromatograph display.
- Checking Vial Return Position FUNCTION 30  
It is specified whether to check the rack position (to ensure that it is empty) before replacing a vial. "000" indicates do not check, and "001" indicates check. Set this parameter with the autosampler keypad, even when using GC-2010/2010Plus/2014/2025.

### 3.4.5 Priority Analysis

#### For GC-2010/2010Plus/2014/2025

- (1) While the gas chromatograph is analyzing (i.e., the autoinjector is standing by), press [Priority] (PF2) in the AOC parameter to display the priority analysis window.
- (2) Specify the desired priority samples and press [Set] (PF2).
- (3) After the analysis currently executed is complete, the autoinjector starts injecting the specified priority samples.
- (4) After the priority analysis is complete, the autoinjector starts injections from the sample next to the one completed before interruption.
- (5) The set values for priority analyses are reset to [0] after the completion of the analyses.

#### For Other Gas Chromatographs

If a priority sample is specified (FUNCTION 10) before analysis starts, the first sample analyzed will be the priority sample (instead of the sample in position 1). After the priority sample is analyzed, the value of FUNCTION 10 returns to 0 (no priority sample).

When FUNCTION 10 is set while the GC is performing analysis (with the autoinjector on standby), after completing the current analysis, the priority sample is analyzed. Analysis will then continue where it left off.

### 3.4.6 Solvent Flush Injection Mode

When using an autosampler, the solvent used to perform solvent flush injections is placed in a special position in the rack. Because the rinse solvent is not used for solvent flush, solvent flush injections have less chance of being contaminated.

Place the solvent for solvent flush injections in position 1 of the rack. (See [Figure 3-25](#).)

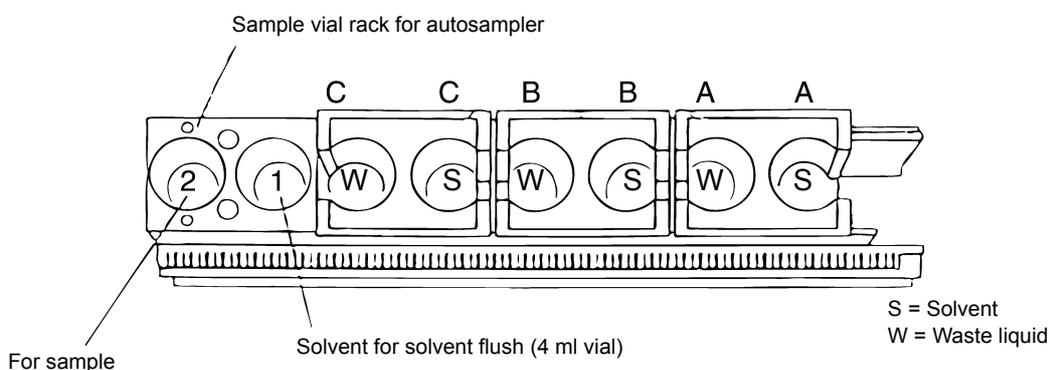


Figure 3-25

[Figure 3-26](#) to [Figure 3-29](#) shows each injection mode available through FUNCTION 07 ([Inj Mode]) for GC-2010/2010Plus/2014/2025) when an autosampler is used.

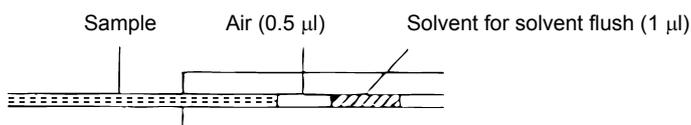


Figure 3-26 When FUNCTION 07 is "001" ([Inj Mode] is [1] for GC-2010/2010Plus/2014/2025)

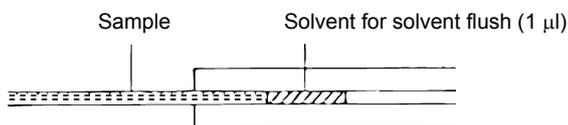


Figure 3-27 When FUNCTION 07 is "002" ([Inj Mode] is [2] for GC-2010/2010Plus/2014/2025)

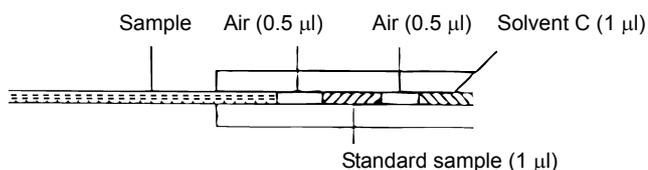


Figure 3-28 When FUNCTION 07 is "003" ([Inj Mode] is [3] for GC-2010/2010Plus/2014/2025)

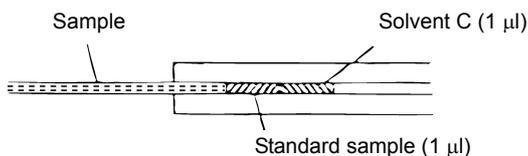


Figure 3-29 When FUNCTION 07 is "004" ([Inj Mode] is [4] for GC-2010/2010Plus/2014/2025)

Set FUNCTION 07 ([Inj Mode] for GC-2010/2010Plus/2014/2025) to "003" or "004" when performing internal standard analysis and solvent flush injection mode. This automatically aspirates internal standard and injects it along with the sample. The internal standard is placed in position 1 of the rack. The solvent for solvent flush is then taken from the solvent in position C of the rack (*Figure 3-30*).

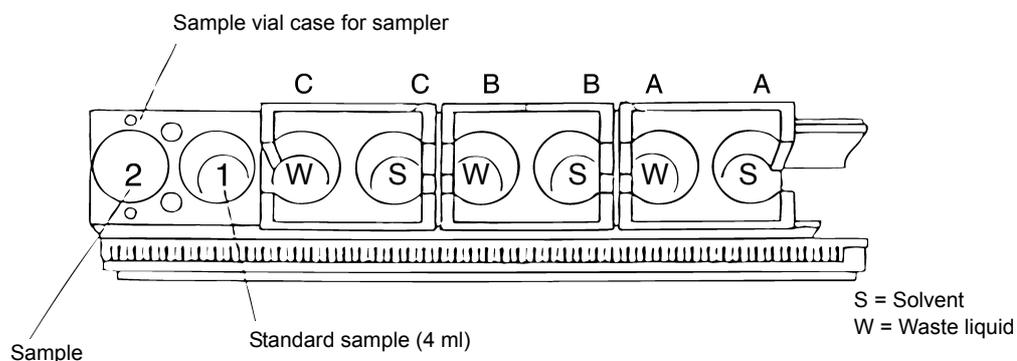


Figure 3-30

When injecting internal standard along with the sample, not only 1  $\mu\text{l}$  but 0.5  $\mu\text{l}$  can be selected for solvent aspiration volume for solvent flush. To do so, set FUNCTION 35 using the autoinjector keypad.

- 0: 10% of syringe volume
- 1: 5% of syringe volume

## 3.5 Analysis Tips and Precautions

Pay attention to the following when analysis is performed with an autoinjector, gas chromatograph, and data processor. (See also ["7 To Achieve Good Analysis Reproducibility" P.155.](#))

- (1) Set up analysis programs on GC and monitor cable connections

- (a) Set up a gas chromatograph temperature, isothermal, or time program

The autoinjector starts the next injection after the temperature, isothermal, or time program (as well as flow program for GC-17A Ver.1/2/3, GC-2010, GC-2010Plus, GC-2014 and GC-2025) ends and the GC becomes READY. If no program was created, sequential analysis cannot be executed. (See ["3.3.1 Sequential Analyses" P.105.](#)) If a sequence is attempted without creating any of above-mentioned programs, the autoinjector stops and returns to home position after injecting the first sample.

- (b) Check the cables

If the autoinjector stops unexpectedly after an injection, check cable connections. If the cable connecting the power supply box and the gas chromatograph is disconnected, or the power of the gas chromatograph is turned OFF, the autoinjector will appear as if the [STOP] key had been pressed.

This problem may also occur when a temperature, isothermal or time program is not set to the gas chromatograph.

- (2) Set the program time of the gas chromatograph longer than the data processor analysis time. (For Chromatopac, add the printout time to STOP.TIME.)

The data processor has to be READY before the gas chromatograph in order to correctly follow the sequence of [Sample injection → Gas chromatograph starts → Data processor starts]. Allow time for any reports to print before starting the next injection, or the data of the next injection may not be acquired.

