

Gas Chromatograph

Nexis™ GC-2030

Instruction Manual

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

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Introduction

Read this Instruction Manual thoroughly before using the product.

Thank you for purchasing this product.

An information booklet and a Utility Package (DVD-ROM) are supplied with this product.

 Information booklet	GC-2030 Operation Guide (221-79201)	The descriptions about daily operations are excerpted from Instruction Manual and Maintenance Help. Store this booklet near the product, and use it for reference.
 Utility Package (DVD-ROM) (221-87450-41)	• Instruction Manual (this document) (English/Japanese/Chinese) • Operation Guide (English/Japanese/Chinese) • Maintenance Help (English/Japanese/Chinese) • Shimadzu GC Remote Display (English/Japanese/Chinese) ▶▶ Reference "Utility Package (DVD-ROM) Contents" P.xxv	• Instrument Configuration • Accessories List • Operation Procedures • Maintenance Procedures

▶▶ Reference For the usage of Utility Package, see ["How to Use the Utility Package \(DVD-ROM\)" P.xxiii.](#)

Keep this manual for future reference.

Only people who get training about gas chromatograph can use the product.

This manual describes how to use the product and accessories and peripherals associated with the product. Please read this manual carefully and use the product correctly following the instructions.

Important

- If the user or usage location changes, ensure that this manual is always kept together with the product.
- If this manual or a product warning label is lost or damaged, immediately contact your Shimadzu representative to request a replacement.
- To ensure safe operation, read "[Safety Instructions](#)" and "[Precautions on Handling Gases](#)" thoroughly before using the product.
- To ensure safe operation, contact your Shimadzu representative if product installation, adjustment, or repair is required. If relocation is required after installation, the user should not move the product. Ask your Shimadzu sales/service representative.

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- The GC-2030 firmware includes LZ4 Library.

LZ4 Library

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- The GC-2030 firmware includes QR-Code-generator.

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<https://www.nayuki.io/page/qr-code-generator-library>

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(30) - Alex Tatmanjants (targets using libc/posix)

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(31) - M. Warner Losh (targets using libc/posix)

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(34) - Jon Beniston (only lm32-* targets)

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(35) - ARM Ltd (arm and thumb variant targets only)

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(37) Texas Instruments Incorporated (tic6x-*, *-tirtos targets)

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(38) National Semiconductor (cr16-* and crx-* targets)

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- In this instruction manual, "AOC" refers to both the AOC-20 series and the AOC-30 series.

Indications Used in This Manual

Precaution symbols are indicated using the following conventions:

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

The following symbols are used in this manual:

Indication	Meaning
 Prohibition	Indicates an action that must not be performed.
 Instruction	Indicates an action that must be performed.
 Hint	Indicates information provided to improve product performance.
 Reference	Indicates the location of related reference information.
Text bracketed by []	On-screen items and screen names are bracketed by square brackets. Example: Click [OK].
Text enclosed by " "	Numbers, texts, keys to be entered are enclosed in double quotation marks. Example: Hold down "Ctrl" key and press "N" key.

How to Use the Utility Package (DVD-ROM)

The manuals for this product are provided on a Utility Package (DVD-ROM) in HTML and PDF format.

The Utility Package (DVD-ROM) also contains the following software.

- Shimadzu GC Remote Display
- Shimadzu GC Maintenance Help

To use the instruction manual in HTML format, Shimadzu GC Remote Display, and Shimadzu GC Maintenance Help, follow the steps below to install the software.

-  **NOTE**
- Log in to the PC as a user with administrator permissions before running the DVD-ROM.
 - System requirements to view Instruction Manual and Maintenance Help is shown below:
Microsoft Edge® (Chromium), Google Chrome™

1

Insert the DVD-ROM into your PC.

2

Double-click "Setup.exe".

If [User Account Control] screen is displayed, click [Yes].

3

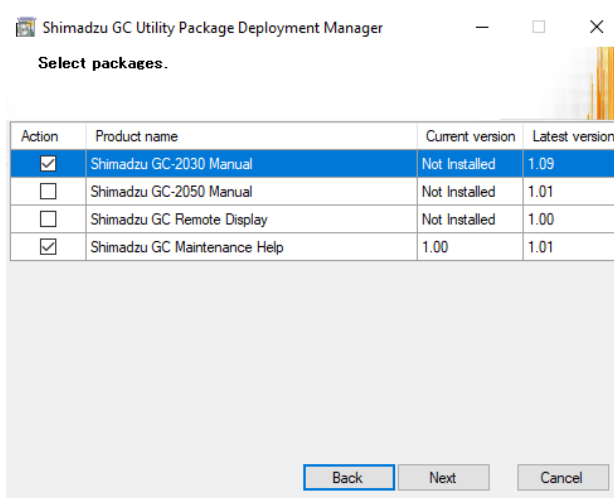
Click [Next].

4

Click [Install or upgrade].

5

Select the packages to be installed and click [Next].

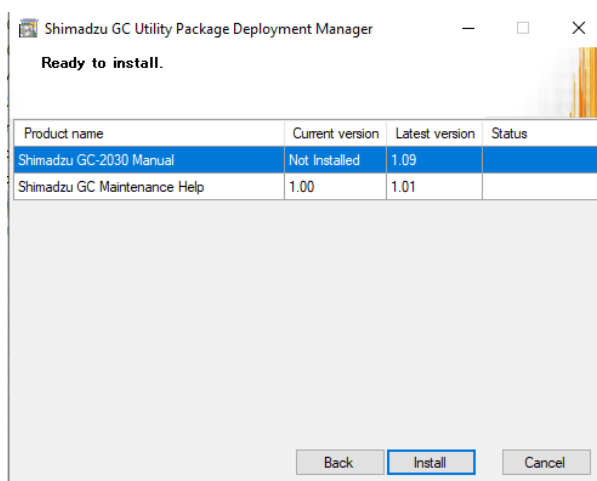
**NOTE**

- If the current version is the same as the latest version, the package will not be installed.
- Shimadzu GC Maintenance Help uses JavaScript to open and close menus.

6

Click [Install].

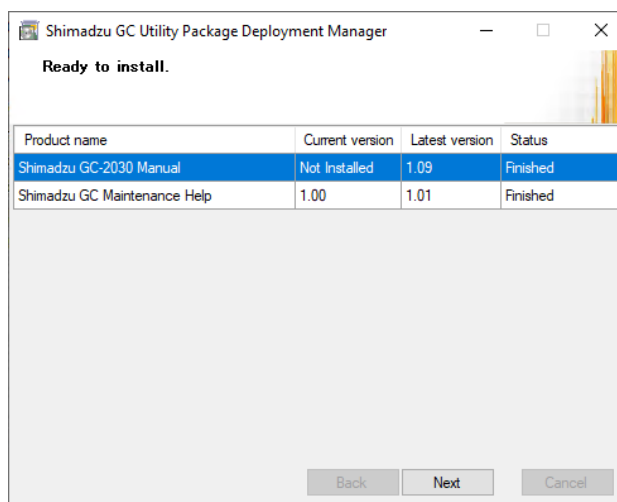
Installation starts.

**NOTE**

- If an older version is installed, it will be automatically uninstalled and the latest version will be installed.
- Clicking [Cancel] during installation will abort the installation after the installation of the currently installing package is completed. No further packages will be installed.

7

When the [Status] of all products to be installed changes to [Finished], click [Next].



8

Click [Complete].

An icon is created on the Desktop, and installation is completed. Each starts by double-clicking the icon.



Utility Package (DVD-ROM) Contents

The Utility Package (DVD-ROM) contains the following instruction manuals and software.

Document name	Document No.	Language	Description
GC-2050 Safety Guideline	221-87602	English/Japanese	This document describes the precautions for safe use of product.
GC-2050 Instruction Manual	221-87454*1	Japanese	This document includes information other than maintenance operation, such as overview and functions of the product. Read this Instruction Manual thoroughly before using the product.
	221-87455*1	English	
GC-2050 Operation Guide	221-87451*1	Japanese	This document describes daily operations of the product.
	221-87452*1	English	
GC-2030 Instruction Manual	221-79203*1	Japanese	This document includes information other than maintenance operation, such as overview and functions of the product. Read this Instruction Manual thoroughly before using the product.
	221-79204*1	English	
	221-79205*1	Chinese	

Document name	Document No.	Language	Description
GC-2030 Operation Guide	221-79200	Japanese	This document describes daily operations of the product.
	221-79201	English	
	221-79202	Chinese	
GC-2030 Maintenance Help	-	Japanese	This Help document describes maintenance operation of GC-2030.
	-	English	
	-	Chinese	
Gas Chromatograph Hydrogen Gas Safety	221-40701* ¹	Japanese	This document describes the precautions for use of hydrogen gas.
	221-40702* ¹	English	
Shimadzu GC Remote Display Instruction Manual	223-66311	Japanese	This document is the instruction manual for Shimadzu GC Remote Display.
	223-66312	English	
	223-66313	Chinese	
Shimadzu GC Remote Display Release Notes	223-66308	Japanese	This document is the release notes for Shimadzu GC Remote Display. This document describes the precautions for use and contains the version upgrade history.
	223-66309	English	
Shimadzu GC Remote Display Certificate of Compliance	223-66314	-	This document is the certificate of compliance for Shimadzu GC Remote Display.

*1 Paper based manuals are available at a fee.

Software name	Language	Description
GC-2050 Instruction Manual (HTML)	Japanese	This is the GC-2050 Instruction Manual in HTML format.
	English	
GC-2030 Instruction Manual (HTML)	Japanese	This is the GC-2030 Instruction Manual in HTML format.
	English	
	Chinese	
Shimadzu GC Remote Display	Japanese	This software enables the display and operation of GC windows that support a remote connection from a Windows terminal via an Ethernet connection or USB connection.
	English	
	Chinese	
Shimadzu GC Maintenance Help	Japanese	This is the help that describes maintenance tasks for GC. Use during instrument maintenance.
	English	
	Chinese	

Safety Instructions

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

The gas cylinders used with this product must conform to the "High Pressure Gas Safety Law". Be sure that the "High Pressure Gas Safety Law" and "Security Regulations for General High-Pressure Gas" are strictly observed. Additionally, be sure that regulations in the "Road Law", "Act on Port Regulations", "Aviation Law", "Ship Safety Law" and "Fire Services Act" as well as SDS (Safety Data Sheet) published by the gas manufacturer are also strictly observed.

■ Product Applications

WARNING



Instruction

Safety regulations and standards.

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



Prohibition

Do NOT use the product for other than intended use.

The product is a device to perform qualitative/quantitative analysis. If you use the product for other than intended use, that may cause accidents.

■ Installation Site

WARNING



Prohibition

Do NOT install the product in an atmosphere with flammable or explosive gases.

May cause fire or explosion.



Prohibition

Do NOT install the product in the vicinity of combustibles.

The product exhausts hot air from the openings. If hot air blows directly on combustibles and burn them, that may cause burn and fire.



Instruction

Install the product in a well-ventilated area.

Poor ventilation may cause oxygen deficiency depending on the kind of gases.

CAUTION



Instruction

Avoid exposure to gases which include corrosive gas/organic solvent/halogen compound/siloxane, oil mist, or excessive dust/dirt.

May cause poor performance or shorten the life.

! CAUTION



Prohibition

Do NOT use the product in the presence of strong electromagnetic waves. Do NOT use power sources with strong noise.

May cause malfunctions. You may not be able to obtain data as the specification.



Instruction

Install the product on a flat and stable table or base with the depth of more than 1040 mm which can carry the total weight of the system.

The weight of the main body of the system is 43.5 kg (for SPL/FID model). If the conditions are not satisfied, that may cause accident due to toppling over or drop.

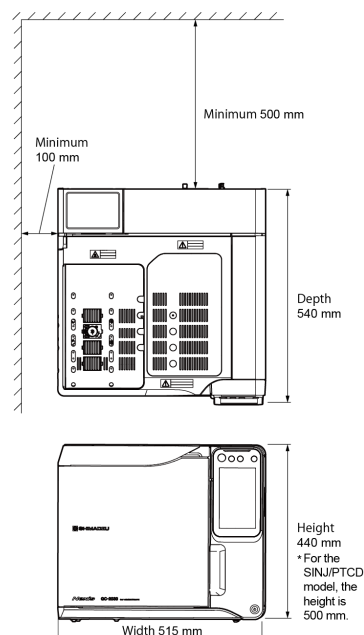


Instruction

Keep the rear of the product more than 500 mm away from the wall.

Hot air is discharged from the vent on the rear of the product while cooling the column oven. Comply with the following conditions for installation.

- Do NOT put combustibles near the rear of the product.
- Keep the rear of the product more than 500 mm away from the wall.
The distance from the wall should be more than 250 mm when optional exhaust duct (P/N: S221-80955-41) is installed.
- Leave a space for maintenance and inspection of the rear.



Instruction

Keep the left side of the product more than 100 mm away from the wall.

The slit on the left side is important to cool the outer wall of the column oven. The vent on the side is required to improve the efficiency of cooling of the column oven.



Instruction

For optimal performance, comply with the following instructions during installation:

- Keep room temperature at 5 to 40 °C with small fluctuation
- Keep humidity from 5 to 90 % (no condensation)
- Prevent the air conditioner from blowing directly on the instrument
- Avoid direct sunlight
- Avoid strong vibration
- Avoid condensation
- Comply with standards for installation environment (IEC)
(category II, pollution degree 2, altitude below 2000 m, indoor)
- Keep the rear of the product more than 500 mm away from the wall to leave a space for maintenance and inspection
- Leave a space of more than 100 mm on both sides of the instrument

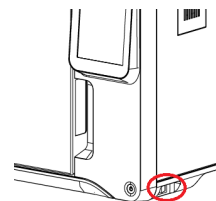
! CAUTION



Instruction

Install the instrument so that you can easily press the power button.

You need to turn OFF the main power of the instrument in an emergency.



■ Installation

To ensure safe operation, contact your Shimadzu representative if product installation or adjustment is required.

If relocation is required after installation, the user should not move the product. Ask your Shimadzu sales/service representative.

! WARNING



Prohibition

Do NOT share circuit breaker and wall outlet with other devices such as data processing device.

Current more than the rated value may cause fire.



Prohibition

Do NOT put heavy objects on the power cable. Do NOT put the cable in the vicinity of heating devices.

Do NOT modify, bend, or pull the power cable.

Do NOT fix the power cable with nails or stapler.

Failure to observe these can cause fire, electric shock, and malfunction.

If the power cable is damaged, contact your Shimadzu sales/service representative.



Instruction

Use a wall outlet which satisfies the following conditions only for GC-2030.

- Rated current

Power voltage	Standard model with FID	The maximum value for models with peripherals
100 V AC	18 A	26 A
115 V AC	15.7 A	22.6 A
230 V AC	11.3 A	14.8 A

- Independent earth leakage breaker
- Three-prong grounded-type



NOTE Earth leakage breaker automatically shuts off the power upon detecting of current leakage from circuits and devices to prevent electric shock and fire.