- (3) Be aware of vial capacity limitations

Remember the capacity limit of the solvent and the waste liquid vials when setting NUMBER OF INJECTIONS ([Number of Injection] for GC-2010/2010Plus/2014/2025), SAMPLE WASH ([Sample Wash]) or SOLVENT WASH ([Solvent Wash]). (See ["2.4.2 Septum Replacement and Sample Volume in Vials" P.48.](#))

- (4) Replace the injection port septum frequently

The injection port septum should be replaced every 100 injections or fewer when the autoinjector is used. Using a worn septum may cause injection port leaks and reproducibility deterioration. Referring to ["2.5 Replacing INJ Port Septum" P.57](#), replace the septum periodically.

- (5) Inspect and maintain the syringe (See ["7.1 Precautions on Use of the Microsyringe" P.155](#) and ["7.2 Maintenance of the Microsyringe" P.156.](#))

When the plunger becomes stiff, the LED to the left of the [SAMPLE SIZE] key blinks as a warning during analysis (when not in solvent flush mode). When the plunger becomes too stiff to move normally, error "-03" displays and the autoinjector stops operation.

## (6) Monitor the injection amount

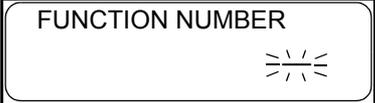
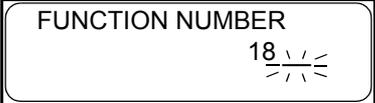
The volume of liquid sample that is normally injected into a GC is 1 to 2  $\mu\text{l}$ . This volume expands rapidly when the liquid vaporizes. The sample vaporized volume varies, depending on the solvent type and its vaporized volume, as well as the GC analysis parameters (such as injection port temperature, carrier gas flow rate, and inlet pressure). If the vaporized volume exceeds the capacity of the injection port glass insert, analysis results will not be reproducible.

Other analysis reproducibility problems occur with a slow sample speed in injection port, such as in splitless analyses using capillary column. Reproducibility problems may occur also when injection volume is very low. In such a case, place the silica wool higher so that the syringe needle tip is inserted into the wool during injections, which may allow small volume samples to vaporize efficiently.

When performing splitless analyses with the GC-17A Ver.2/3, reproducibility may improve if the pressure mode during the sampling time (split vent closed) is changed to front pressure mode. This is especially effective for solvents with a large vapor volume (such as acetone and methanol).

To change the GC-17A Ver.2/3 splitless mode to front pressure mode, follow the table below.

Table 3-15

	Key Operation	Display Comment	
①	<b>FUNC</b>	FUNCTION NUMBER 	
②	<b>1</b> <b>8</b>	FUNCTION NUMBER 18 	Selects FUNCTION No. (18: Customization)
③	<b>ENTER</b>	FUNCTION NUMBER CUSTOMIZE 18 __	
④	 	SPL1 SPLITLESS F.PRESS B.PRESS __	Displays current setting. The default setting is for back pressure mode.
⑤	<b>ENTER</b>	SPL1 SPLITLESS F.PRESS__ B.PRESS	Changes to front pressure mode.
⑥	<b>ESC</b>	FUNCTION ESCAPE	Ends parameter setting.

## 3.6 GCsolution

### 3.6.1 System Configuration

Select a type of the autosampler to be used under [Available Modules] in the [System Configuration] window. Add it to the analytical line as a [Modules Used for Analysis].

AOC-20i only:	AOC-20i
AOC-20i + AOC-20s:	AOC-20i+s
Dual injection system (MAIN):	AOC-20d (M)
Dual injection system (SUB):	AOC-20d (S)

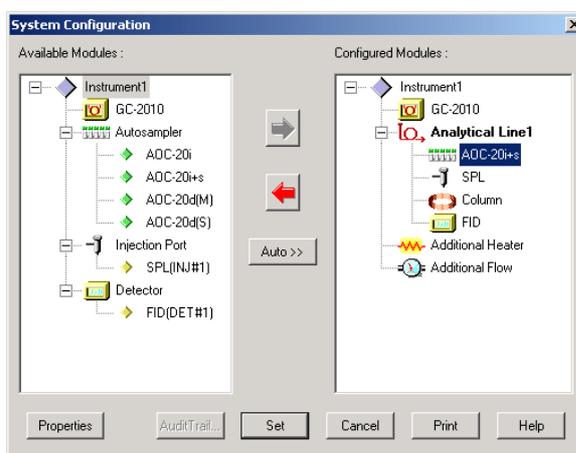


Figure 3-31

For details on the dual injection system, refer to the instruction manual of AOC-20 Dual Injection System (P/N 221-40483).

Complete the required setting in the properties of the AOC unit icon under Analytical line.

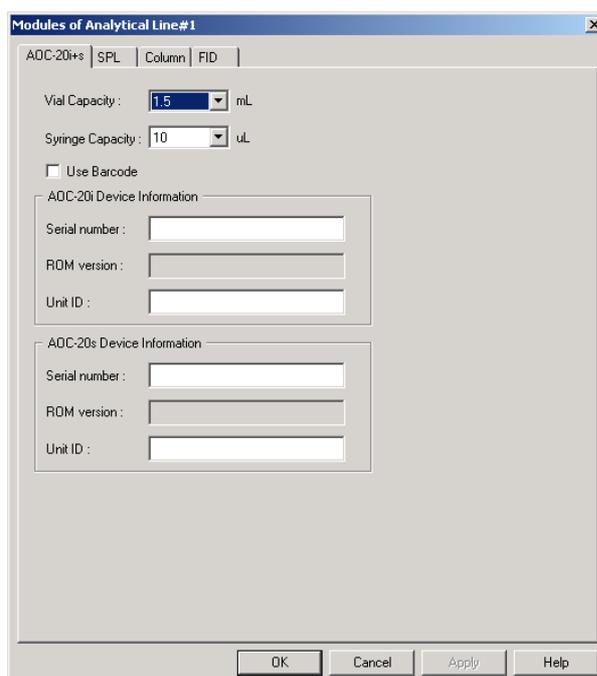


Figure 3-32

## 3.6.2 Setting Parameters

Complete the parameter settings in the autosampler tab page in [Data Acquisition] - [Instrument Parameter View].

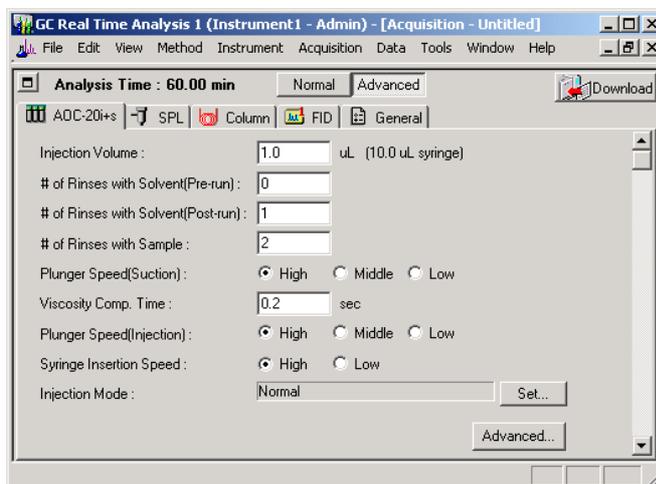


Figure 3-33

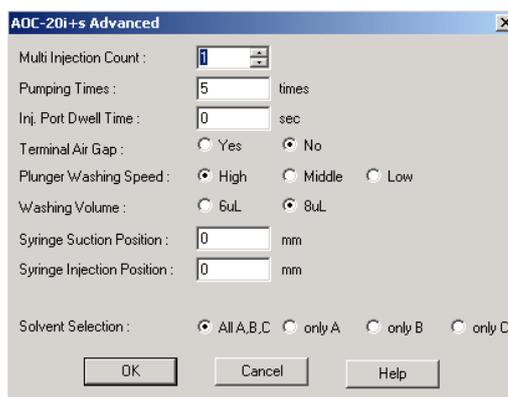


Figure 3-34

### NOTE

For details on the parameter settings, refer to the instruction manual of GCsolution.

For the setting procedures for GCMSsolution, refer to the instruction manual of GCMSsolution.

## 3.7 CLASS-GC10

### 3.7.1 System Configuration

Select the following items from the system configuration autosampler drop-down list.

AOC-20i with short rack:	AOC-20i (short)
AOC-20i with long rack:	AOC-20i (long)
AOC-20i + AOC-20S:	AOC-20s
Dual injection system:	AOC-20d

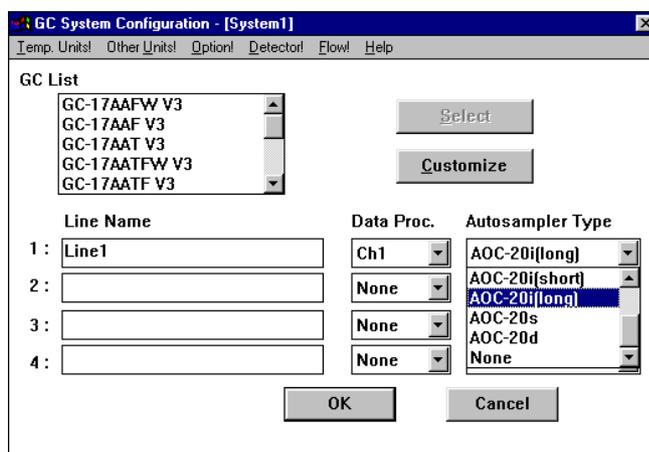


Figure 3-35 CLASS-GC10 System Configuration screen

\* For a dual injection system, refer to the instruction manual of AOC-20 Dual Injection System (P/N 221-40483).

## 3.7.2 Setting Parameters

Select [AUTOSAMPLER] from the [METHOD SETUP] menu, or the [AUTOSAMPLER] menu command in the <GC SETTING> window, to open the <autosampler> window, and set up the parameters.

The screenshot shows the 'Autosampler(Line1)' dialog box with the following parameters and values:

# of Rinses with Sample	2
# of Rinses with Solvent(pre)	0
Viscosity Comp. Time(sec)	0.2
Injection Speed	<input checked="" type="radio"/> High <input type="radio"/> Medium <input type="radio"/> Low
Syringe Speed	<input checked="" type="radio"/> High <input type="radio"/> Low
Inj. Port Dwell Time(sec)	0
# of Rinses with Solvent(post)	1
Injection Mode	0:Sample
Pumping Times	5

Buttons: OK, Cancel, Help

Figure 3-36 <Autosampler> window

The following parameters appear in this screen.

- # of Rinses with Sample: Sample rinse frequency
- # of Rinses with Solvent (pre): Solvent rinse frequency (before injection)
- Viscosity Comp. Time: Plunger hold time after sample aspiration (sec)
- Injection Speed: Plunger injection speed
- Syringe Speed: Syringe injection speed
- Inj. Port Dwell Time: Wait time after injection (sec)
- # of Rinses with Solvent (post): Solvent rinse frequency (after injection)
- Injection Mode: Injection mode (normal, solvent flush, etc.)
- Pumping Times: Number of pumpings

Specify the injection volume and the number of injections per sample, when registering samples or creating the sample schedule.



### NOTE

For setting up large volume sample injections, see ["3.3.3 Injection Modes", "Large Volume Injection Mode \(Low-speed Injection Method\)" P.115](#). The range of injections per sample is 0 - 10.



### NOTE

The default values of [Injection Speed] and [Inj. Port Dwell Time] are [Medium] and [0.3 sec], respectively. The recommended AOC-20 values are [High speed] and [0 sec].

## 3.8 CLASS-VP

### 3.8.1 Autoinjector/Autosampler Configuration

To configure CLASS-VP for the AOC-20 autoinjector and/or autosampler, choose Configuration from the CLASS-VP Main Menu. Then select the Injection button. The autoinjector primary configuration screen is displayed; choose Shimadzu AOC from the drop-down list. Click on Settings.

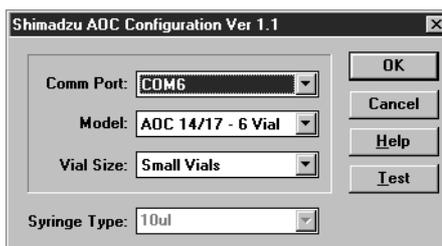


Figure 3-37

Choose the appropriate Comm. Port, Model, Vial Size, and Syringe Type from the drop-down list selections. To test the connection, click on the Test button. Restart the program for the new configuration to take effect. Please see the CLASS-VP manual for more information.

### 3.8.2 Pretreatment Setup Screen

From the [Batch] menu, select [Pretreatment Setup] to enter autoinjector parameters.

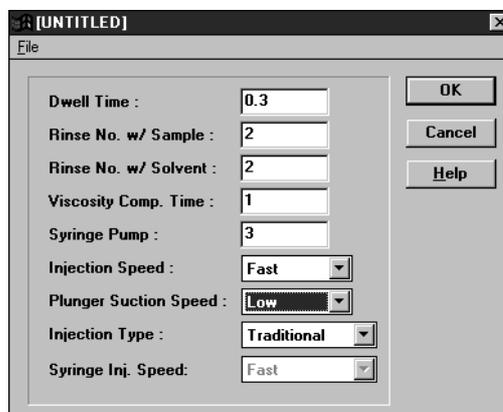


Figure 3-38

The parameter functions correspond to the autoinjector parameters described in ["3.2 Display and Keypad Functions" P.89](#). Set them up as you would on the autoinjector. Then, save the pretreatment file by choosing [Save] from the [File menu]. The file is saved with an.aoc extension, which is then specified when setting up the batch.



#### NOTE

When the autoinjector is controlled by CLASS-VP, FUNCTION 31 must be set to 655 min.

# 4

## External Control

This section describes how to control the autoinjector externally.

When connecting the autoinjector and an external control device, the following two methods of transmission can be used. (Set FUNCTION 83 to select transmission method.)

- Transmission by "Simple procedure"  
This is the transmission method used for AOC-17 or AOC-14 communication. Use this method when connecting a PC or Chromatopac (except for the C-R7A). Also, specify this method when creating new programs or using programs created for the AOC-17 or AOC-14.
- "Level 2" transmission  
This transmission method is used to connect the autoinjector to a C-R7A Chromatopac. This method is also used for communication between the gas chromatograph and the C-R7A Chromatopac.

Either a fiber optic or RS-232C interface can be used for the external control connection. However, both cannot be used at the same time.

The pin configuration for the RS-232C connector is shown below. It is the same configuration as that of IBM PC/AT compatible computers. Use a commercially available null modem cable for an RS-232C connection to external devices.

Table 4-1 RS-232C pin configuration

Pin No.	Function
1	NC (Not used)
2	RxD (Received Data)
3	TxD (Transmitted Data)
4	DTR (Always ON)
5	Ground
6	NC (Not used)
7	RTS (Always ON)
8	NC (Not used)
9	NC (Not used)

## 4.1 Preparation

Make the following settings to prepare for the autoinjector transmission. Restart the unit for the settings to take effect.

### ■ Transmission by Simple Procedure

- F80 ..... Baud rate. Leave the default value of 2.
- F81 ..... Parity. Leave the default value of 0. (A value of 1 indicates even parity).
- F82 ..... Stop bits. Leave the default value of 1.
- F83 ..... CH1 protocol. Change to Simple procedure (0).
- F84 ..... To remain compatible with the AOC-17 or AOC-14, leave the default value of 1; otherwise, set to 0. See Note 1).
- F86 ..... Leave the default value of 0.

- Note 1) Depending on the setting for F84, the following transmission parameters are changed.
- 0: Numerical values consist of three digits  
A response is made to RSET (reset command).
  - 1: Numerical values consist of two digits (100 is transformed to "1\*").  
The RSET (reset) command has no effect.  
The parameter setting ranges become the same as those of the AOC-17.  
A value larger than 100 cannot be sent when F84 is set to 1.

### ■ Level 2 Transmission

- F80 ..... Baud rate. Leave the default value of 2.
- F81 ..... Setting not necessary
- F82 ..... Setting not necessary
- F83 ..... Leave the default value of 1.
- F84 ..... Setting not necessary
- F86 ..... Leave it as 0 (default value).
- MODE setting of the Chromatopac (communication port parameter) ..... Change to 12917

## 4.2 External Control

The external control device communicates with the autoinjector as follows.

- Sends parameters to the autoinjector.
- Receives parameters or monitors the autoinjector status.
- Controls autoinjector operation (Start, Stop, Reset, etc.)

The Simple procedure method of sending/receiving commands differs from the Level 2 procedure. Although a decimal number such as "00.3" can be displayed on the screen (as in a time or injection volume setting), only whole integer values can be used for transmission. For example, transmit 003 instead of 00.3 and 100 instead of 10.0.

"4.2.1 Transmission by Simple Procedure" P.135 describes transmission by Simple procedure, and "4.2.2 Level 2 Transmission" P.138 describes Level 2 transmission.

"4.2.3 Command List" P.140 lists communication commands.

### 4.2.1 Transmission by Simple Procedure

When transmitting a command to the autoinjector, 3 kinds of modes are available: K, M, and S. These codes are added to the beginning of a transmission command to distinguish each mode.