! WARNING



Instruction

Connect the power cord to the power supply equipped with a circuit breaker at an easily accessible position. In addition, explicitly indicate that the circuit breaker is dedicated to the product.

The circuit breaker must be used to shut off the power supply in case of emergency.



Instruction

Comply with the rated current of the outlet.

Failure to observe this can cause fire, electric shock, and malfunction.



Instruction

Connect the power supply complying with the power-supply voltage shown on the label on the rear of the product.

Otherwise, fire or electric shock could result. Check that the power supply voltage is stable and that its current capacity is sufficient to operate all the components of the system. If not, the instrument will not operate at its rated performance.

Power Supply Voltage* ¹ (indicated on the instrument)	Power Consumption	Frequency	Rated Breaking Capacity* ²
100 V AC (100 V~)	1800 VA	50 Hz/60 Hz	80 A
115 V AC (115 V~)	1800 VA	50 Hz/60 Hz	80 A
230 V AC (230 V~)	2600 VA	50 Hz/60 Hz	50 A

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

*2 Connect the instrument to a power outlet that is equipped with a circuit breaker that shuts off the current at the described value or less.



Instruction

Fix or bundle the metal gas lines to prevent them from getting near the wall outlet, the power cable, and the power plug.

If metal gas lines come into contact with power sources, explosion or burn due to heating may occur.



Instruction

Take measures to prevent the instrument from falling over during an earthquake.

Earthquake may cause falling over or drop of the instrument resulting in injuries.



Instruction

Ground the instrument.

Failure to observe this may cause electric shock when malfunction or current leakage occurs. Grounding is important to ensure stable operation.



Instruction

Insert the power cable into a wall outlet which you can reach easily.

You need to disconnect the power cable from the wall outlet in an emergency.

! CAUTION

Prohibition

Do NOT put other devices or objects on the product. Or do NOT put the product on other devices.

That may cause accident due to toppling over or drop.



Instruction

Ventilate your room adequately after installation.

The instrument may emit a smell when the oven is heated to a high temperature. This smell is caused by paste inside insulation of the oven (material: corn starch etc.) and it will disappear after a few hours.



Instruction

Ground the PC, peripheral devices, and the optional units with equal potential grounds.

Otherwise, communication between units may be interrupted and system failure may occur.

■ Operation**! WARNING**

Prohibition

Do NOT put combustibles near the openings or the rear.

Hot air is exhausted from the openings and the rear. If hot air blows directly on combustibles, that may cause ignition and fire.



Prohibition

Do NOT place combustibles inside the oven.

Before closing the oven door, check that there are no combustibles inside. Flammable materials such as paper wipes may cause ignition.



Prohibition

Do NOT disconnect the power cable while the main power switch is turned on.

A spark due to discharge occurs and may cause fire (for example, organic solvents may catch fire).



Instruction

When using flammable solvent or sample (such as carbon disulfide), seal the vial (including bottles for solvent and waste fluid) with septum cap and secure it tightly.

If vapors of solvent or sample fill inside the room, fire may occur because the vapors catch fire.



NOTE Make sure to use sample cooling fan (P/N: S221-44995-91) especially when using very flammable solvent such as carbon disulfide for AOC-20. It is also recommended to use sample cooling fan when using the other flammable solvent or sample.



Instruction

Use waste fluid vial within the allowable capacity so that fluid does not overflow.

If fluid overflows or vapors of solvent or sample fill inside the room, they may catch fire from the heat at inlet, which results in fire.



Instruction

Be careful of hot air exhausted from the openings and the rear.

Hot air is exhausted from the openings and the rear. Hot air may cause burn and fire.

⚠ CAUTION

Prohibition

Do NOT use mobile phone near the detector (especially TCD, PTCd and FTD).
May cause malfunctions. You may not be able to obtain data as the specification.



Instruction

Use specified gases.
If not, that may cause malfunction and accident.



Instruction

Make sure to attach the inlet cover when manually injecting the sample in the injection port.



Instruction

If liquid such as water and organic solvent spills on the product, wipe it immediately.
May cause malfunction.



Instruction

When using OA equipment including PC with this product, caution must be exercised not to spill liquid.
Failure to observe this can cause fire and electric shock.



Instruction

Follow the instructions below during operation of the power cable and plug.

- Do NOT connect/disconnect the power plug with wet hands.
- Grasp the power cord by the plug and connect/disconnect it in a straight line.
- Ensure that the power plug is inserted completely.
- Do NOT use the power plug when the connection of the plug and the outlet is too loose or the plug is not fixed securely.
- Do NOT use the power cable in a bundle.
- Do NOT use an extension cord or a outlet strip.
- Do NOT extend the power cable.



Instruction

Clean dust on the power plug with a dry cloth.
Do it every 6 months. It prevents fire due to tracking phenomena.
If the power plug is kept inserted into the wall outlet for a long time, the connection of the plug and the wall outlet becomes covered with dust. When the dust takes on moisture, sparking occurs repeatedly between pins of the plug. The heat caused by sparking is applied on the insulation in contact with the wall outlet, which results in degradation of the insulation. Thus, current comes to pass between pins of the plug, then cause ignition.

■ Repair, Disassembly and Modification

CAUTION



Prohibition

Do NOT modify/disassemble the product without permission.

Accident due to electric shock or short may occur. It may also cause malfunction or injury.



Instruction

Ask your Shimadzu sales/service representative for repair.

Repair by yourself may cause fire, electric shock, or injury.

■ Inspection and Maintenance

WARNING



Prohibition

During cleaning of the instrument exterior, do NOT keep the instrument wet and do NOT wipe the instrument with a cloth dampened with alcohol or thinner or the similar solvent.

May cause poor performance or shorten the life.

Clean the exterior of the instrument with a soft cloth dampened with a small amount of water or mild detergent and wipe it dry with a dry cloth.



Instruction

Ensure that the column oven temperature drops below 40 °C on [Temp Monitor] screen.

Ensure that the temperatures of the injection port and the detector drop below 50 °C on [Temp Monitor] screen.

- Temperatures of parts may be high immediately after the GC stops. Operate them after temperatures of parts drops to a temperature where you can perform maintenance.
- Operation at a high temperature may cause burns. Tightening the nut or ClickTek connector (optional) at a high temperature may cause the seizing (galling) of the sliding part.

▶▶ Reference ["7.2.3 \[Temp Monitor\] Screen" P.163](#)



Instruction

For parts replacement, use items listed in ["2.1 Standard Accessories" P.3](#), ["Gas Chromatograph Accessories and Supplies"](#), and ["Maintenance Help"](#).

When you use items not on the lists, the part may be damaged and may not operate properly. It may also cause malfunction or injury.

! WARNING

Instruction

Check the operation of earth leakage breaker periodically.

Malfunction of the earth leakage breaker increases the risk of electric shock and fire.

Inspection procedure

1. Ensure that the main power of the instrument is turned off.
2. Disconnect the power plug from the wall outlet.
3. Press test button of earth leakage breaker.
4. Ensure that the breaker trips off and shut off the current.
5. Reset the breaker.
6. Insert the power plug into the wall outlet.

**NOTE**

- Appropriate power source is required for correct operation and precise temperature control. If either of the voltage and current value of the power source is not appropriate, a problem may occur during basic operation, for example, the rate of temperature rise of column oven may not satisfy specifications.
- The instrument has several large-capacity heaters to control temperatures of column oven, injection port, and detector during analysis.

! CAUTION

Instruction

Wear safety glasses during maintenance and inspection.

The sample may squirt and be got in your eyes causing damage of your eyes.



Instruction

Before use of the instrument, periodically check that insulation on the inner wall of column oven door does not become deformed.

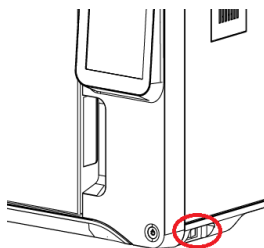
If insulation becomes deformed, heat in column oven is lost from the gap and you may not be able to obtain data as the specification. When insulation becomes deformed, stop using the instrument immediately and contact your Shimadzu sales/service representative.

■ In an Emergency

If you find any abnormality such as unusual noise or smell, stop the instrument urgently. Inspect the instrument before reboot after emergency stop, and contact your Shimadzu sales/service representative as needed.

Emergency stop

- 1 Turn off the main power of the instrument.



- 2 Turn off all of the associated devices.
- 3 Shut off the main valve of the cylinder of carrier gas, hydrogen, air, makeup gas, and oxygen.
- 4 Disconnect the power plug from the wall outlet, and shut off the power supply.
 - If BID detector is installed, unplug the power cable of "Helium Purifier Assy" attached to the rear of the instrument.
 - If SCD detector is installed, unplug the power cable of the SCD detector.
 - If the power cable is secured on the power switchboard by screws, turn off the power switchboard.
- 5 Open doors and windows of the room where the instrument is installed for ventilation.

■ During a Power Outage

Operate the instrument according to the following procedure.

- 1 Shut off the hydrogen gas and oxygen supply immediately.
- 2 Turn off the main power of the instrument.
- 3 Turn off all of the associated devices.
- 4 Open doors and windows of the room where the instrument is installed for ventilation.
- 5 After recovery, see ["Installation" P.xxix](#) and ["Operation" P.xxxi](#) and start up the instrument in the usual way.

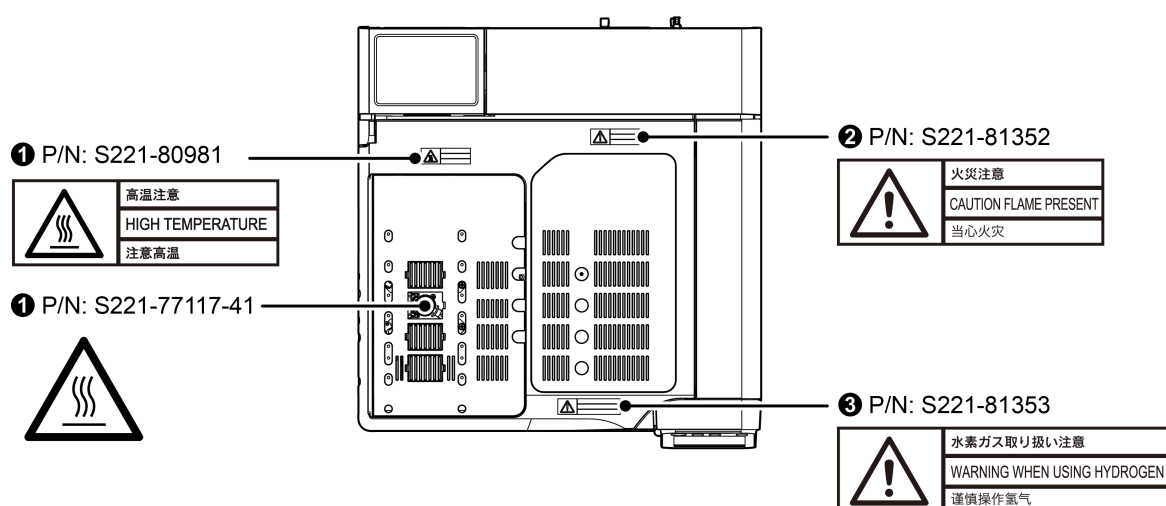
▼ **NOTE** In the case of power failure, gas supply automatically stops.
We provide Protection Kit Against Power Failure (P/N: S221-81005-41)
to prevent degradation due to carrier gas stop during power failure.
Use it as needed.

Warning Labels and Residual Risk Information

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

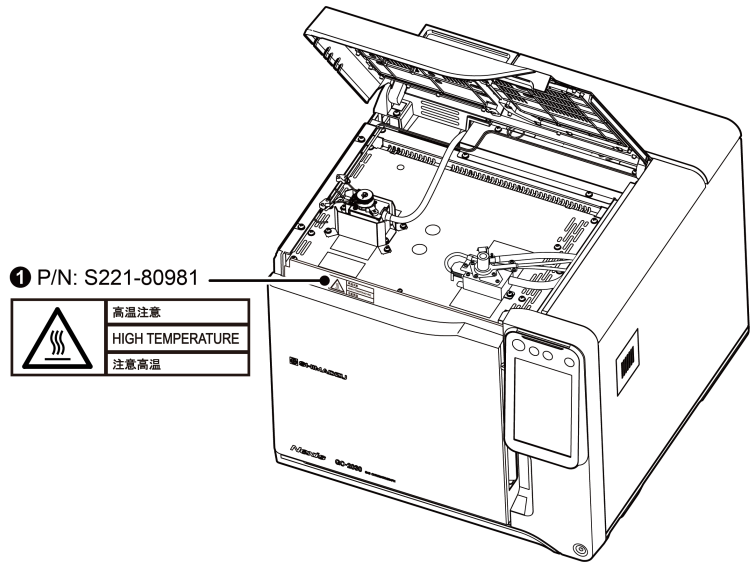
A residual risk indicates a risk that could not be reduced or eliminated in the process of design and manufacture. Read and understand "Description" before use.

■ Top Face



No.	Description
1	HIGH TEMPERATURE Do NOT touch injection port, detector and INJ/DET cover during analysis. May cause burn. Make sure to attach the inlet cover when manually injecting the sample in the injection port.
2	CAUTION FLAME PRESENT Do NOT put objects on INJ/DET cover. May cause fire.
3	WARNING WHEN USING HYDROGEN Close all unused valves for hydrogen pressure control and seal the column fittings. If hydrogen fills the oven, it may cause explosion.

■ Inside of the Instrument



No.	Description
1	HIGH TEMPERATURE Do NOT touch injection port, detector and INJ/DET cover during analysis. May cause burn. Make sure to attach the inlet cover when manually injecting the sample in the injection port.