- K: Setting mode (Setting parameters and Start, Stop, and Reset)  
 M: Actual value request mode (such as monitoring the sample number)  
 S: Setting value request mode (reading parameters)

#### 4.2.1.1 Parameter Transmission (Setting)

Setting autoinjector parameters from an external device is illustrated below.

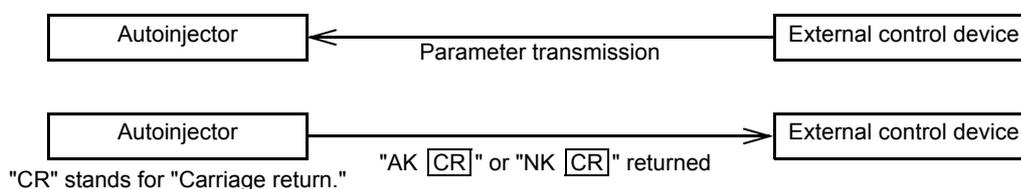


Figure 4-1 Setting a parameter

The steps in [Figure 4-1](#) are shown below.

- 1 Transmit "K" + Transmission command + " " + Parameter + `[CR]` to the autoinjector.**  
 For example, the command for setting SAMPLE WASH to 3 is "KWRPT 003" + CHR\$(0DH). Note that " " means a space.
- 2 If the setting was successfully made, the autoinjector returns "AK `[CR]`". If the setting was not successfully made, then "NK `[CR]`" is returned.**

#### NOTE

For the list of transmission commands, see ["4.2.3 Command List" P.140](#).

When setting autoinjector parameters, use the format described in 1. Always designate parameters with 3 digits (for example, to set 3, use 003). However, use only 2 digits when FUNCTION 84 is set to "001".

If the setting was successfully completed, the autoinjector returns "AK [CR]". If the setting was not performed (mistaken transmission code, invalid parameter, etc.), "NK [CR]" is returned.

For an example, a BASIC program for setting the PUMPING frequency to 6 from a Chromatopac C-R7A or C-R4A is shown below. (Port No. 3 is used.)

OPEN TRS 3	Port open
C\$ = "KPUMP 006" + CHR\$(0DH)	Command for PUMPING 6 times
PRINT #3,C\$;	Transmission
INPUT #3,A\$	Input response from the autoinjector
CLOSE TRS 3	Port close

**NOTE**

Be sure to add a semi-colon (;) at the end of the sentence when sending a command.

### 4.2.1.2 Parameter Reception and Status Monitoring

Reception of autoinjector parameters by an external control device is illustrated below.

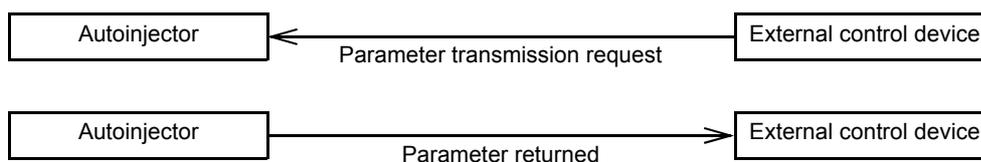


Figure 4-2 Transmission and reception of a parameter

The steps in [Figure 4-2](#) are described below.

- 1 Transmit "S" + Transmission command + " " + [CR] to the autoinjector.**  
(For example, the command for receiving the value for SAMPLE WASH is "SWRPT" + CHR\$(0DH)).
- 2 The parameter is returned.**  
(However, if the command was sent improperly, "NK [CR]" is returned.)  
(For example, when SAMPLE WASH is set to 2, "002 [CR]" is returned.)

**NOTE**

Use "M" at the beginning of a command, instead of an "S", to monitor operations (receive actual values). See the command list in ["4.2.3 Command List" P.140](#).

### 4.2.1.3 Controlling Injector Operation

To control the autoinjector (RESET, START, STOP) through an external device, follow the procedure below.

- 1 **Transmit "K" + Transmission command + " " + CR to the autoinjector.**  
(For example, the command to start the autoinjector is "KSTRT" + "CHR\$(0DH).")
- 2 **"AK CR" or "NK CR" is returned.**

 **NOTE**

The reset command is ignored when F84 is set to 1.

### 4.2.1.4 Transmission Precautions

- (1) Three types of commands are available: K mode (setting mode), M mode (actual value request mode), and S (set value request mode). Some commands can only be used for certain modes. See the command list in ["4.2.3 Command List" P.140](#).
- (2) When a command is sent to the autoinjector, "AK CR", "NK CR" or a parameter is returned. The response is 3 bytes for AK and NK. For a parameter, it is 4 bytes. However, when FUNCTION 84 is set to "001", the response of a parameter is 3 bytes (2 digits not including CR), and there is no response when the RESET command is sent.
- (3) If a transmission error occurs, and the condition cannot be returned to normal, send CHR\$(05H) (ENQ command) to the autoinjector. CHR\$(05H) resets the autoinjector transmission line, and "AK CR" is returned.
- (4) When " " (space) in the transmission command is replaced with "\$", the autoinjector returns the command along with the value. This makes it easy to distinguish to which command the response corresponds.

**For example:**

Command to be transmitted	Autoinjector
"SWRPT"+ CHR\$(0DH)	"001 <span style="border: 1px solid black; padding: 0 2px;">CR</span> "
"SWRPT\$"+ CHR\$(0DH)	"WRPT = 001 <span style="border: 1px solid black; padding: 0 2px;">CR</span> "
"KSTRT"+ CHR\$(0DH)	"AK <span style="border: 1px solid black; padding: 0 2px;">CR</span> "
"KSTRT\$"+ CHR\$(0DH)	"STRT = AK <span style="border: 1px solid black; padding: 0 2px;">CR</span> "

 **NOTE**

Follow the procedures below to prevent transmission errors.

- (5) When a command is transmitted to the autoinjector, make sure the response is returned from the autoinjector before sending the next command.
- (6) As in the program example shown in ["4.2.1.1 Parameter Transmission \(Setting\)" P.135](#), be sure to add a semi-colon (;) at the end of the sentence when sending a command. When a program is executed without including the semi-colon, no carriage returns or line feeds occur.

## 4.2.2 Level 2 Transmission

When Level 2 transmission is used, transmission is performed with single commands instead of programs. The following three kinds of modes are available.

- K: Setting mode (Setting of parameters and START, STOP, and RESET commands.)
- M: Actual value request mode (such as reading SAMPLE NUMBER)
- G: Set value request mode (reading parameters)

### 4.2.2.1 Opening the Port

Before transmission can occur between the autoinjector and the Chromatopac, perform the following operation on the C-R7A Win3 screen to open the port.

Be sure to insert a space between "OPEN" and "TRS" as well as "TRS" and the physical port number.

```
OPEN TRS 3 
           ↑
           Physical port number
```

For the physical port number, refer to the GC network instruction manual.

### 4.2.2.2 Transmission of Parameters (Setting)

To change the autoinjector set values from the Chromatopac, perform the following operation on the Win 3 screen. (These are K mode operations.)

**Example 1: Set the NUMBER OF INJECTIONS to 3.**

```
REPT#3=3 
```

**Example 2: Set the VISCOSITY to 3 sec.**

```
WTPP#3=30 
           ↑
           Logical port number
```

For the logical port number, refer to the GC network instruction manual.

In Simple procedure transmission, the number must be transmitted in 3 digits, so that [1] becomes [001] (or, when F84 is set to 1, in two digits). However, in Level 2 transmission, the number of digits is not taken into consideration.

### 4.2.2.3 Reception of Parameters and Status Monitoring

To display set or monitored autoinjector values on the Chromatopac screen, perform the following operations from the Win 3 screen.

**Example 1: Display the number of solvent rinses. (SOLVENT WASH)**

```
PRINT WMOD#3 
```

**Example 2: Print the SAMPLE NUMBER.**

```
LPRINT ISNO#3M 
                ↑
                Logical port number
```

Receiving the set value, as shown in Example 1, is a G mode operation.

Monitoring the status, as shown Example 2, is an M mode operation. Therefore, M is added to the command.

### 4.2.2.4 Controlling the Autoinjector

To operate the autoinjector from the Chromatopac (START, STOP and RESET), perform the following operation on the Win 3 screen (these are K mode operations).

**Example 1: Start the autoinjector.**

STRT#3 

**Example 2: Stop the autoinjector.**

STOP#3 

**Example 3: Reset the autoinjector.**

RSET#3   
↑ Logical port number

### 4.2.2.5 Closing the Port

Before turning OFF the power of either the autoinjector or Chromatopac, close the port. To close the port, perform the following operation on the Chromatopac Win 3 screen.

Be sure to insert a space between "CLOSE" and "TRS" as well as "TRS" and the physical port number.

CLOSE TRS 3   
↑ Physical port number

## 4.2.3 Command List

- SAMU, SUBU, BARC commands  
In G and S modes, the set values are returned as the response. The M mode response indicates whether the unit is ready (a response of 1 indicates that the unit can be used.)
- RDYF command  
1 is returned when waiting for analysis or START, and 0 otherwise.
- STRF  
1 is returned when ready to start. 0 indicates an error.

Table 4-2

Command Name	Mode	Contents	Valid Range	Default Value
STRT	K	START		
STOP	K	STOP		
RSET	K	RESET		
WRPT	K, G, S	SAMPLE WASH	000 - 099	002
WMOD	K, G, S	SOLVENT WASH	000 - 099	001
REPT	K, G, S	NUMBER OF INJECTIONS	001 - 099	001
IVOL	K, G, S	SAMPLE SIZE	001 - 080	010
WPRS	K,G,S	F01 PRE SOLVENT WASH	000 - 099	000
PUMP	K, G, S	F02 PUMPING	000 - 099	005
WTPP	K, G, S	F03 VISCOSITY	000 - 999	002
WAIT	K, G, S	F04 DWELL TIME	000 - 999	000
ISPD	K, G, S	F05 INJ SPEED (PLUNGER)	000 - 002	002
SSPD	K, G, S	F06 INJ SPEED (SYRINGE)	000 - 001	001
SAND	K, G, S	F07 INJECTION MODE	000 - 004	000
SOLV	K, G, S	F08 SOLVENT SELECT	000 - 003	000
SINT	K, G, S	F10 PRIORITY SAMPLE	000 - 150	000
SSNO	K, G, S	F11 INJECTION SAMPLE	000 - 150	000
FSAM	K, G, S	F12 FINAL SAMPLE	000 - 150	000
SNO2	K, G, S	F13 INJECTION SAMPLE2	000 - 150	000
AAIR	K, G, S	F20 WITH/WITHOUT AIR ASPIRATION	000 - 001	000
WKEY	K, G, S	F21 KEY FOR SOLVENT WASH BEFORE INJECTION	000 - 001	000
USPD	K, G, S	F22 PLUNGER ASPIRATION SPEED	000 - 002	002
DSPD	K, G, S	F23 SPEED TO LOWER PLUNGER	000 - 002	002
UVOL	K, G, S	F24 SUCTION VOLUME AT SAMPLE WASH AND PUMPING	000 - 001	000
HIGH	K, G, S	F25 SYRINGE HEIGHT WHEN ASPIRATING (UP)	000 - 020	000
LOWS	K, G, S	F26 SYRING HEIGHT WHEN ASPIRATING (DOWN)	000 - 010	000
INJH	K, G, S	F27 SYRING HEIGHT ATINJECTION (UP)	000 - 022	000
SLMD	K, G, S	F28 3 SOLVENT VIALS IN USE	000 - 001	000
VIAL	K, G, S	F29 VIAL SIZE	000 - 001	000
CKTR	K, G, S	F30 WITH/WITHOUT TRAY CHECK	000 - 001	000

Command Name	Mode	Contents	Valid Range	Default Value
TANL	K, G, S	F31 ANALYSIS TIME	000 - 655	000
TSTR	K, G, S	F32 ANALYSIS START TIME	000 - 999	000
STRI	K, G, S	F33 NUMBER OF INJECTIONS PER ONE ANALYSIS	001 - 099	001
LSYR	K, G, S	F34 SYRINGE SIZE	000 - 002	000
SVOL	K, G, S	F35 SOLVENT ASPIRATION VOLUME IN SOLVENT FLUSH MODE 3, 4	000 - 001	000
SAMU	K, G, S, M	F40 USE/NOT USE AUTOSAMPLER	000 - 001	000
SUBU	K, G, S, M	F41 USE/NOT USE SUB AOC	000 - 001	000
BARC	K, G, S, M	F42 USE/NOT USE BAR-CODE READER	000 - 001	000
SPMD	K, G, S	F50 SAMPLE DISTRIBUTION OF DUAL AOC	000 - 008	000
PAR1	K, G, S	F51 OPERATING SUB-INJECTOR BY PARAMETERS OF MAIN-INJECTOR	000 - 001	000
SET2	K, G, S	F63 SEND PARAMETER COMMAND TO SUB AOC	000 - 001	000
GLPM	K, G, S	VALIDATION MODE SETTING	000 - 001	000
CH1B	K, G, S	F80 CH1 BAUD RATE	000 - 004	002
CH1P	K, G, S	F81 CH1 PARITY FOR SIMPLE PROCEDURE TRANSMISSION	000 - 001	000
CH1S	K, G, S	F82 CH1 STOP BIT FOR SIMPLE PROCEDURE TRANSMISSION	000 - 001	001
CH1L	K, G, S	F83 CH1 SIMPLE PROCEDURE/LEVEL 2 TRANSMISSION	000 - 001	001
CH1M	K, G, S	F84 TRANSMISSION BY SIMPLE PROCEDURE NORMAL/AOC-17 COMPATIBLE	000 - 001	001
CH2B	K, G, S	F85 CH2 BAUD RATE	000 - 004	000
ATSP	K, G, S	F90 AUTOMATIC STOP FUNCTION OFF/ON	000 - 001	001
ARSG	K, G, S	F91 READY SIGNAL POLARITY OPEN/CLOSE	000 - 001	000
SORD	K, G, S	F92 AOC SINGLE/DUAL	000 - 001	000
TLET	K, G, S	F93 RACK SHORT/LONG	000 - 001	000
TSEL	K, G, S	F94 RACK POSITION WHEN AUTOSAMPLER IS USED	000 - 002	001
DUAL	K, G, S	F95 MAIN-AOC/SUB-AOC	000 - 001	000
TLT2	K, G, S	F96 RACK FOR AOC-17/FOR AOC-20i	000 - 001	001
RDYF	M	MONITOR WHETHER ANALYSIS IS BEING PERFORMED	000 - 001	
NINJ	M	MONITOR INJECTION NUMBER	000 - 099	
NSPS	M	MONITOR SAMPLE WASH NUMBER	000 - 099	
NSLW	M	MONITOR SOLVENT WASH NUMBER	000 - 099	
NPMP	M	MONITOR PUM FREQUENCY	000 - 099	
NTIM	M	MONITOR ANALYSIS (START) TIME	000 - 999	
ISNO	M	MONITOR SAMPLE No.	000 - 150	
ISN2	M	MONITOR SAMPLE No. OF SUB-AOC	000 - 150	
STRF	M	MONITOR START STATUS	000 - 001	

## 4.3 Example Programs

Example programs for printing Sample Number and Injection number on a C-R7A Chromatopac are given below, along with an explanation of the programs.

"4.3.1 Example Program for Simple Procedure Transmission" P.142 shows Simple procedure example, and "4.3.2 Example Program for Level 2 Transmission" P.144 shows a Level 2 transmission example.

### 4.3.1 Example Program for Simple Procedure Transmission

List 4-1

```

100    PO=3
110    A$="MISNO" +CHR$(0DH)
120    B$="MNINJ" +CHR$(0DH)
130    S$="KSTRT" +CHR$(0DH)
140    OPEN TRS PO : CT=0
150    PRINT #PO,S$; : GOSUB 340
160    IF ((A$="NK" OR A$="") AND CT<4) THEN CT=CT+1 : GOTO 150
170    IF CT>=4 THEN LPRINT "ERROR" : CLOSE TRS PO : GOTO 420
180    CLOSE TRS PO
190    WAIT START
200    OPEN TRS PO : CT=0
210    PRINT #PO,A$; : GOSUB 340
220    IF ((A$="NK" OR A$="") AND CT<4) THEN CT=CT+1 : GOTO 210
230    IF CT>=4 THEN LPRINT "ERROR" : CLOSE TRS PO : GOTO 420
240    SNS=AS$ : CT=0
250    PRINT #PO,B$; :GOSUB 340
260    IF ((A$="NK" OR A$="") AND CT<4) THEN CT=CT+1 : GOTO 250
270    IF CT>=4 THEN LPRINT "ERROR" : CLOSE TRS PO : GOTO 420
280    NI$=AS$
290    CLOSE TRS PO
300    IF SN$="1*" THEN SN$="100"
305    LPRINT : LPRINT
310    LPRINT "SAMPLE No. : ";SN$;" REPEAT : ";NI$"
315    LPRINT
320    WAIT STOP
330    GOTO 190
340    REM *INPUT SUBROUTINE
350    T=TIME : WT=30 : AS$="" : AB$=""
360    IF T+WT<TIME THEN GOTO 410
370    IF (TRSF%(PO) AND 01H)<>0H THEN AB$=INPUT$(1.PO)
380    IF AB$=CHR$(0DH) THEN GOTO 410
390    IF AB$=<>"" THEN AS$ [LEN(AS$)+1]=AB$
400    AB$="" : GOTO 360
410    RETURN
420    END