■ Rear

❶ P/N: S221-81354-01

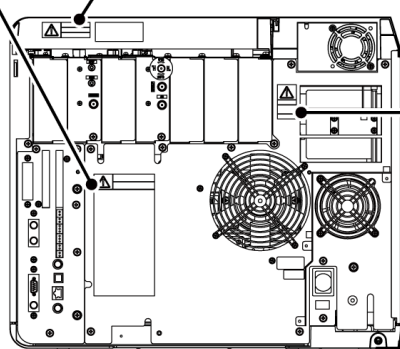
	水素ガス使用上の注意
	WARNINGS IN USING HYDROGEN
	谨慎使用氢气
水素ガスが大量に漏れた場合、爆発する可能性があります。 ・配管を間違わないようにして接続してください。 ・使用しない時はガスの元栓を閉めてください。 ・使用の都度、ガス漏れがないことを点検してください。 ・換気を十分に行い、不必要に火気を使用しないでください。 ・異常を感じた場合、装置の電源を落として、ガスの元栓を閉めてください。	
When hydrogen gas is in use, care should be exercised in order to prevent accident. ・ Connect gas lines correctly. ・ When the device is not in use, the main valve of the hydrogen gas cylinder or generator must be closed. ・ The flow line for hydrogen gas should be checked for leakage whenever it is used. ・ The room in which the device is used should be well ventilated. Do not use any spark producing instrument, except for analysis, near the device. ・ If there is any abnormality, turn off the device and close the main valve of the hydrogen gas cylinder or generator.	
氢气大量泄漏时，可能引发爆炸。 ・ 请正确连接氢气管路。 ・ 不使用仪器时，请关闭氢气瓶总阀门。 ・ 每次使用仪器前，请确认氢气是否泄漏。 ・ 保持实验室通风，禁止使用与分析操作无关的明火。 ・ 发现仪器有异常时，请立即关闭仪器电源，并关闭氢气瓶总阀门。	

❷ P/N: S221-81357

	誤配管注意
	ENSURE LEAK FREE CONNECTION
	请确认气路无泄漏

❸ P/N: S221-80982

	熱風注意
	HOT AIR EXHAUST
	当心热气



No.	Description
❶	WARNINGS IN USING HYDROGEN When hydrogen gas is in use, care should be exercised in order to prevent accident. • Connect gas lines correctly. • When the device is not in use, the main valve of the hydrogen gas cylinder or generator must be closed. • The flow line for hydrogen gas should be checked for leakage whenever it is used. • The room in which the device is used should be well ventilated. Do not use any spark producing instrument, except for analysis, near the device. • If there is any abnormality, turn off the device and close the main valve of the hydrogen gas cylinder or generator.
❷	ENSURE LEAK FREE CONNECTION Install the piping correctly. Wrong tubing may cause release of large amount of gases. We designed the joint of air inlet to be right-handed screw and the joint of hydrogen inlet to be left-handed screw to prevent incorrect piping.
❸	HOT AIR EXHAUST Hot air is exhausted from the openings and the rear. Hot air may cause burn and fire. If hot air blows directly on combustibles, that may cause ignition and fire.

■ Auto Injector

There is a risk of puncturing your finger with the syringe needle.

- When replacing the syringe, use caution to avoid the needle tip.
- Do not open the door while the auto injector is in operation.

Precautions on Handling Gases

The gas cylinders used with this product must conform to the "High Pressure Gas Safety Law". Be sure that the "High Pressure Gas Safety Law" and "Security Regulations for General High-Pressure Gas" are strictly observed. Additionally, be sure that regulations in the "Road Law", "Act on Port Regulations", "Aviation Law", "Ship Safety Law" and "Fire Services Act" as well as SDS (Safety Data Sheet) published by the gas manufacturer are also strictly observed.

▶▶ **Reference** For kind, purity, and supply pressure of gases used for the product, see "[8.3.1 Gas Type and Purity](#)" P.399.

■ High Pressure Gas Cylinder Precautions

WARNING



Instruction

General precautions are provided below.

Consult state and local regulations for specific precautions.

- Keep gas cylinders away from the lab, preferably outdoors, but not exposed to direct sunlight. The area must be well-ventilated. Use tubing to bring the gases to the lab.
- Flammable items must be kept at least 2 m from a gas cylinder. Secure gas cylinders with rope etc. to avoid toppling over and drop.
- The temperature of gas cylinders must not exceed 40 °C.
- When using high pressure gases, pay strict attention to ventilation, and perform daily leak checks.
- Check for gas leakage with soapy water etc. during starting inspection.
- When using flammable gases (such as hydrogen), never smoke or allow open flame within 5 m of the equipment.
- Fire extinguishers must be present.
- Use an oil-free pressure reducing valve.
- If the inside of the valve, for example the pipe which comes in contact with high pressure gases, is coated by oil, do NOT use the valve.
- When finished with the gas, tighten the main valve of the cylinder immediately.

■ Precautions on Handling Hydrogen Gas

Read a separate volume, "Gas Chromatograph Hydrogen Gas Safety" and follow the instructions to handle hydrogen correctly.

NOTE We provide a plate for caution on handling hydrogen gas (Part No.: S221-44025-02) without charge.

WARNING



Instruction

Close all unused valves for hydrogen pressure control and seal the column fittings.

If hydrogen fills the oven, it may cause explosion.



Instruction

Make sure that the supply pressure to the flow controller does not exceed 300 kPa.

If the flow controller fails with a hydrogen gas supply pressure over 300 kPa, a dangerous situation exists. Large amounts of leaking hydrogen could cause the FID flame to expand out of the detector.

Set supply pressure to APC at 300 kPa when the H₂ flow is set at the initial value (32.0 mL/min). It is enough for operation.



Instruction

Pay strict attention to ventilation so that leaking hydrogen is vented out of the room and cannot accumulate.

Hydrogen gas is lighter than air. If it leaks, it can accumulate near the ceiling.

■ Hydrogen Carrier Gas Precautions

WARNING



Instruction

Install pipings so that the gas exhausted from split vent and purge vent are discharged to open air or a ventilation equipment (such as the draft chamber).

If much hydrogen gas is released into the poorly ventilated room, it may cause the explosion.



Instruction

Install the instrument in the well ventilated area. (Ex. in the draft chamber).

If much hydrogen gas is released into the poorly ventilated room, it may cause the explosion.



Instruction

In order to measure hydrogen gas concentration, equip a hydrogen gas sensor in the room. Keep the hydrogen concentration low.

If much hydrogen gas is released into the poorly ventilated room, it may cause the explosion.



Instruction

Ensure that the column is connected correctly.

If the column is not connected correctly, especially when the carrier gas flow is set at a high value, the oven may be filled with hydrogen gas and it may explode.

■ Caution in Gas Plumbing

WARNING



Instruction

Set the gas inlet pressure below the maximum pressure shown in the instruction manual.

If pressure above its specifications is applied, the pressure regulator valve may be damaged and it may result in gas leakage.

▶▶ Reference ["8.3.2 Gas Supply Pressure" P.402](#)



Instruction

When the product shares gas supplies with other devices, check all specifications.

Pressure above the specifications may damage the devices. Set supply pressure so that it satisfies specifications for all the devices.

Precautions on Using CRG

CRG uses liquefied CO₂ or pressurized liquid N₂ as coolant. Prepare siphon type cylinder when using liquid CO₂. When using liquid N, prepare the gas in a low-temperature liquefied gas container regulated to 50 to 200 kPa.

Care should be taken when handling the coolant.

Be sure to follow the instructions below.

■ Operation

WARNING



Instruction

Ventilate the room adequately.

The device releases large amount of CO₂ or N₂. Oxygen deficiency may occur in a closed room.



Instruction

Wear safety glasses and leather gloves when handling coolant.

Contact with skin or eye can result in frostbite or blindness. Extreme caution should be paid when handling coolant cylinder.



Prohibition

Do NOT breathe blowing gases.

May cause burn. Extreme caution should be paid when replacing column and handling coolant cylinder.

CAUTION



Instruction

Set [Valve] to [Off] on [CRG] screen and ensure that the column temperature reaches near room temperature before opening the column oven door.

If the valve is not turned off, gases are released, which may cause oxygen deficiency.

▶▶ Reference "7.7.1 [CRG] Screen" P.296



Instruction

Ensure that wiring of electrical devices are not located around you before you take out coolant from the cylinder.

If frost forms on the upper part of the cylinder and wiring, the frost may melt and drip.



Instruction

After analysis, turn off the GC and shut off the main valve of the cylinder.

In case of gas leakage, oxygen deficiency may occur.



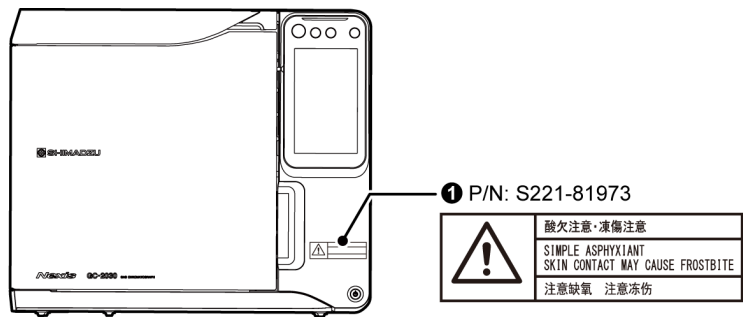
Instruction

Fix the liquid N₂ container and liquid CO₂ cylinder to a desk or wall before use.

- ▼ **NOTE**
- When you perform low-temperature analysis on highly humid day, condensation may occur on the instrument surface or inside the column oven. In this case, set the column oven temperature at about 200 °C and dry out the instrument.
▶▶ Reference "Drying out of the instrument" P.398
When the humidity is too high in the atmosphere, adjust the humidity using air conditioner etc.
 - When moving a liquid N₂ container or a liquid CO₂ cylinder, be careful not to get your feet caught by the container or cylinder.

■ **Warning Label**

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



No.	Description
①	SIMPLE ASPHYXIAANT SKIN CONTACT MAY CAUSE FROSTBITE • Provide sufficient room ventilation. Insufficient room ventilation may cause oxygen deficiency resulting in anoxia (oxygen deficiency). • Wear eye protection and insulated gloves when handling coolant. Direct contact with coolant may cause frostbite. • When setting the oven temperature to -50 °C or lower, maintain a room temperature of at least 10 °C.

Precautions for Use of Electron Capture Detector (ECD)

Important: Legal regulations

- Since a radioisotope is used as the radiation source, check the laws and regulations before installation.
- ECD-2010 Exceed is classified as B646666 / IEC 60405 and ISO/12/C32211 of ISO 2919.
- ECD-2010 Exceed must be checked for radiation leakage periodically depending on your local regulation.

■ Corrosive Gas and Dust

The vital section of the measuring circuit of this detector is shielded in a case. In view of maintaining the service life and accuracy of the detector, avoid installing in a dusty or corrosive environment.

■ Discharge of Carrier Gas

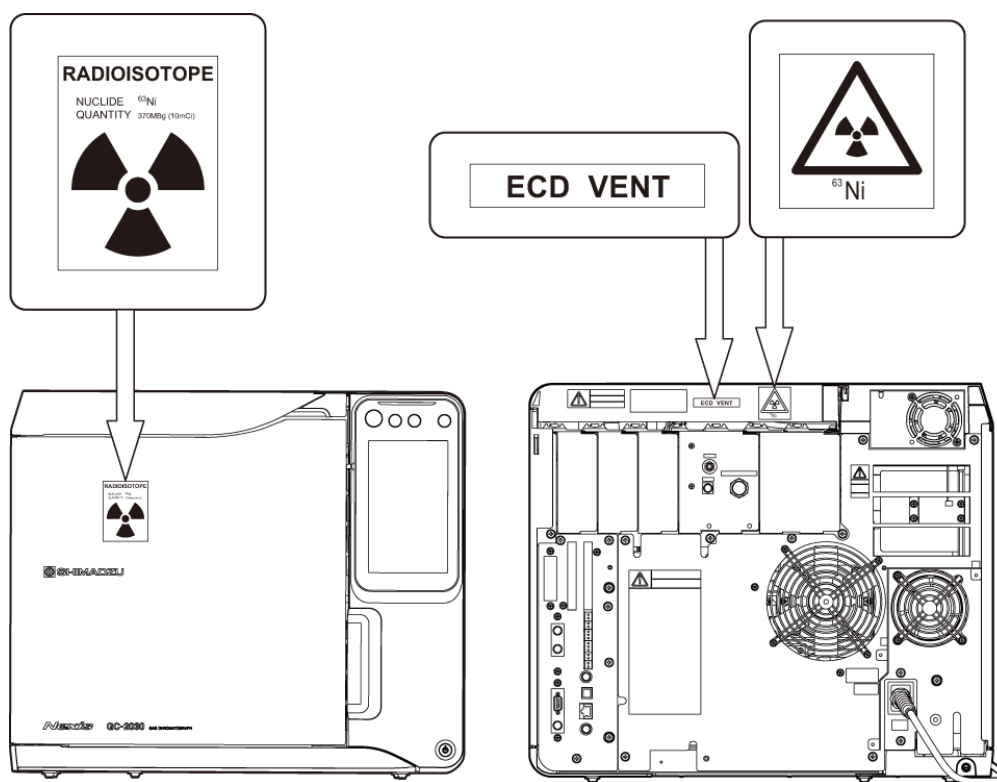
Connect a vinyl or PTFE tube to the exhaust port (VENT) when using the detector, and set the other end of the tube on the roof of the building or other place where no person is likely to come within 1 m from the tube end.

■ Precautions on Unit Removal

Do NOT remove or disassemble the ECD (detector). When it is necessary to remove the ECD, contact your Shimadzu representative.

■ Application Name Plates

Stick the name plates at the position shown below:



■ Actions to Be Taken in Case There Is the Doubt of Break

If there is a doubt of break of the ECD, the measurement with the survey meter must be carried out. If there is any abnormality such as the disuse of the ECD etc.

■ Cautions at Disposal

When disusing the used ECD etc., you must take legal administrative procedures at the same time. Also, in the case of disposing the gas chromatograph equipped with the ECD, be sure to remove the ECD and take the measures mentioned above.

When removing the ECD from the gas chromatograph, contact your Shimadzu representative.

Keep the original packing container for future transportation of the ECD unit.

NOTE When removing the ECD unit, plug the hole with the heat insulating material which was cut off at installation.

Precautions for Use of Sulfur Chemiluminescence Detector (SCD)

When using SCD, be sure to follow the instructions below.

■ Installation Site

! CAUTION



Instruction

Install the product on a flat and stable table or base with the depth of more than 1040 mm which can carry the total weight of the system.

The total weight of GC-2030 and SCD-2030 is about 70.5 kg. If the conditions are not satisfied, that may cause accident due to toppling over or drop.



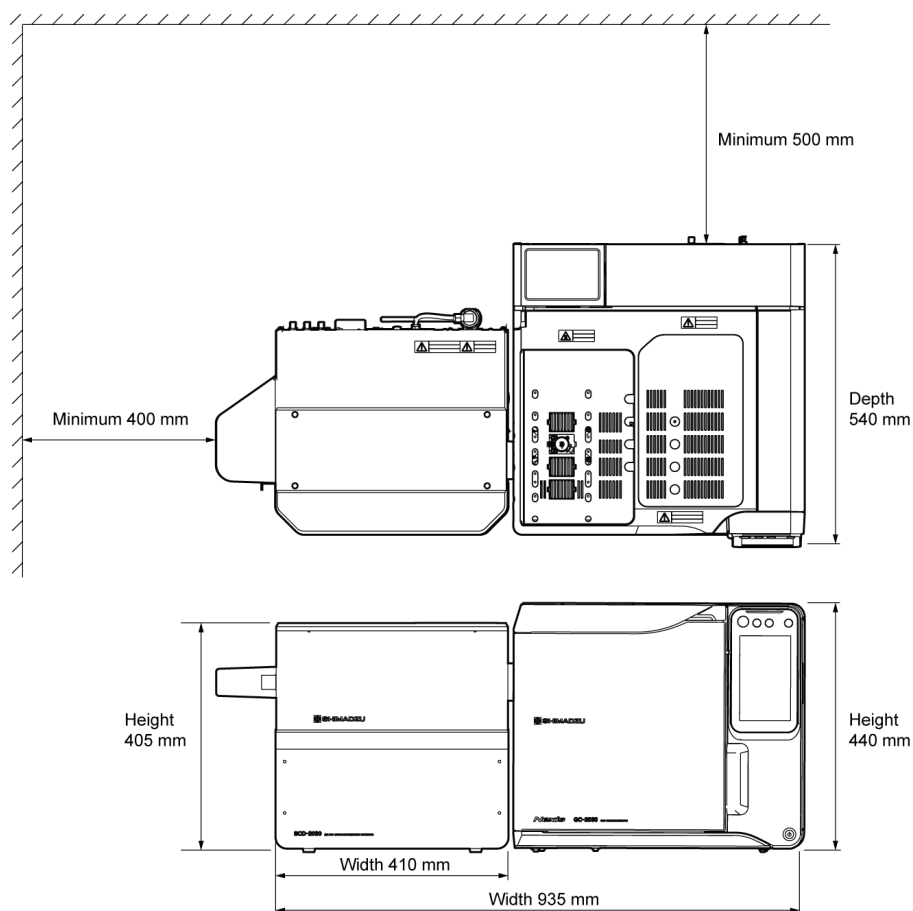
Instruction

Keep the rear of the product more than 500 mm away from the wall.