```

## Program explanation

Line Number	Explanation
100	Defines the port used by the Chromatopac RS-232C interface. When a port other than No. 3 is used, use that number on this line.
110 - 130	These lines define the commands to be sent to the autoinjector. A\$ displays the Sample No., B\$ displays the Injection No., and S\$ STARTs operation.
140 - 180	This starts the autoinjector operation. If "NK [CR]" is returned in response to the command, or if no response is returned, the command transmission is repeated up to 4 times. If a normal response is not returned on the fourth transmission, "ERROR" is printed and program stops. (Repeat execution of the program until normal transmission is established.) It is necessary to include the semi-colon (;) in line 150, which contains the statement to send the command. Transmitting "PRINT #PO,S\$" without the ";" will cause "[CR] [LF]" to be appended to S\$ in the transmission.
190	This causes the program to wait until the Chromatopac analysis starts (sample injection is performed). When the autoinjector completes the injection, the Sample No. and Injection No. will be displayed on the CRT monitor. This causes the Sample No. to be displayed during analysis.
200 - 240	The Sample No. is displayed, substituting the value for SN\$.
250 - 290	The Injection No. is displayed, substituting the value for NI\$.
300	When F84 is 1, when the Sample No. is 100, this indicates that the "1*" response should be corrected to "100".
310	This prints out the Sample No. and Injection No.
320	This causes the program to wait until the Chromatopac analysis stops (the time set using the STOP TM key).
340 - 410	This is a sub-routine for input of responses from the autoinjector. Each time a character is received, it is input; this routine ends when a "[CR]" is received. The routine will also end when reception continues for about 30 seconds, thereby exiting from the routine after a fixed period of time if a response is not received after a command is transmitted. When the characters "INPUT #" are used, the reception routine will end after 1 line is received, and in this case, the program execution will stop if the response from the autoinjector is not received normally.

4

## Operation procedure

- 1 Set the parameters for the autoinjector, GC and C-R7A.**  
Set the program time of the gas chromatograph longer than the data processor analysis time. (For Chromatopac, add the printout time to STOP.TIME.)
- 2 Execute (RUN) the program.**  
When the START command is sent from the C-R7A, the autoinjector will start operation.
- 3 The sample will be injected.**  
When the C-R7A starts analysis, the Sample No. and Injection No. are transmitted for display on the monitor and then printed out. This sequence is then repeated for each analysis.

## 4.3.2 Example Program for Level 2 Transmission

List 4-2

```

100    OPEN TRS 3
110    STRT#3
120    WAIT START
130    SN$=ISNO#3M
140    NI$=NINJ#3M
150    LPRINT:LPRINT
160    LPRINT"SAMPLE No.:";SN$;" REPEAT :";NI$
170    LPRINT
180    WAIT STOP
190    GOTO 120
200    END

```

### Program explanation

Line Number	Explanation
110	This starts the autoinjector operation.
120	This causes the program to wait until the Chromatopac analysis starts.
130 - 160	This prints out the Sample No, and Injection No.
180	This causes the program to wait until the Chromatopac analysis stops.
190	Repeat lines 120 - 180.

# 5

## Maintenance



### NOTE

Clean the cover of the unit with a soft cloth dampened with water or a solution of water and a mild detergent.

---

## 5.1 Cleaning the Vials

Sample and solvent vials can be re-used if they are cleaned after each use. Follow the procedure below to ensure that vials are as clean as possible.

- 1 Remove and discard the caps and septa.**
- 2 Place the glass part of the vials in a flask made of material that can tolerate a vacuum, and add the cleaning solution (descaler, organic solvent, water etc.).**
- 3 Reduce the pressure in the flask, with an aspirator etc., to extract the air from the vials.**
- 4 Gradually allow the pressure to return to normal. The vials will fill with cleaning solution.**
- 5 Place the flask in an ultrasonic cleaning device.**
- 6 Discard the cleaning solution, and wash with water.**  
If acid solution was used, rinse with water at least three times using the procedure described above.
- 7 If water remains, dry the vials with acetone, alcohol or another highly volatile solvent.**
- 8 Use new septa on clean vials.**

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## 5.2 Syringe Inspection and Maintenance

For details on the inspection and maintenance procedure, see ["7.1 Precautions on Use of the Microsyringe" P.155](#) and ["7.2 Maintenance of the Microsyringe" P.156](#).

### CAUTION

- Since a syringe is manufactured precisely, always use only the plunger supplied with the syringe. plungers are not interchangeable.

## 5.3 Consumable Parts and Standard Accessories

### 5.3.1 Autoinjector Consumable Parts

Name	Part No.	Remarks
Syringe (10 µl)	S221-34618	
Syringe (50 µl)	S221-45243	
Syringe (250 µl)	S221-45244	
Syringe (0.5 µl)	000445	By Shimadzu GLC
Syringe (5 µl)	5F-S-0.63	By Shimadzu GLC
Large vial (4 ml)	S221-34267-92	50 pcs.
Large cap (4 ml)	S221-34268-92	50 pcs. (white)
Large septum (4 ml)	S221-34266-92	50 pcs.
Small vial (1.5 ml)	S221-34272-92	100 pcs.
Small cap (1.5 ml)	S221-34273-92	100 pcs. (white)
Small septum (1.5 ml)	S221-41239-91	100 pcs.
Plunger holder	S221-45177-91	5 pcs.
Small vial set	S221-34274-91	1.5 ml vial, cap and septum, 100 pcs.
Large vial set	S221-34269-91	4 ml vial, cap and septum, 50 pcs.
Barrel holder	S221-45178-91	5 pcs.
Super elastic microsyringe (10 µl)	S221-49548	Shimadzu GLC Part No.: MS-E10AOC23G
Super elastic microsyringe (5 µl)	MS-E05AOC23G	By Shimadzu GLC



#### NOTE

The table above only lists the main syringes with 23 gauge needles.

### 5.3.2 Autoinjector/Autosampler Accessories

In addition to the consumables listed in ["5.3.1 Autoinjector Consumable Parts" P.147](#), the autoinjector/autosampler has various accessories described in ["1.5 Accessories List" P.6](#). To purchase required parts, please see the consumable list in ["1.5 Accessories List" P.6](#) and make an order.

## 5.4 Maintenance Parts

Unit	Name	Specification	Parts No.
AC100 - 120 V	Fuse	250 V 5 A TYPE T	S072-02004-23
AC220 - 240 V	Fuse	250 V 3.15 A TYPE T	S072-02004-21

**NOTE**

The design life of this instrument is seven years. After being installed for seven years, the instrument's maintenance parts will need to be inspected.

**⚠ WARNING**

For continued fire protection, replace only with fuses of the same type and rating.

## 5.5 Optional Parts

### Optional autoinjector parts

Name	Part No.	Remarks
Long rack assembly	S221-45622-91	Sample capacity: 12
Small sample cooling fan assembly	S221-44995-91	
FPD fan assembly	S221-44996-91	Required for the GC-14A/B, 15A, 16A when FPD is used
50 µl syringe	S221-45243	
250 µl syringe	S221-45244	
Syringe for OCI (10 µl)	S221-37282-02	Required when OCI INJ is used

### Optional autosampler parts

Name	Part No.	Remarks
4 ml vial rack	S221-44878-91	See <a href="#">"2.7.3 Using 4 ml Vials (Option)" P.70</a>
1.5 ml vial cooling/heat insulating rack	S221-44998-91	Requires constant temperature circulating water tank separately.
4 ml vial cooling/heat insulating rack	S221-44999-91	Requires constant temperature circulating water tank separately.

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### Optional C-R7A parts

Name	Part No.	Remarks
Fiber optic/RS-232C transmission interface	S223-02983-91	
Fiber optic cable	S070-92025-52	2 m

### Optional parts for GC-2014

Name	Part No.	Remarks
AOC-20i Installation kit	S221-48545-92	Used for mounting the existing AOC-20i (external power type) to GC-2014
AOC-20i Installation parts	S221-44548-94	Used for attaching the AOC mounting guides on multiple injection ports beforehand

**Optional parts for GC-2010/2010Plus**

Name	Part No.	Remarks
AOC-20i Installation kit	S221-48545-91	Used for mounting the existing AOC-20i (external power type) to GC-2010/2010Plus
AOC-20i Installation parts	S221-44548-93	Used for attaching the AOC mounting guides on multiple injection ports beforehand

# 6

# Troubleshooting

## 6.1 Error Codes

### 6.1.1 Autoinjector Error Codes

If the autoinjector does not operate normally, an error code is displayed. The various error codes are listed and described below.