Keep the left side of the product more than 400 mm away from the wall.

Hot air is discharged from the vent on the rear of the product while cooling the column oven. Comply with the following conditions for installation.

- Do NOT put combustibles near the rear of the product.
- Keep the rear of the product more than 500 mm away from the wall.
The distance from the wall should be more than 250 mm when optional exhaust duct (P/N: S221-80955-41) is installed.
- Leave a space for maintenance and inspection of the rear.



! CAUTION

Instruction

Discharge the gas from the vacuum pump to the outdoor where no flame nor entry is permitted.

Exhaust from the vacuum pump includes flammable hydrogen and toxic nitrogen compounds. If it is not properly discharged to the outdoor, a fire or adverse effect on humans may occur.

■ Installation

! WARNING

Instruction

Use a wall outlet which satisfies the following conditions only for GC-2030. When using SCD-2030, be sure to ground it and GC-2030 with equal potential grounds and use the same power supply with GC-2030 if you can.

- Rated current for GC-2030

Power voltage	Standard model with FID	The maximum value for models with peripherals
100 V AC	18 A	26 A
115 V AC	15.7 A	22.6 A
230 V AC	11.3 A	14.8 A

- Rated current for SCD-2030

Power voltage	Rated current
100 V AC to 120 V AC	5 A
220 V AC to 240 V AC	2.3 A

- Independent earth leakage breaker (For SCD-2030, you can share it with GC-2030.)
- Three-prong grounded-type



NOTE Earth leakage breaker automatically shuts off the power upon detecting of current leakage from circuits and devices to prevent electric shock and fire.

! WARNING

Instruction

Connect the power supply complying with the power-supply voltage shown on the label on the rear of the product.

Otherwise, fire or electric shock could result. Check that the power supply voltage is stable and that its current capacity is sufficient to operate all the components of the system. If not, the instrument will not operate at its rated performance.

Instrument Type	Power Supply Voltage ^{*1} (indicated on the instrument)	Power Consumption	Frequency	Rated Breaking Capacity ^{*2}
GC-2030 main unit	100 V AC (100 V~)	1800 VA	50 Hz/60 Hz	80 A
	115 V AC (115 V~)	1800 VA	50 Hz/60 Hz	80 A
	230 V AC (230 V~)	2600 VA	50 Hz/60 Hz	50 A
SCD-2030	100 V AC to 120 V AC	500 VA	50 Hz/60 Hz	50 A
	220 V AC to 240 V AC	500 VA	50 Hz/60 Hz	50 A

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

*2 Connect the instrument to a power outlet that is equipped with a circuit breaker that shuts off the current at the described value or less.

■ Inspection and Maintenance**! CAUTION**

Prohibition

Do NOT remove the covers except the side cover.

May cause electric shock, burn, and injury.

For maintenance and replacement other than the inner pyrotube and outer pyrotube in the side cover, contact your Shimadzu sales/service representative.

■ Ozone Generator and Toxicity of Ozone

Ozone is toxic for human bodies, therefore, the ozone scrubber decomposes and then discharges it.

When the filling materials in the ozone scrubber become degraded, exhaust from the vacuum pump may include ozone. For safety, replace the ozone scrubber periodically. We recommend to replace the ozone scrubber once a year.

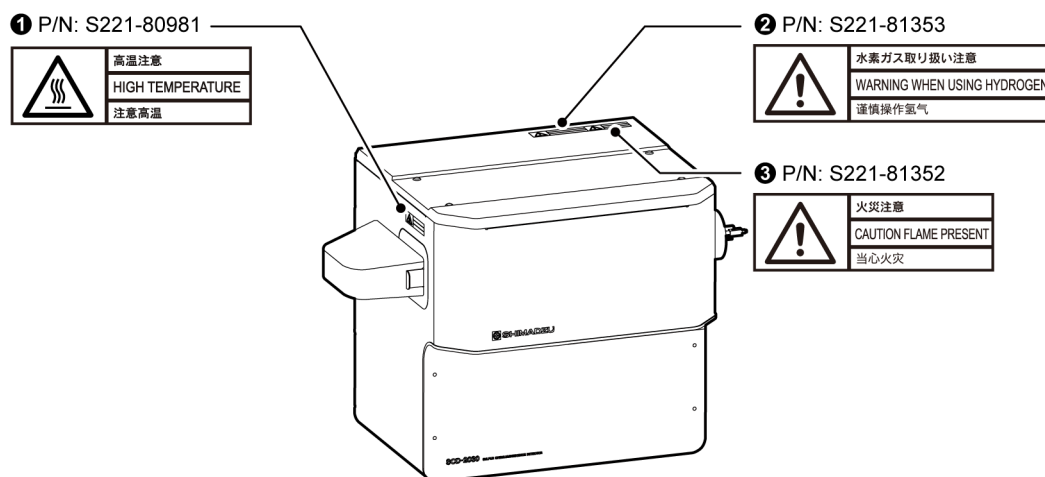
▶▶ Reference "4.2 Recommended Inspection Cycle" P.44

■ Warning Labels and Residual Risk Information

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

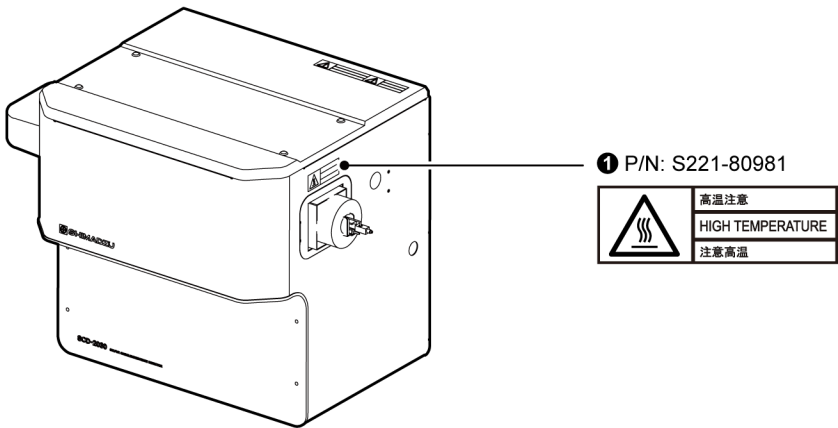
A residual risk indicates a risk that could not be reduced or eliminated in the process of design and manufacture. Read and understand "Description" before use.

Left Side / Top Face



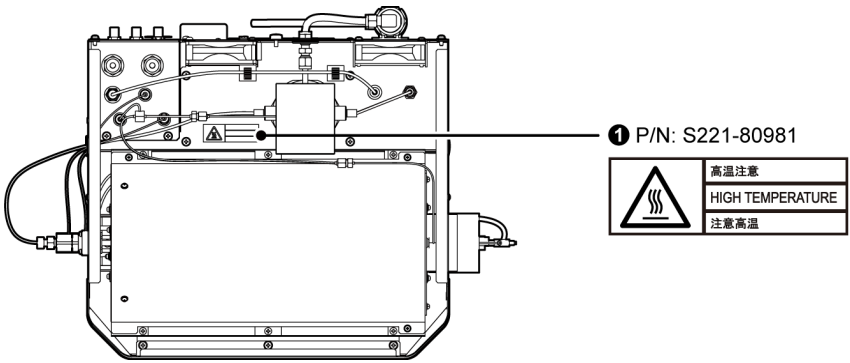
No.	Description
①	HIGH TEMPERATURE Do NOT open the side cover during analysis. May cause burn. While the SCD runs, the oxidation/reduction furnace on which the pyrotube is installed becomes very hot (about 1000 °C). Stop the GC and SCD and wait until the oxidation/reduction furnace cools down before you open the side cover.
②	WARNING WHEN USING HYDROGEN Close all unused valves for hydrogen pressure control and seal the column fittings. If hydrogen fills the oven, it may cause explosion.
③	CAUTION FLAME PRESENT Do NOT put objects on the top cover. May cause fire.

Right Side



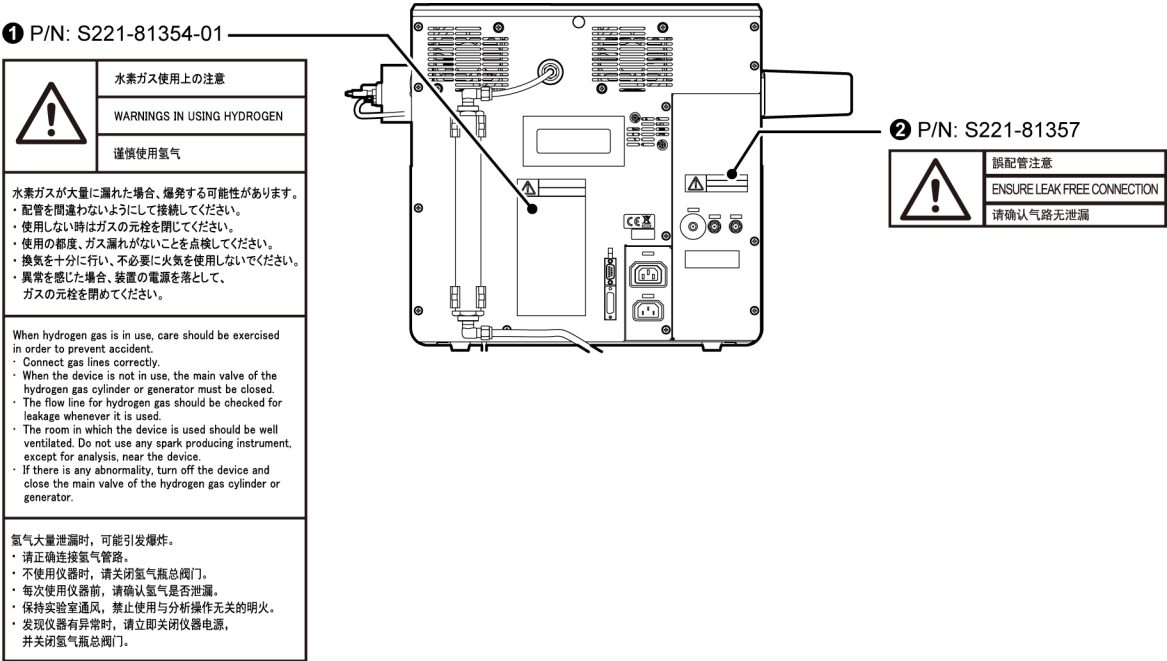
No.	Description
①	HIGH TEMPERATURE Do NOT touch the interface of the instrument during analysis. May cause burn.

Inside of the Instrument



No.	Description
①	HIGH TEMPERATURE Do NOT touch the inside of the instrument during analysis. May cause burn. While the SCD runs, the oxidation/reduction furnace becomes very hot (about 1000 °C). Normally, you do not need to open the top cover for operation of the inside of the instrument.

Rear



No.	Description
①	WARNINGS IN USING HYDROGEN When hydrogen gas is in use, care should be exercised in order to prevent accident. • Connect gas lines correctly. • When the device is not in use, the main valve of the hydrogen gas cylinder or generator must be closed. • The flow line for hydrogen gas should be checked for leakage whenever it is used. • The room in which the device is used should be well ventilated. Do not use any spark producing instrument, except for analysis, near the device. • If there is any abnormality, turn off the device and close the main valve of the hydrogen gas cylinder or generator.
②	ENSURE LEAK FREE CONNECTION Install the piping correctly. Wrong tubing may cause release of large amount of gases. We designed the joint of air inlet to be right-handed screw and the joint of hydrogen inlet to be left-handed screw to prevent incorrect piping.

Electromagnetic Compatibility

This product complies with European standard EN61326-1, class A for electromagnetic interference (Emissions) and basic electromagnetic environment for electromagnetic susceptibility (Immunity).

This is group 1 equipment.

Group 1 equipment: group 1 contains all equipment in the scope of this standard which is not classified as group 2 equipment.

Group 2 equipment: group 2 contains all ISM RF equipment in which radio-frequency energy in the frequency range 9 kHz to 400 GHz is intentionally generated and used or only used locally, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material, for inspection/analysis purposes, or for transfer of electromagnetic energy.

■ Emissions (Electromagnetic Interference)

This is a class A product.

Class A equipment is equipment suitable for use in all locations other than those allocated in residential environments and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

CAUTION



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

This is a class A product. Class A equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

■ EN61326-1 Immunity (Electromagnetic Susceptibility)

Compliance with these standards does not ensure that the product can operate at a level of electromagnetic interference that is stronger than the level tested. Interference stronger than the values specified above may cause the product to malfunction.

When installing or using this product, in an industrial location:

Locate the product away from any device emitting strong levels of electromagnetic noise. Use a power source that is separated from the power source of any device emitting strong levels of electromagnetic noise.

To prevent static electricity:

Prior to touching the product, the operator should be sure to discharge the static electricity stored in their body by first touching a grounded metallic structure. Do not touch any terminals or connectors that are not connected to cables while the product is turned ON.

Take the following measures before installing and/or using the instrument in industrial locations:

- Install the instrument away from the device with strong electromagnetic noise.
- Supply power from a different power source.
- Take measures to prevent buildup of static electricity.

Warranty

Shimadzu provides the following warranty for this product.

1. Period:

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

2. Description:

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

3. Limitation of Liability:

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

4. Exceptions:

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

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

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

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

After-Sales Service and Availability of Replacement Parts

■ After-Sales Service

If any problem occurs with this product, perform an inspection and take appropriate corrective action as described in ["5 Trouble Shooting" P.53](#) of this manual.

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

■ Replacement Parts Availability

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

If Shimadzu receives notice of the discontinuation of units or parts, the necessary quantity for the above period is immediately calculated and secured. However, such units or parts may cease to be available within seven years after the discontinuation of the product, depending on the conditions of individual manufacturers and on changes in the quantity required.

Maintenance, Inspections, and Adjustment

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

- For daily maintenance, inspection, and replacement parts, see ["4 Maintenance and Inspection"](#) of this manual.
- Periodic inspection should be requested to your Shimadzu representative.
- Replacement cycles described for periodic replacement parts are a rough estimate. Replacement may be required earlier than the described replacement cycles depending on usage environment and frequency.

Disposal Precautions

Dispose of the GC unit using a qualified industrial waste management company, in compliance with the applicable laws in the country where it is used.

Note also that the GC unit contains batteries (location: PCBs). Dispose of the unit appropriately and in accordance with the laws and regulations of the country or region.

■ Disposal of Electron Capture Detector (ECD)

An instrument equipped with the ECD cannot be disposed as normal waste.

Do NOT remove or disassemble the ECD (detector).

When it is necessary to remove the ECD, contact your Shimadzu representative.

The ECD contains a radioisotope, ^{63}Ni . When removing the ECD (detector) for cleaning or disposing as waste, contact your Shimadzu representative.

For California, USA Only

CAUTION



Instruction

This product contains a battery that contains perchlorate material.
Perchlorate Material - special handling may apply.
See www.dtsc.ca.gov/hazardouswaste/perchlorate

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1 Overview

1.1 Overview

Shimadzu GC-2030 is a high-end gas chromatograph which achieves the highest level of sensitivity and repeatability in the world.

GC-2030 provides "high throughput", which enables high-speed microanalysis, and "excellent usability", which enables intuitive operations.

1.2 Features

■ Basic features

Improved sensitivity of detectors

GC-2030 achieves the highest level of sensitivity and repeatability in the world. (As of May 2017, our investigation)

New flow controller

New flow controller (AFC/APC) equipped with CPU enables various carrier gas control modes including constant velocity/flow/pressure, and achieves high-speed and high-precision control and excellent repeatability.

Advanced Flow Technology (AFT)

The performances of back flush system and detector splitting system are improved. GC-2030 supports various carrier gas control modes (constant velocity/flow/pressure) and migration from the previous analytical settings is easy.

■ Better usability

Touch operation

Touch panel is adopted for the interface. You can check the device status and settings intuitively.

Enhanced hardware

You can open/close the inlet, replace the glass insert, and the split filter without tools. You can check the dirt on the split filter with your eyes. We also provide an optional device which enables you to install column without tools.

■ Environmentally friendly

Options for cooling rate of column oven temperature

You can select cooling rate of column oven temperature from 3 options (Fast, Mid, Slow) or customize the rate. It may help to reduce cooling time and damages of the liquid phase of the column during cooling.

Control range of column oven temperature becomes wider (from a temperature 2 °C higher than room temperature)

The control range of previous model is from 4 °C higher than room temperature. GC-2030 can control the column oven temperature from 2 °C higher than room temperature. GC-2030 can perform the same analysis as the previous models even if the analysis room temperature is controlled within the range of ± 2 °C. Thus, the power consumption in the analysis room can be reduced.

Auto start/Auto stop function

Auto start/Auto stop function can save the running cost.

Sleep mode

The instrument includes sleep mode to wait with a minimum power consumption when the main power is turned on.

Carrier gas saver

In split/splitless sample injection mode, this function reduces split ratio after sample injection to reduce split flow, which saves carrier gas consumption.

Monitoring function

You can check the power consumption in real time.

■ Expandability

Up to three injection units and four detectors can be controlled simultaneously.

You can choose from 5 kinds of injection units and 8 kinds of detectors (Maximum installation: 3 for injection units and 4 for detectors).

Using LabSolutions, you can control 4 detectors simultaneously to collect data.

2 Configuration

2.1 Standard Accessories

Standard accessories are shown below. Check the contents and their number.

Type	Name		Part number	Qty	
				Capillary model	Packed model
Manuals	Operation Guide		S221-79201	1	1
	GC Utility Package (DVD-ROM)		S221-87450-41	1	1
Parts	Branch tube ^{*1}		S221-72658-91	1	1
	Branch tube ^{*2}		S221-72658-92	1	-
	Column nut (without split)		S221-16325-01	1	-
	Column nut (with split)		S221-32705	1	-
	Graphite jig, SPL (SPL/PTV Column insertion jig) ^{*3}		S221-41532-91	1	-
	Column hanger ^{*4}		S221-47159	1	-
	Inlet cover ^{*5}		S221-89038	1	1
	Cable tie (red) ^{*6}		S072-60606-01	2	-
	Touch pen		S228-58619-41	1	1
Consumables ^{*7}	Standard Accessory Kit for GC-2030		S227-35003-01	1	-
	Contents	Premium Green Septa ^{*8}	-	2	-
		Deactivated Insert with wool for Split	-	1	-
		Deactivated Insert with wool for Splitless	-	1	-
		O-ring for Insert	-	2	-
		Graphite Ferrule 0.5 (fired)	-	4	-
	Standard Accessory for GC-2030 Packed		-	-	-
	Contents	Glass insert for packed column	S221-80902	-	1
		SUS column adapter, for INJ	S221-14087-92	-	1
		SUS column adapter, for DET	S221-43143-92	-	1
		Glass column joint	S221-15561-91	-	2
	Gasket, AL		S201-35183	1	1
	Gasket, silicone		S201-35184	-	1
	O-ring, S2 ^{*9}		S036-19004-66	5	-

2 Configuration

Type	Name	Part number	Qty	
			Capillary model	Packed model
Other	Declaration of conformity	S221-30991-71	1	1
	Declaration of conformity: Descriptions	S228-30164	1	1

*1 Supplied only with AF/ATF models.

*2 Supplied only with ATF/AT models.

*3 Supplied only with AF/ATF/AT/N models.

*4 Installed in the inside of the column oven.

*5 Attach it to INJ/DET cover in the case of manual injection.
(See "2.2.1 General View" P.6 in "2 Configuration" P.3.)

*6 Attach the cable ties to the hydrogen gas line for making a distinction from other gas lines.
Supplied only with FID-equipped models.

*7 We also provide Consumable Set for repeat orders.

Name	Part number
Premium Green Septa (50 pcs.)	S227-35004-01
Deactivated Insert with wool for Split (5 pcs.)	S227-35007-01
Deactivated Insert with wool for Splitless (5 pcs.)	S227-35008-01
O-ring for Insert (10 pcs.)	S227-35005-01
Graphite Ferrule 0.5 (10 pcs.)	S227-35006-01
Graphite Ferrule 0.8 (10 pcs.)	S227-35009-01
Glass insert for packed column (5 pcs.)	S221-80902-84

*8 Max temperature of premium green septa is 350 °C.

*9 Supplied only with AF/ATF/AT/AM models.

■ Detector accessories

Accessories for each detector are shown below.

Type	Name	Part number	Qty
FID	Graphite jig, FID (FID Column insertion jig)	S221-41532-04	1
	Column nut (with split)	S221-32705	1
TCD	Graphite jig, TCD (TCD Column insertion jig)	S221-48610-01	1
	CAUTION label TCD-2030	S221-42741	1
	Card case, A6	S038-03069-11	1
	Column nut (with split)	S221-32705	1
FTD	Graphite jig, FTD (FTD Column insertion jig)	S221-41532-92	1
	Column nut (with split)	S221-32705	1
FPD	Graphite jig, FPD (FPD Column insertion jig)	S221-48610-02	1
	Column nut (with split)	S221-32705	1
ECD	Graphite jig, ECD (ECD Column insertion jig, 43 mm) *1	S221-48610-07	1
	Graphite jig, ECD (ECD Column insertion jig, 32 mm) *1	S221-48610-04	1
	Column nut (with split)	S221-32705	1
BID	Graphite jig, BID (BID Column insertion jig)	S221-41532-02	1
	Column nut (with split)	S221-32705	1
SCD	Instruction Manual (DVD-ROM)	S221-79206-41	1
	Graphite Vespel® jig, SCD (SCD Column insertion jig)	S221-83764-01*2	1
	Graphite Vespel® ferrule, GVF16-004	S670-15003-03	1 (10 pcs.)
	Spanner, SCD	S221-83722	1
	Column nut (for SCD)	S670-11009	1 (5 pcs.)
	Spanner for column nut, 3/16 × 1/4	S225-20801-01	1
	Spanner, SCD, maintenance	S221-84181	1
	Flow inspection connector, SCD	S221-84174-41	1
	Inner pyrotube	-	1 (3 pcs.)
	PTFE ferrule	S228-16007	3
	Outer pyrotube	-	1
	Positioning jig for SCD inner pyrotube	S221-87403-41	1

*1 The column insertion length for ECD varies depending on the ECD detector configuration. See ["2.2.8 How to Differentiate ECD-2010 Exceed Flow Paths" P.20.](#)

*2 "S221-83764" for the right installation model.

2.2 Names and Functions of Parts

2.2.1 General View

! WARNING



Instruction

Before you open the column oven door, ensure that the column oven temperature drops below 40 °C on [Temp Monitor] screen.

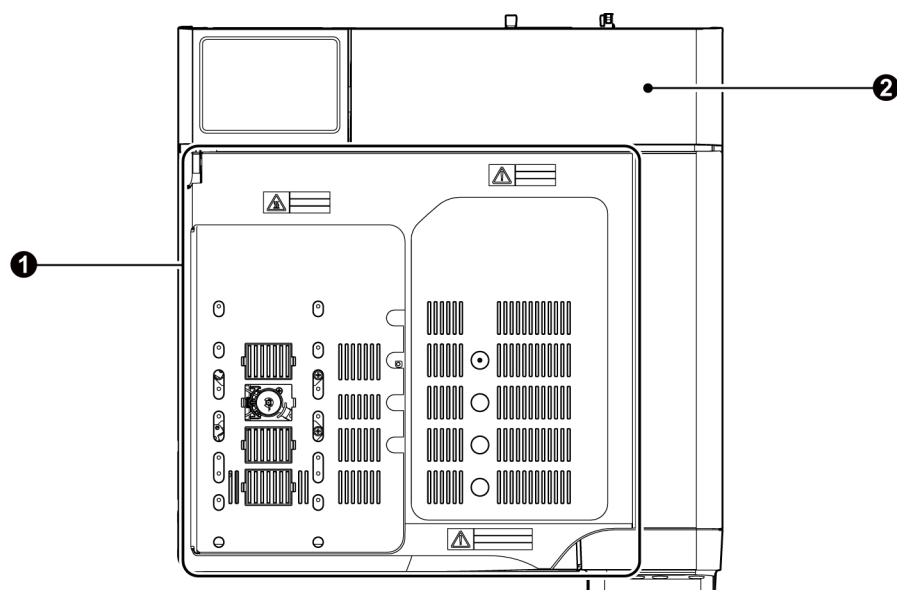
Operation at a high temperature may cause burns. Tightening the nut at a high temperature may cause the seizing (galling) of the sliding part.

▶▶ Reference "7.2.3 [Temp Monitor] Screen" P.163



No.	Name	Description
①	Inlet cover	Attach it to INJ/DET cover in the case of manual injection. This cover protects you from burns.
②	Column oven door	Column is installed in the inside of the column oven door.
③	Column oven door latch	Pull the column oven door latch toward you to open the door.
④	Control panel	Sets analytical conditions and starts analysis. ▶▶ Reference "2.2.6 Control Panel" P.14
⑤	 (Power button)	Turns ON/OFF the instrument.
	Not Illuminating	The main power of the instrument is turned off.
	Orange	The main power of the instrument is turned on.
	White	The instrument is turned on.
⑥	Main power switch	Turns ON/OFF the main power of the instrument. Normally, you do not need to use the main power switch.
	○	The main power of the instrument is turned off.
		The main power of the instrument is turned on.

2.2.2 Top Face



No.	Name	Description
❶	AFC/APC cover	Open the cover for maintenance of AFC and APC.
❷	INJ/DET cover	Open the cover to check the whole inside of the instrument.

▶▶ Reference See Maintenance Help for the way to open the cover.

2.2.3 Inside of the Instrument

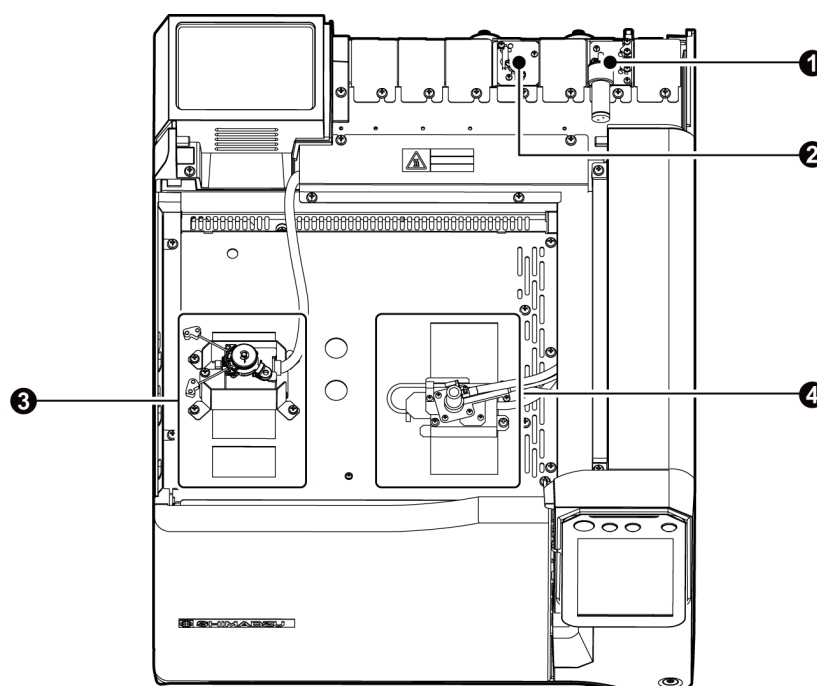
! WARNING

Instruction

Before you touch the inside of the instrument, ensure that the temperatures of the injection port and the detector drop below 50 °C on [Temp Monitor] screen.

Operation at a high temperature may cause burns. Tightening the nut or the ClickTek connector (optional) at a high temperature may cause the seizing (galling) of the sliding part.

▶▶ Reference "7.2.3 [Temp Monitor] Screen" P.163



No.	Name	Description
❶	AFC	Controls carrier gas.
❷	APC	Controls detector gas.
❸	Injection port	Injects the sample from here.
❹	Detector	Detects vaporized component passing through the column, and outputs electrical signals to external devices.