Table 6-1 Error codes and troubleshooting

Error code	Troubleshooting
-01	Rack not in home position or not operating properly • Rack has not moved completely to home position. ↓ Remove the rack. Clean the rack gears and gear wheel thoroughly. Place the rack again and press the [RESET] key. • Rack not in place. ↓ Install the rack and press the [RESET] key.
-02	Syringe not in home position or not operating properly • Syringe not completely in home position. ↓ Press the [RESET] key.
-03	Plunger not in home position or not operating properly • Plunger not completely in home position. ↓ Press the [RESET] key. • Plunger does not move smoothly. (See Note 1.) ↓ Turn the power off, remove the syringe and perform maintenance on or replace the plunger.
-04	Autoinjector is not READY to start. • The [START] key was pressed after the autoinjector experienced an error. ↓ Press the [RESET] key to clear the error and then, press the [START] key.
-05	Autoinjector memory error (RAM) and values initialized. (See Note 2.) ↓ Re-enter the parameters.
-06	Autoinjector memory error (ROM) (See Note 3.)
-08	CH2 error (transmission for sub-injector or the autosampler.) ↓ Press the [RESET] key. (For GC-2010/2010Plus/2014/2025, check if the analytical line setting is correctly configured.)
-09	No PRIORITY sample (set by transmission - see Note 4) or no sample in the position specified by the INJECTION SAMPLE. ↓ Press the [RESET] key to restart after the sample has been placed in the rack.
-10	Memory (RAM) does not operate correctly. (See Note 3.)
-11	Autoinjector not correctly installed ↓ Re-install the autoinjector.

Error code	Troubleshooting
-12	The CH1 transmission line connecting the computer or the Chromatopac is not operating correctly. (See Note 3.)
-13	The CH2 transmission line connecting the sub-injector or the autosampler is not operating correctly. (See Note 3.)
-14	The waste liquid vial is not in position. ↓ Place the vial in position. Press the [RESET] key to restart.

- Note 1) If the plunger movement becomes slightly stiff, no error is generated, but a warning is displayed (the LED to the left of the [SAMPLE SIZE] key blinks while waiting for analysis) and operation continues.
- Note 2) The error code "-05" is displayed when a RAM error occurs, and also when parameters are initialized. If this error occurs every time power is supplied, the RAM back-up battery may be dead. For battery replacement, contact your Shimadzu representative.
- Note 3) When errors "-06" or "-10" occur, the autoinjector does not operate. When error "-12" occurs, the autoinjector cannot be controlled externally. When error "-13" occurs, the sub-injector or autosampler cannot be used. If these errors occur, contact your Shimadzu representative.
- Note 4) When a PRIORITY SAMPLE is set up by the keypad, no error is generated when there is no sample in the position; the next sample number is injected. An error is generated only when a PRIORITY SAMPLE has been set up by transmission from an external device, and there is no vial in that position. When an INJECTION SAMPLE is set up, whether by keypad or transmission, an error is generated if no vial is found in the position specified.

## 6.1.2 Autosampler Error Codes

When the autosampler generates an error, the error codes are displayed on the autoinjector. (For dual AOC, these error codes are displayed on the main injector.)

Table 6-2 Autosampler error codes and troubleshooting

Error code	Troubleshooting
E01	Arm does not rotate properly. ↓ Press the [RESET] key.
E02	Arm does not move properly along the x- or y- axis. ↓ Press the [RESET] key.
E03	Arm does not move up and down properly. ↓ Press the [RESET] key.
E04	Autosampler is not READY to start. • The [START] key was pressed after the autosampler experienced an error. ↓ Press the [RESET] key to clear the error, then press the [START] key.
E05	An error occurred when placing the vial in the rack. • A vial is already in position where the vial is to be placed. ↓ Remove the extra vial and press the [RESET] key. • Vial cannot be placed in the rack. ↓ Check the rack. Replace the vial in the autosampler, and press the [RESET] key, or perform teaching process.
E06	An error occurred when returning a vial to the autosampler. • A vial is already in position where the vial is to be placed. ↓ Remove the extra vial and press the [RESET] key.
E07	An error occurred when holding/releasing a vial. • The grip motor did not operate normally. ↓ Replace the vial and press the [RESET] key. • The vial could not be held or released. ↓ Check and replace the vial and press the [RESET] key. • The grip did not let go of the vial when the [RESET] key was pressed. ↓ Remove the vial from the grip and press the [RESET] key again.
E08	Vial was removed during vial transfer. ↓ Replace the vial and press the [RESET] key.
E09	No vial in the position specified by PRIORITY SAMPLE. (See Note 1.) No vial in the position specified by INJECTION SAMPLE. ↓ Place the vial in position and press the [RESET] key.

Note 1) This error is generated only when the priority sample setting was entered by transmission (through an external device) before start.  
When it has been set up after start, an error is generated whether the priority sample was set up by the keypad or by transmission.

### 6.1.3 Sub-injector Error Codes

When a sub-injector error occurs in a dual injector system, its display shows an error code. On the main injector, the error code is displayed with a dash after, rather than before, the error code, as in "01-". If an "E05" error occurs on the sub-injector, then "05E" is displayed on the main injector.

### 6.1.4 Miscellaneous Error Messages

Message	Troubleshooting
OP	The door is open. (Opening the door during operation causes the autoinjector to STOP.) ↓ Close the door. (The display returns to normal.) Press the [START] key to restart.
LE1	A CH1 transmission line error has occurred (this transmission line connects the computer or Chromatopac). ↓ Redo the cable connections, and re-type the OPEN command for the autoinjector port.
LE2	A CH2 transmission line error has occurred (this transmission line connects the sub-injector or autosampler). ↓ Redo the cable connections, and press the [RESET] key. (For GC-2010/2010Plus, verify that the analytical line has been properly set.)

# 7

## To Achieve Good Analysis Reproducibility

Please observe the following precautions when using the AOC-20i to ensure reliable analysis results.



### NOTE

The microsyringe (P/N S221-34618) used in the autoinjector is specifically designed for the AOC. Be sure to use the specified microsyringe.

## 7.1 Precautions on Use of the Microsyringe

The life and the analytical reproducibility of the microsyringe will vary considerably depending on how well it is maintained. Observe the following precautions in daily use of the microsyringe.

- After use, be sure to wash the microsyringe thoroughly with solvent, etc. Do not leave the microsyringe with traces of sample, etc. remaining on the end of the needle, inside the barrel or in the plunger.
- Before turning on the power of the autoinjector, always test that the plunger moves up and down smoothly by moving the plunger holder by hand. If the plunger does not move smoothly, remove the microsyringe from the autoinjector, and perform maintenance of the microsyringe. (For the maintenance procedure, see ["7.2 Maintenance of the Microsyringe" P.156.](#))
- After replacing the injection port septum, turn off the power of the autoinjector and move the syringe drive unit up and down to make a hole in the injection port septum once, then turn on the autoinjector. This is to ensure that an excessive force will not be applied at the end of the needle, which would reduce the life of the needle.
- Do not operate the plunger of the microsyringe when solvent or sample is not supplied sufficiently. This may cause the barrel glass and the plunger of the autoinjector to seize up against each other and be damaged.
- Before starting to use the autoinjector, check that fragments of the septum, etc. are not clogged at the end of the syringe needle. (In the first operation of a sequence using the autoinjector, check that the microsyringe is smoothly filled with solvent or sample.)

### CAUTION

- The microsyringe is manufactured with extremely high precision. Always use the syringe main unit and the plunger in the original combination. It is not permitted to replace only the plunger and use the original syringe and a new plunger together.

For attachment and removal of the microsyringe, see ["2.2 Mounting and Removing the Syringe" P.26.](#)

After attaching the microsyringe and fixing the plunger, check that the plunger is touching the lower position of the syringe barrel.

## 7.2 Maintenance of the Microsyringe

When performing maintenance of the microsyringe, remove it from the autoinjector.

(1) Maintenance of the plunger

Repeatedly aspirate and discharge solvent, etc. into/from the micro syringe, and check whether the plunger is moving smoothly. Move the plunger a full stroke, and check whether the plunger moves easily without being caught or other abnormalities.

If the plunger of the syringe does not move smoothly, the reproducibility may deteriorate, so be sure to perform maintenance.

Wash the syringe and the plunger with solvent, etc. and perform pumping to remove dirt, etc. from the inside of the syringe barrel and the plunger. A soft cloth, moistened with solvent etc., can be used effectively to wipe dirt off the plunger after removing it from the barrel. (Black marks on the plunger are caused by stainless powder.) Wipe the plunger thoroughly, set it into the syringe barrel, then perform pumping with solvent to confirm that it moves smoothly.