2.2.4 Inside of the Column Oven

! WARNING

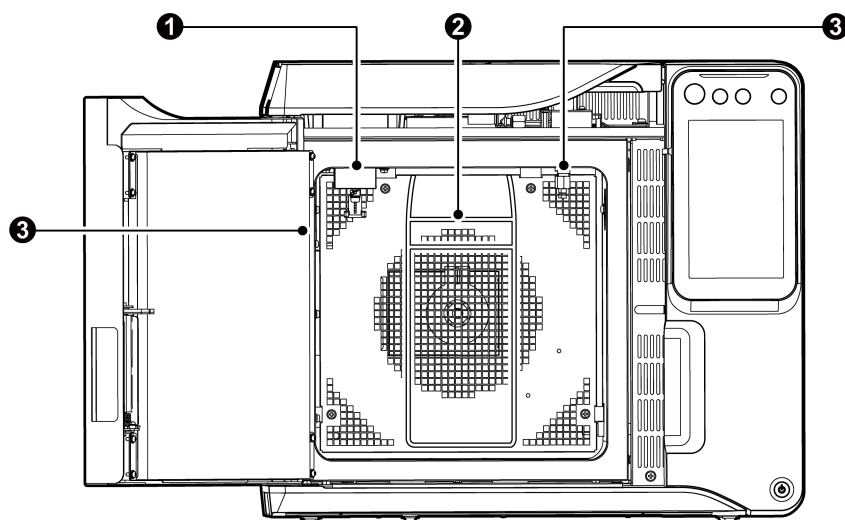


Instruction

Before you touch the inside of the column oven, ensure that the column oven temperature drops below 40 °C on [Temp Monitor] screen.

Operation at a high temperature may cause burns. Tightening the nut or the ClickTek connector (optional) at a high temperature may cause the seizing (galling) of the sliding part.

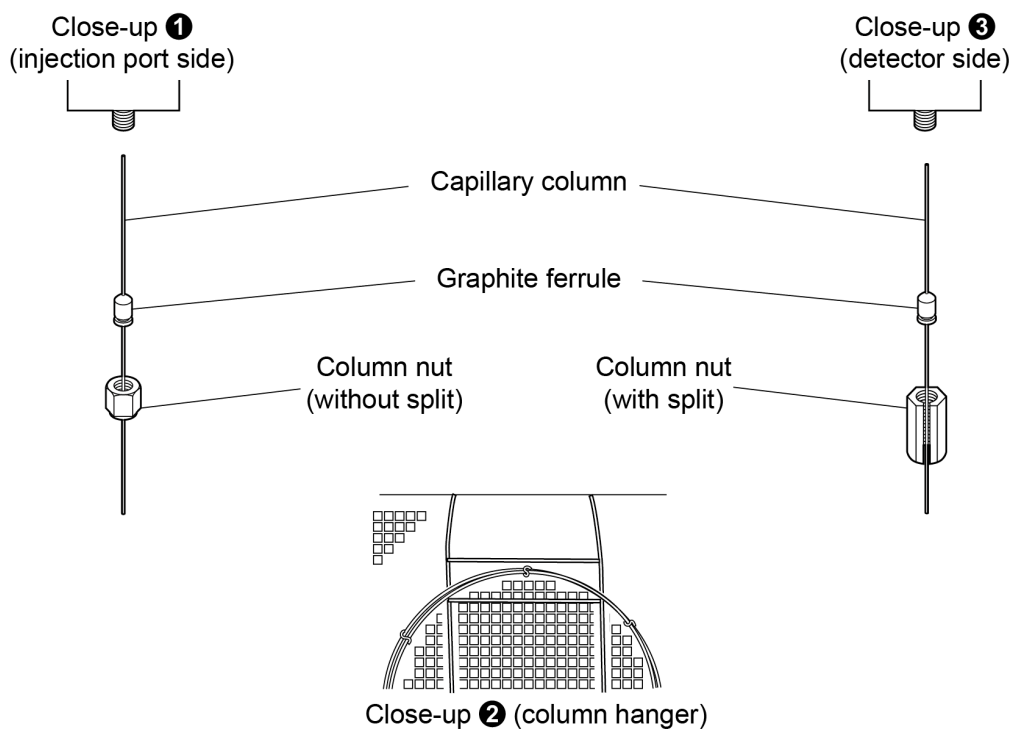
▶▶ Reference "7.2.3 [Temp Monitor] Screen" P.163



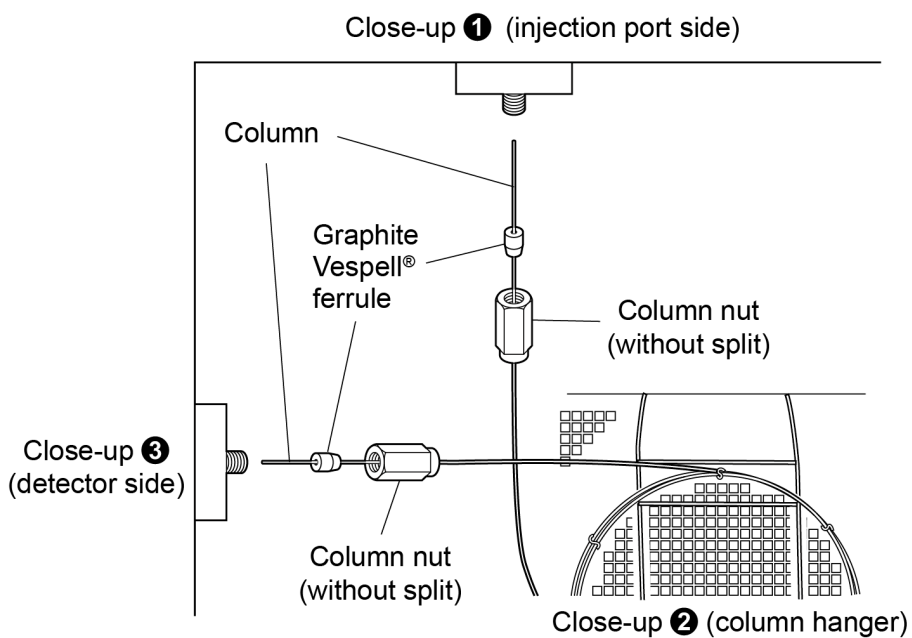
No.	Name	Description
①	Column connection (injection port side)	Attaches the column to the injection port. (close-up ①)
②	Column hanger	Install the capillary column here. (close-up ②)
③	Column connection (detector side)	Attaches the column to the detector. (close-up ③)

■ Close-ups of the inside of the column oven

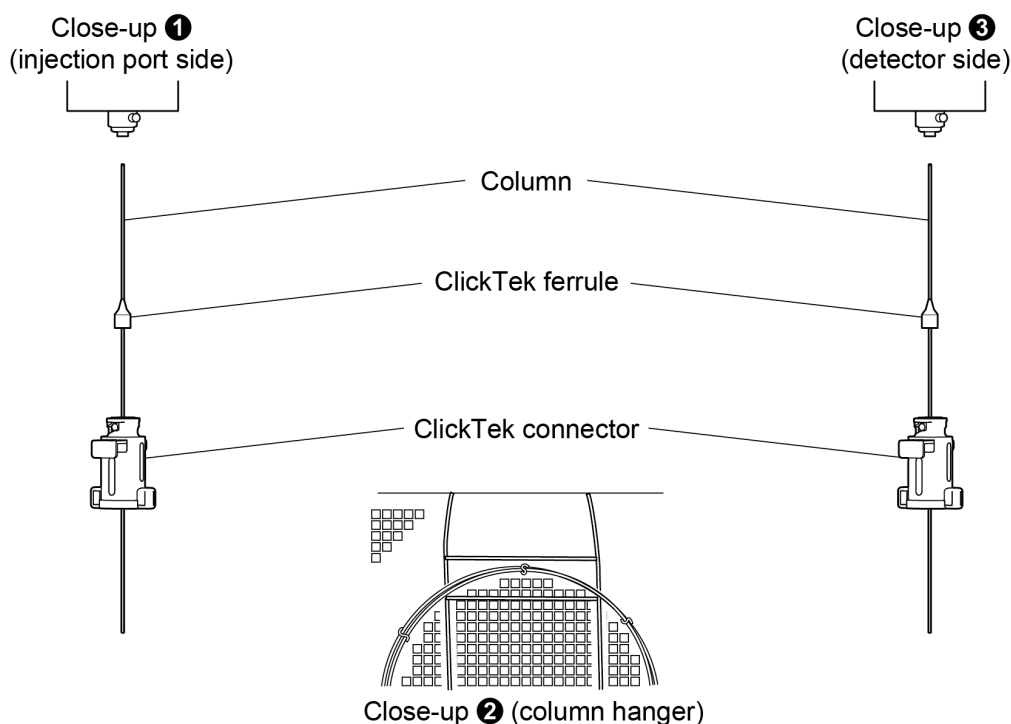
For graphite ferrule



For graphite Vespel® ferrule



For ClickTek ferrule (optional)



2

2.2.5 Rear

! WARNING

Prohibition

Do NOT touch the connections or terminals when the power is turned on.
It may cause electric shock or malfunctions of the instrument.



Instruction

To avoid electrical shock, follow the instructions below.

- Do NOT remove the rear cover.
- Ensure that the power switchboard and other associated equipment are turned off before connection if the power cable will be connected directly to terminals on the power switchboard.
- Never put heavy objects on the power cable.



Instruction

Check gas flow lines for leaks.

In particular, large amount of hydrogen leak may cause explosion.



Instruction

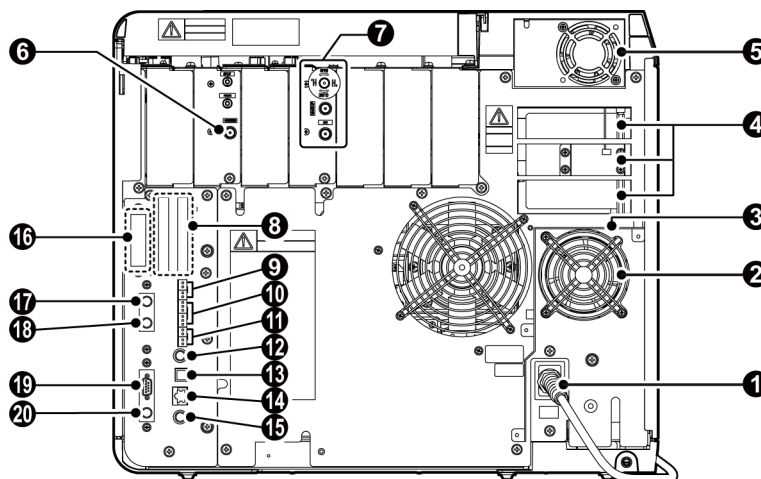
Be careful of hot air exhausted from the openings and the rear.

Hot air is exhausted from the openings and the rear. Hot air may cause burn and fire.

The positions of the rear connectors of the GC-2030 CPU board are different depending on the version of the firmware. There are two types of CPU boards, which can be differentiated by whether the board has the INJECTOR1 connector for the back of the

GC. The CPU board of firmware version 1.XX or 2.XX has the INJECTOR1 connector, and that of firmware version 4.XX does not.

■ When the CPU board firmware version is 1.XX or 2.XX (S221-77080-XX)

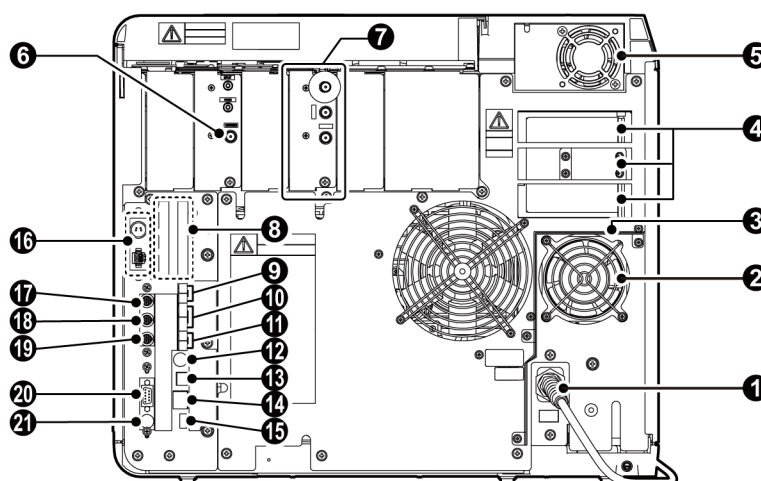


No.	Name	Description
①	Power cable	Supplies power to the instrument.
②	Air inlet fan	Sends air to the column oven to cool it down.
③	Partition plate	Prevents the air from flowing back into the column oven.
④	Exhaust vent	This vents the column oven during cooling.
⑤	INJ/DET fan	Used to cool the injection port and the detector.
⑥	Carrier gas inlet	Supplies carrier gas.
⑦	Detector gas inlet	Supplies detector gas.
⑧	PRG connector *1	Connect optional PRG-2030 or valve.
⑨	Relay output connector (1 Relay)	Connect an external device to output the signal set on [Relay Control] screen.
⑩	Relay output connector (2 Relay)	Connect an external device to output the signal set on [Relay Control] screen.
⑪	Relay input connector	Connect an external device to input the signal set on [Relay Control] screen.
⑫	INJECTOR1 connector	Connect auto injector. When using auto injectors in dual configuration, connect the main auto injector.
⑬	USB connector	Connect USB cable. For communications with PC.
⑭	Ethernet connector	Connect LAN cable. For communications with PC.
⑮	Detector signal output terminal for Ch1 (analog)	Outputs detector signal to analogue inputs including CHROMATOPAC.
⑯	External input connector for A/D board *1	Inputs external analog signal.

No.	Name	Description
⑰	SAMPLER connector *1	Connect auto sampler.
⑱	INJECTOR2 connector *1	When using auto injector in dual configuration, connect the secondary auto injector.
⑲	RS-232C connector *1	Connect RS-232C cable. For communications with CHROMATOPAC.
⑳	Detector signal output terminal for Ch2 (analog) *1	Outputs detector signal to analogue inputs including CHROMATOPAC.

*1 Connectors to connect optional devices. Normally they are covered with a plate.

■ When the CPU board firmware version is 4.XX (S221-89060-XX)



No.	Name	Description
①	Power cable	Supplies power to the instrument.
②	Air inlet fan	Sends air to the column oven to cool it down.
③	Partition plate	Prevents the air from flowing back into the column oven.
④	Exhaust vent	This vents the column oven during cooling.
⑤	INJ/DET fan	Used to cool the injection port and the detector.
⑥	Carrier gas inlet	Supplies carrier gas.
⑦	Detector gas inlet	Supplies detector gas.
⑧	PRG connector *1	Connect optional PRG-2030 or valve.
⑨	Relay output connector (2 terminals × 1 port)	Connect an external device to output the signal set on [Relay Control] screen at contact a or contact b.
⑩	Relay output connector (3 terminals × 2 ports)	Connect an external device to output the signal set on [Relay Control] screen at contact c.
⑪	Relay input connector (2 terminals × 3 ports)	Connect an external device to input the signal set on [Relay Control] screen.
⑫	MPV/EVNT connector	This port is not available for this instrument.

No.	Name	Description
13	USB connector	Connect USB cable. For communications with PC.
14	Ethernet connector	Connect LAN cable. For communications with PC.
15	USB connector (optional)	This port is not available for this instrument.
16	Optional connector *1	Use for external analog signal input, SCD detector signal input/output, etc.
17	SAMPLER connector	Connect auto sampler.
18	INJECTOR2 connector	When using auto injector in dual configuration, connect the secondary auto injector.
19	INJECTOR1 connector	Connect auto injector. When using auto injectors in dual configuration, connect the main auto injector.
20	RS-232C connector *1	Connect RS-232C cable. For communications with CHROMATOPAC.
21	Detector signal output terminal for Ch1 (analog) *1	Outputs detector signal to analogue inputs including CHROMATOPAC.