If the plunger does not move smoothly after several series of pumpings, washing or wiping during maintenance was insufficient. In these cases, wash and wipe the syringe and the plunger again in the same way, and check that the syringe moves smoothly, then attach the syringe to the autoinjector.

If the syringe is very dirty, it may be more effective to pull the plunger out of the syringe barrel and wash both the plunger and the barrel with ultrasonic waves in cleaning detergent or solvent (for approximately 1 min.).

Further, when analyzing water solution samples, use a super elastic microsyringe (See ["5.3.1 Autoinjector Consumable Parts" P.147.](#)) to prevent the plunger movement from becoming constricted.

## (2) Maintenance of the end of the syringe needle

Repeatedly aspirate and discharge solvent, etc. into/from the microsyringe, and check how the sample is discharged from the end of the needle. Under normal conditions, the sample is discharged in a straight line from the end of the needle. However, if the end of the needle is clogged, the sample may be dispersed as a spray or discharged at an angle. Or even if the sample is discharged in a straight line, the discharge diameter may be smaller than under normal conditions. (To make the comparison easier, it is recommended that you compare the discharge from the existing needle with that from a new needle that does not have any clogging.)

If the sample is discharged abnormally, the sample vaporization characteristics inside the glass insert may change at every injection and the analytical reproducibility may deteriorate. Maintenance of the end of the needle is required to prevent such abnormalities from occurring.

Remove clogging from the end of the needle by using a syringe cleaning wire (5 wires in 1 set, Shimadzu GLC), and check that the sample is discharged normally before using the syringe.

To remove dirt effectively from the inside of the syringe and the end of the needle, aspirate dirt using an aspirator or the syringe cleaner.

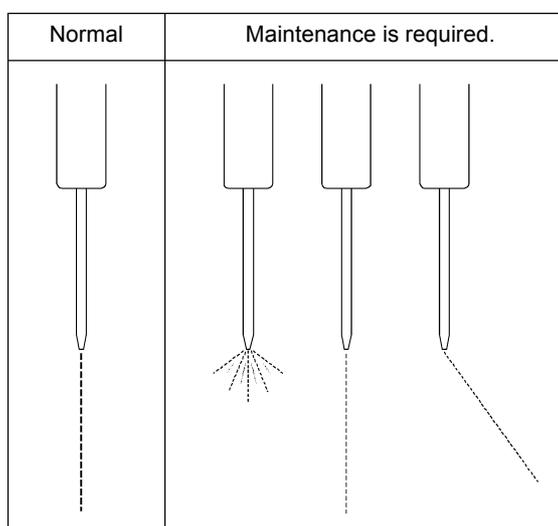


Figure 7-1

## 7.3 Precautions on Packing with Silica Wool

### (1) Amount of silica wool

Although the appropriate amount of silica wool may vary slightly depending on the sample being analyzed, use the following amount as a standard guide.

- Split analysis:                   Approx. 10 mg
- Splitless analysis:               Approx. 2 mg (Approx. 1 mg in the GC-17A)

However, for a sample with high absorptivity such as agricultural chemicals, a good analytical result may be obtained when the silica wool amount is decreased. On the other hand, for samples with large vaporization latent heat such as water, a better analytical result may be obtained when the silica wool amount is increased.



### NOTE

The silica wool offered as standard accessory with the GC-2010/2010Plus/2014/2025 (SPL) is different from conventional silica wool, and is inert. This silica wool has thick fibers and low density. Accordingly, even if the weight is the same, its volume is greater than that of conventional silica wool.

### (2) Stuffing position of silica wool

The silica wool should be packed in the glass insert in a position that is at a distance of 1 to 2 mm from the end of the needle during injection.

If the needle is too far from the silica wool or if the needle touches the silica wool, the peak shape and the reproducibility of the analysis results may deteriorate. See the figure below when packing the silica wool.

 **NOTE**

For standard GC-2014/2025 split analysis, silica wool is packed at 20 mm from the insert end. In this case, however, the needle tip is inserted approximately 5 mm into the silica wool. This is for obtaining stable reproducibility regardless of how samples are discharged from the needle tip. If you wish to further improve reproducibility, place the silica wool at 25 mm from the end, as in the case of GC-2010/2010Plus.

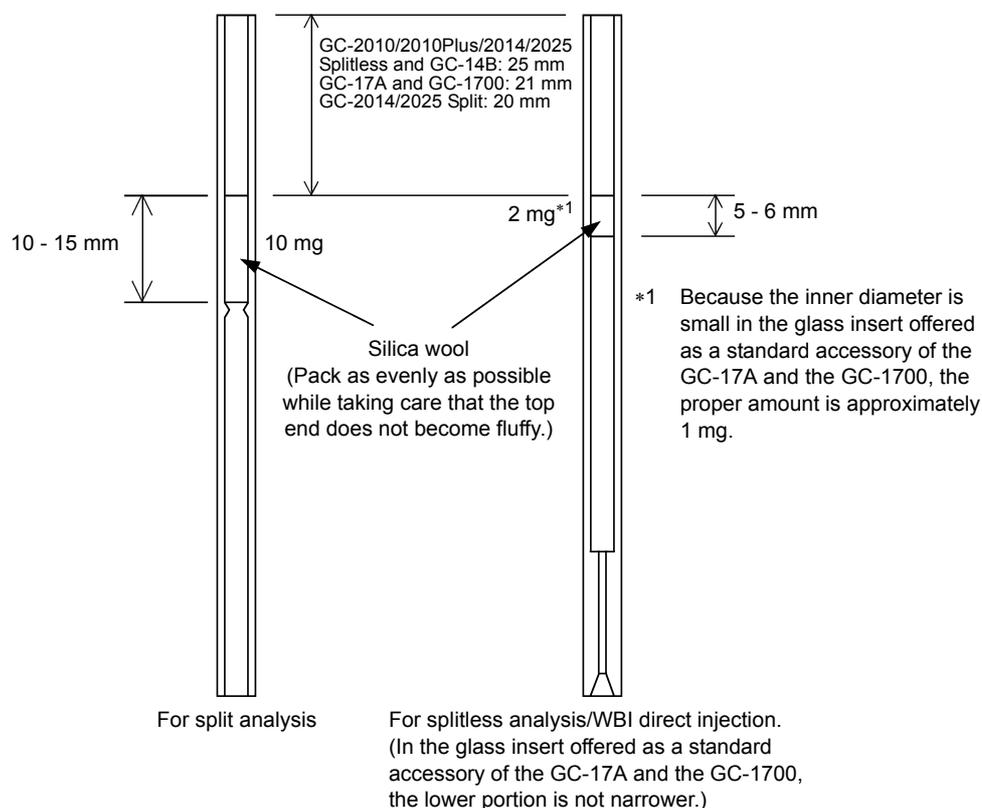


Figure 7-2

 **NOTE**

For splitless analysis in which the flow velocity inside the insert is slow, and WBI direct injection in which the inlet pressure is low, it may be better to pack the silica wool at a lower position. This is due to INJ port pressure fluctuations during vaporization and the distance from the silica wool to the insert top end. The optimal amount of silica wool and its position also vary depending on the type of solvent, the temperature in the injection port, and the volume of the sample.

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## 7.4 Precautions on Replacing the Septum

Replace the injection port septum after a fixed number of injections so that fragments of the septum do not clog the syringe. (It is recommended to replace the septum after every 100 injections.)

When replacing the septum, do not tighten the septum nut too tightly. Close the septum nut by hand until it stops, then return it by a half turn. If the septum nut is tightened too tightly, the injection port septum will be compressed more than necessary. As a result, fragments of the septum can easily become clogged in the syringe, and its durability will deteriorate.

For details on the septum replacement procedure, refer to the instruction manual of the gas chromatograph and the GC maintenance help.

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## 7.5 Other Precautions on Use

- (1) Check that no gas leak is detected in the column connection areas and the tubing connection areas.
- (2) In order to improve the reproducibility, it is advisable to replace the silicon septum used in solvent vials and waste liquid vials with PTFE sheeting. By doing so, the chances of fragments of the septum becoming clogged in the syringe are reduced.

For the same reason, it is also advisable to reduce the number of times for sample washing to 0 or 1 when analyzing multiple times using the same sample.

When using the GC-2010/2010Plus/2014/2025 (SPL), be sure to also observe the following precautions.

- (3) Be sure to attach the INJ/DET cover during analysis.
- (4) When attaching the column, be sure to use the small nut (column nut for injection port) on the INJ side.

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