*1 Connectors to connect optional devices. Normally they are covered with a plate.

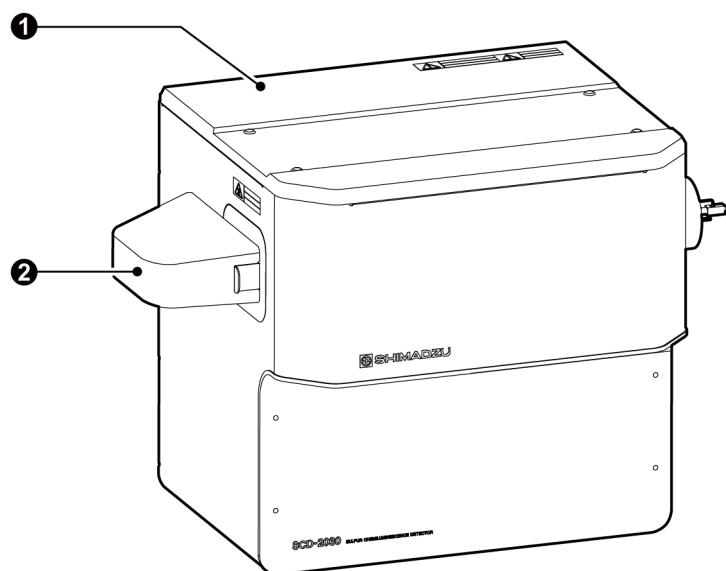
2.2.6 Control Panel



No.	Name		Description
①	Status light		Indicates the instrument status by the color of the light.  NOTE When the CPU board firmware version is 4.XX, the status light temporarily illuminates in light purple when the power is turned on.
		Not Illuminating	Indicates the following instrument status. • The instrument is turned off. • The instrument is waiting in sleep mode. • The instrument is turned on, however the GC has not started yet.
		Yellow	The GC started and the instrument is getting ready.
		Green	The GC started and the instrument is ready.
		Blue	During analysis or diagnosis.
		Red	An error occurs.
②	Operation buttons		Use to start/stop analysis or analytical programs and display HOME screen.
		 (START)	Analysis will start. Use for manual sample injection. When pre-run program is set, pre-run program will start.
		 (PREP RUN)	Use it while PREP RUN function is active (the instrument status on the touch panel flashes). The instrument enters the status where the instrument can start analysis.  Reference "7.9.10 [PREP RUN] Screen" P.381
		 (STOP)	Stops analysis or analytical programs.
		 (HOME)	Displays HOME screen.  Reference "HOME" P.142
③	1.2.2 Touch Panel		Use it to set analytical conditions and check instrument status.  Reference • "Displayed items on the touch panel" P.23 • "7 Screens Displayed on Touch Panel and Their Functions" P.142

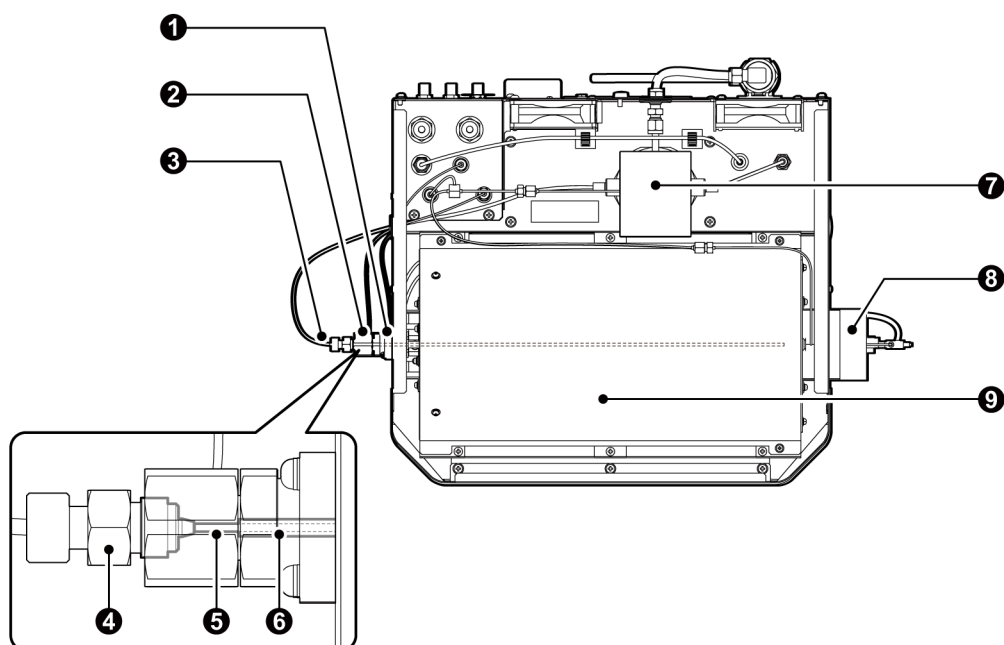
2.2.7 SCD-2030 Parts Names and Functions

■ General View



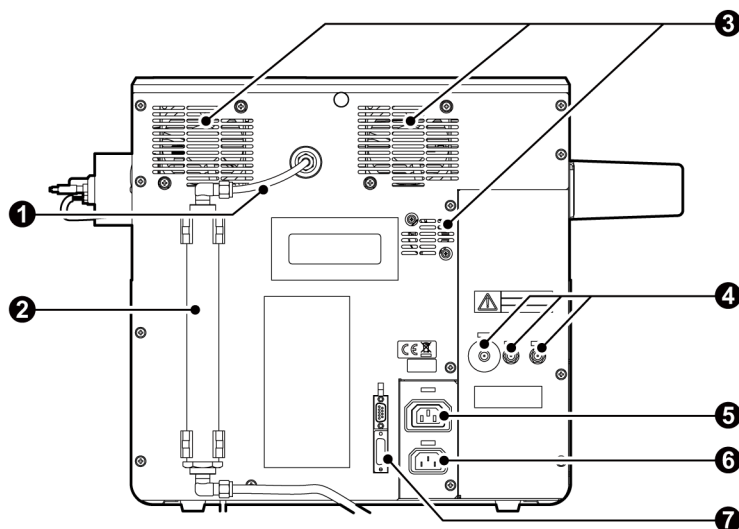
No.	Name	Description
①	Top cover	It is used by Shimadzu service personnel for maintenance.
②	Side cover	The interface for user maintenance is accommodated. Open it when replacing the inner or outer pyrotube.

■ Inside of the Instrument



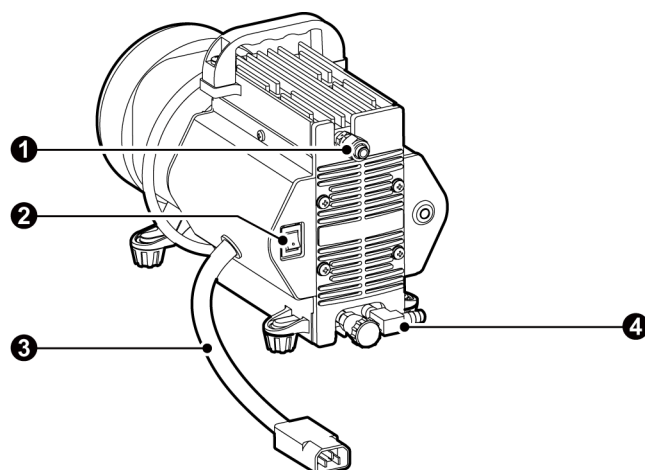
No.	Name	Description
①	Oxidizer inlet	Fixes the outer pyrotube.
②	Reductant inlet	Fixes the inner pyrotube.
③	Transfer line	The tube that introduces oxidized/reduced sample to the detector part.
④	Transfer adapter	Connects the inner pyrotube and the transfer line.
⑤	Inner pyrotube	Reduction reactions are promoted in this tube.
⑥	Outer pyrotube	Oxidation reactions are promoted in this tube.
⑦	Detector part	Detects the light emitted from the reaction between oxidized/reduced sample and ozone.
⑧	Interface	The connection between the GC and SCD.
⑨	Oxidation/reduction furnace	The heating furnace to oxidize/reduce sulfur compounds.

■ Rear



No.	Name	Description
①	Air outlet tube	The tube to discharge the sample after reaction.
②	Ozone scrubber	Decomposes ozone in discharged gases to oxygen.
③	Air outlet fan	The fan to cool down the inside of the detector.
④	Detector gas inlet	Supplies detector gas (hydrogen, oxygen, and nitrogen).
⑤	Connector for the vacuum pump	The connector dedicated to power supply to the vacuum pump.
⑥	Power connector (for SCD)	Supplies power to the main body of the detector and vacuum pump.
⑦	GC connector	The connector to connect the GC and SCD.

■ Vacuum Pump



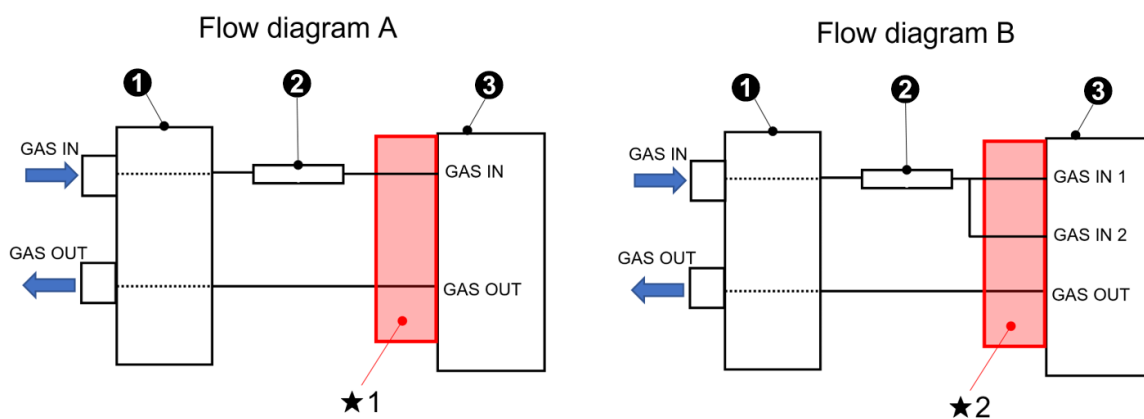
No.	Name	Description
①	Air inlet	Connects the pipe from the ozone scrubber.
②	Power switch	The main power switch of the main body of the vacuum pump.
③	Power cable	Connect it with the connector for the vacuum pump on the rear side of the SCD.
④	Exhaust vent	Carrier gas or detector gas after reaction is discharged.

2.2.8 How to Differentiate ECD-2010 Exceed Flow Paths

■ Flow path of ECD-2010 Exceed

ECD-2010 Exceed has two flow path designs: flow path A (left figure below) and flow path B (right figure below).

Flow path A emphasizes sensitivity, while B emphasizes durability.



No.	Name
①	APC (gas flow controller)
②	MS filter
③	ECD cell

In flow path A, two tubes are connected to the ECD cell, with gas entering through one line and exiting through the other (indicated by ★1 in the figure).

In flow path B, three tubes are connected to the ECD cell, with gas entering through two lines and exiting through one line (indicated by ★2 in the figure).

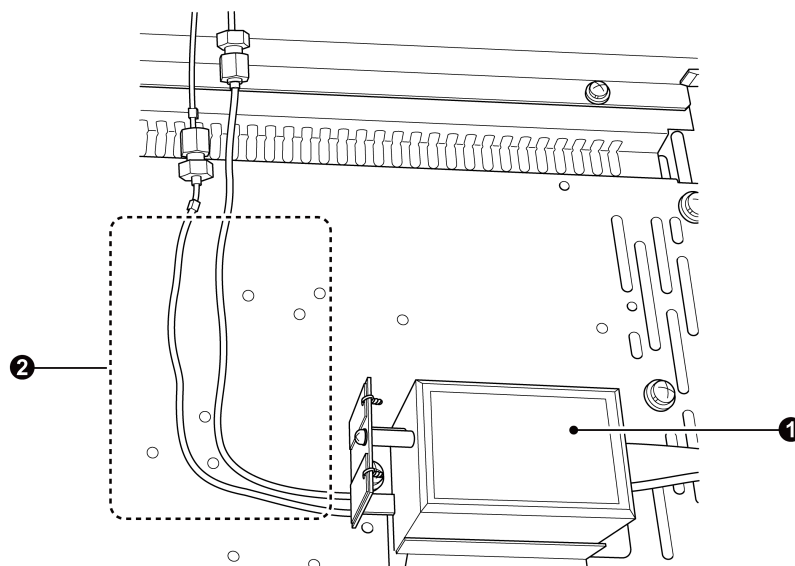
■ Checking procedure

- 1 Ensure from the instrument screen or the workstation that the temperature of the column oven has dropped below 40 °C, and the temperatures of the injection port and the detector below 50 °C.
- 2 Turn off the main power of the instrument.
- 3 Open INJ/DET cover.

4

Check the number of tubes connected to the ECD cell (2 or 3 pcs) indicated by ❷ in the figure below. (The figure shows the example of 2 tubes.)

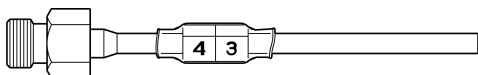
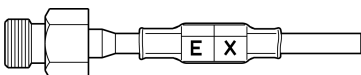
- 2 tubes are connected: Flow path A
- 3 tubes are connected: Flow path B



No.	Name
❶	ECD cell
❷	Tubes connected to ECD

■ Graphite jig

Note that the column insertion length varies between flow paths A and B.
Using an appropriate graphite jig, attach graphite ferrule to the column correctly.

	Flow path A	Flow path B
Column insertion length	43 mm	32 mm
Name	Graphite jig, ECD (ECD Column insertion jig, 43 mm)	Graphite jig, ECD (ECD Column insertion jig, 32 mm)
Part number	S221-48610-07	S221-48610-04
Shape		

■ ECD gas flow

The ECD gas flow varies between flow paths A and B.
Set the appropriate gas flow accordingly.

	Flow path A	Flow path B
ECD gas flow	15 mL/min	30 mL/min

3 To Analyze

Analysis procedure is different depending on the detector and your purpose of the analysis.

This chapter describes general procedure for analysis.

3.1 Touch Panel Operation

This section describes items displayed on HOME screen and the touch panel.

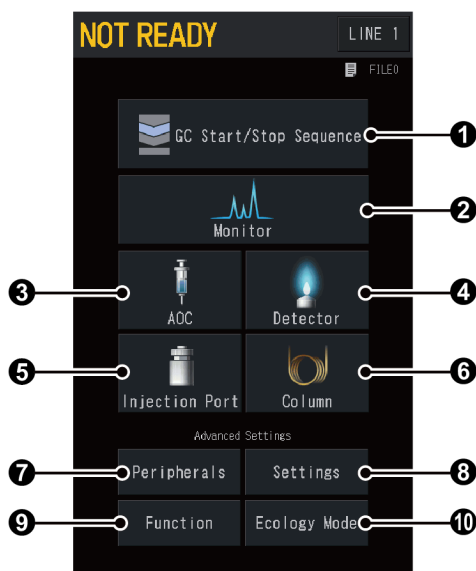
▶▶ **Reference** See "7 Screens Displayed on Touch Panel and Their Functions" P.142 for details about each screen.

■ **NOTE** Do not turn off the main power for 10 seconds after you change the setting. If you turn off the main power within 10 seconds, the changed setting may not be reflected.

■ HOME

HOME screen is displayed when you turned on the instrument.

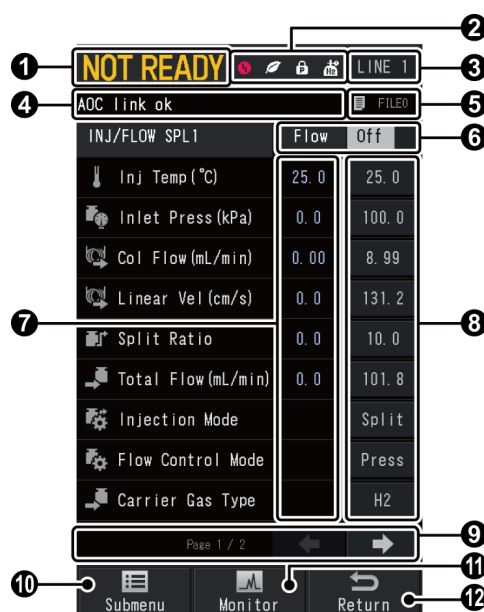
HOME screen is also displayed when you press  (HOME) on the control panel while the instrument is turned on.



No.	Item	Description	See also
①	GC Start/Stop Sequence	Sets parameters related to the GC start and stop.	P.143
②	Monitor	You can check conditions of injection ports, columns, and detectors and the baseline.	P.156
③	AOC	Sets AOC.	P.165
④	Detector	Sets detector temperature, conditions for the detector gas, and signal output.	P.185

No.	Item	Description	See also
⑤	Injection Port	Sets inlets temperature and various conditions for the carrier gas.	P.247
⑥	Column	Sets column temperature, column information (inner diameter, length, etc.), and temperature program.	P.285
⑦	Peripherals	Sets optional devices (CRG, AUX-APC, etc.).	P.295
⑧	Settings	Sets line settings and frequently changed conditions (various temperatures, the carrier gas, detectors, etc.) by batch.	P.313
⑨	Function	Sets configuration and time program.	P.317
⑩	Ecology Mode	Sets carrier gas saver and auto stop/start of the instrument.	P.383

■ Displayed items on the touch panel



No.	Item	Description
①	Instrument Status	Displays the current status of the instrument.
	Norm	The text changes depending on GC status. • NOT READY : GC is in preparation • READY : GC is ready • RUN : Analyzing • PRERUN : Pre-Run Program is running • DIAGNOSIS : Self-Diagnosis is running • CLEANUP : Clean up is running • PREP RUN : Analysis is in standby state (PREP RUN is active) • PREPARING : Analysis is in preparation

No.	Item	Description
1	Highlight	The background of the instrument status is highlighted while the instrument is working.
	Flashing	The instrument status on the touch panel will flash when the instrument is set in waiting state by PREP RUN function. PREP RUN function can be active when the instrument is in the following situations: • [Carrier Gas Saver] is turned [On] • [Back Flush Mode] is turned [On] • [Split Mode] is set at [Splitless] • [High Press Injection Mode] is set at [Auto] • Optional CRG is used, [Valve] is turned [On], and default value of [Temperature Program] is set under "Room Temperature + 2 °C". • [Final Temp Hold] is turned [On] in the setting for column oven temperature control When PREP RUN function is active, the instrument is in waiting status for analysis and cannot perform analysis. Press  (PREP RUN) on the control panel to change the instrument from waiting status for analysis to the status which enables analysis (READY). ▶▶ Reference "7.9.10 [PREP RUN] Screen" P.381
2	Status Icons	Displays icons depending on the instrument status.
	 (Error)	Displayed when an error occurs. Press the icon to check the current error. ▶▶ Reference "6 Error Messages" P.94
	 (Eco)	Displayed when [Carrier Gas Saver] are set at [On] on [Eco Setting] screen. If several injection ports are configured in the analytical line, it is displayed when [Carrier Gas Saver] are set at [On] for all injection ports. ▶▶ Reference "7.10.1 [Eco Setting] Screen" P.384
	 (Screen Lock)	Displayed when Screen Lock function is active. ▶▶ Reference "[Screen Lock] Screen" P.361
	 (Parameter Lock)	Displayed when Parameter Lock function is active. ▶▶ Reference "[Parameter Lock] Screen" P.362
	 (Hydrogen is used)	Displayed when the carrier gas is hydrogen.
	 (Hydrogen Leak Check)	Displayed when optional Hydrogen Leak Check function is active. ▶▶ Reference "7.7.3 [Hydrogen Leak Check] Screen" P.300

No.	Item	Description
③	Line	Displays the analytical line number. When several analytical line are configured, switch the line number to set parameters for each line. ▶▶ Reference "7.8.2 [Line Configuration] Screen" P.314
④	Message Display	Displays messages depending on the instrument status.
⑤	Used File	Displays the name of the loaded file. ▶▶ Reference "7.1.3 [File Select] Screen" P.150
⑥	Control Status	Displays the current control status. Press [Off] or [On] to switch the control status.
⑦	Value	Displays the actual values in blue text.
⑧	Setup Button	Press the button to change the settings.
⑨	Page Switching	Displayed when items are continued to the next page. Switch pages to set items.
⑩	Submenu	Press to display Submenu for each screen.
⑪	Monitor	Press to display the monitor screen. ▶▶ Reference "7.2 Monitor" P.156
⑫	Return	Press to display the previous screen.

Graph window

When you set Temperature Program, etc., press  (Graph) to display the graph window.

You can see the program in graph form.

Press outside of the graph window to close the graph window.



3.2 Analysis Procedure

This section describes general procedure for analysis.

- ▶▶ **Reference**
- See Maintenance Help for the installation of the parts.
 - See ["7 Screens Displayed on Touch Panel and Their Functions" P.142](#) for details about the setting screen.

WARNING



Instruction

Ensure that the column oven temperature drops below 40 °C on [Temp Monitor] screen.

Ensure that the temperatures of the injection port and the detector drop below 50 °C on [Temp Monitor] screen.

- Temperatures of parts may be high immediately after the GC stops. Operate them after temperatures of parts drops to a temperature where you can perform maintenance.
- Operation at a high temperature may cause burns. Tightening the nut or ClickTek connector (optional) at a high temperature may cause the seizing (galling) of the sliding part.

▶▶ **Reference** ["7.2.3 \[Temp Monitor\] Screen" P.163](#)

1

Prepare the injection port and the detector.

- 1 Install a glass insert depending on the injection mode.
- 2 Ensure that O-ring does not degrade and replace it as needed.



Hint If you replace the glass insert or O-ring, reset the use count on [Analysis Counter] screen after you turn on the instrument.

▶▶ **Reference** ["\[Analysis Counter\] Screen" P.375](#)

- 3 When the detector is FPD, ensure that the correct optical filter is installed.

▶▶ **Reference** Maintenance Help

2

Install a column.

▶▶ **Reference** Maintenance Help

3

Connect the cable of the data processing unit.

When using LabSolutions

- 1 Connect the USB or Ethernet cable to the connector on the back of the instrument.
- 2 Set up the instrument.

▶▶ **Reference** ["8.9.1 Connecting to LabSolutions" P.457](#)

When using CHROMATOPAC

- 1 Connect the cable of CHROMATOPAC to "Detector signal output terminal for Ch1 (analog)" on the back of the instrument.
- 2 Set up the instrument.
 ▶▶ Reference ["8.9.2 Connecting to CHROMATOPAC" P.458](#)

4

Press the power button on the front of the instrument to turn on the instrument.
 [HOME] screen appears.

 **NOTE** When using LabSolutions, use LabSolutions to perform the procedure after step 5.

▶▶ Reference For LabSolutions operation, refer to LabSolutions Instruction Manual.

5**Set analytical information.**

- 1 Press  (HOME) - [Settings] - [Submenu] - [Line Configuration].
 [Line Configuration] screen appears.
 ▶▶ Reference ["7.8.2 \[Line Configuration\] Screen" P.314](#)
- 2 Configure units to be used in analytical lines.
- 3 Press  (HOME) - [Column] - [Column Info.].
 [Column Information] screen appears.
 ▶▶ Reference ["7.6.2 \[Column Information\] Screen" P.292](#)
- 4 Set the column oven temperature.

6**Set analytical conditions and start up the GC.****When the detector is FID, TCD, PTCd, FPD, ECD, or BID**

- 1 Press  (HOME) - [Settings].
 [SET (Analysis Settings)] screen appears.
 ▶▶ Reference ["7.8.1 \[Analysis Settings\] Screen" P.313](#)
- 2 Set basic items such as temperature and flow of each part.



Hint For the items which are not displayed on [SET (Analysis Settings)] screen, go HOME screen or Monitor screen, go to screens for injection port, detector, and column, and then set the details.

- 3 When the detector is TCD, PTCd or ECD, press  (HOME) - [Detector] to set the current value.

- ▶▶ Reference
- "7.4.2 [Detector] Screen (TCD Tab)" P.192
 - "7.4.3 [Detector] Screen (PTCD Tab)" P.196
 - "7.4.6 [Detector] Screen (ECD Tab)" P.212

 **NOTE** When the detector is TCD, ensure that [Current] is set at "0" before starting the GC. Set [Start Time] on [GC Start Setting] screen to approximately 10 minutes and then press [Start GC]. Ensure that the gas flows to the detector vent. Filaments may break if the current passes the filaments when the air inside the cell is not replaced with carrier gas or makeup gas.

- 4 Set analytical programs such as temperature program.

- 5 Press  (HOME) - [Function] - [Diagnosis] - [Carrier Gas Leak Check].
[Carrier Gas Leak Check] screen appears.

 **NOTE** The "Carrier Gas Leak Check" function is not available under the following conditions.
Go to sub-step 7.

- When using packed columns
- When MS is configured in the analytical line
- When AFT is configured in the analytical line

- 6 Press [Start].
Carrier Gas Leak Check starts.

- ▶▶ Reference "8.6.9 Carrier Gas Leak Check Function" P.440

 **Hint** When you connect/disconnect the column, perform Carrier Gas Leak Check to check that the connection has no leak.
If you do not connect/disconnect the column, you can skip Carrier Gas Leak Check.

- 7 Press  (HOME) - [GC Start/Stop Sequence].
[GC Start Sequence] screen appears.

- ▶▶ Reference "7.1.1 [GC Start Sequence] Screen" P.143

- 8 Set [Start Temp/Det] to [Enable].

- 9 Set the period of time after flow control starts until temperature/detector control starts in [Start Time].

- NOTE**
- When the detector is ECD, set [Start Time] at a value more than 10 minutes. If the temperature increases when the air in the cell is not replaced with nitrogen, it accelerates degradation of the cell.
 - When the detector is BID, extra caution should be exercised on [Start Time] setting to avoid degradation of helium purifier. Normally, set it at 10 minutes. After piping installation or cylinder replacement, set it at about 60 minutes.

- 10 Set other parameters related to the GC start.
- 11 Press [Start GC] to start the GC.
The GC starts according to [GC Start Sequence] screen settings.
After the GC startup is completed, the status light illuminates in green and Monitor screen is displayed.

When the detector is FTD

- 1 Press  (HOME) - [Settings].
[SET (Analysis Settings)] screen appears.
▶▶ Reference "7.8.1 [Analysis Settings] Screen" P.313
- 2 Set [Column Temp] at 40.0 °C, and set basic items such as temperature and flow of each part.

 **Hint** For the items which are not displayed on [SET (Analysis Settings)] screen, go HOME screen or Monitor screen, go to screens for injection port, detector, and column, and then set the details.
- 3 Press  (HOME) - [Detector].
[Detector] screen appears.
▶▶ Reference "7.4.4 [Detector] Screen (FTD Tab)" P.200
- 4 Ensure that [Detector Control] is turned [On] and [Power Controller] is turned [Off].
- 5 Press  (HOME) - [Function] - [Diagnosis] - [Carrier Gas Leak Check].
[Carrier Gas Leak Check] screen appears.
- 6 Press [Start].
Carrier Gas Leak Check starts.
▶▶ Reference "8.6.9 Carrier Gas Leak Check Function" P.440

 **Hint** When you connect/disconnect the column, perform Carrier Gas Leak Check to check that the connection has no leak.
If you do not connect/disconnect the column, you can skip Carrier Gas Leak Check.

- 7 Press  (HOME) - [GC Start/Stop Sequence].
[GC Start Sequence] screen appears.
▶▶ Reference ["7.1.1 \[GC Start Sequence\] Screen" P.143](#)
 - 8 Set parameters related to the GC start.
 - 9 Press [Start GC] to start the GC.
The GC starts according to [GC Start Sequence] screen settings.
After the GC startup is completed, the status light illuminates in green and Monitor screen is displayed.
 - 10 Enter the background current in [Current] on [Detector] screen.
▶▶ Reference ["Setting of background current" P.205](#)
-  **NOTE** Excessive current value will shorten the alkaline source life. Do not use excessive values.
- 11 Set [Power Controller] on [Detector] screen to [On] after the detector temperature reaches the set value.
 - 12 Press  (HOME) - [Column].
[Column Oven] screen appears.
▶▶ Reference ["7.6.1 \[Column Oven\] Screen" P.285](#)
 - 13 Set the column oven temperature for analysis.

When the detector is SCD

- 1 Press  (HOME) - [Settings].
[SET (Analysis Settings)] screen appears.
▶▶ Reference ["7.8.1 \[Analysis Settings\] Screen" P.313](#)
- 2 Set basic items such as temperature and flow of each part.

💡 **Hint** For the items which are not displayed on [SET (Analysis Settings)] screen, go HOME screen or Monitor screen, go to screens for injection port, detector, and column, and then set the details.
- 3 Press  (HOME) - [Detector].
[Detector] screen appears.
▶▶ Reference ["7.4.8 \[Detector\] Screen \(SCD Tab\)" P.223](#)
- 4 Ensure that [SCD Auto Start at GC Start] is set at [Enable].
- 5 Press [SCD System Control].
[SCD System Control] screen appears.

- 6 Ensure that [Furnace red.] is set at 750 °C or higher and [SCD O3] is set at 16.0 mL/min or higher.
 - 7 Press  (HOME) - [Detector] - [Submenu] - [SCD Leak Check].
[SCD Leak Check] screen appears.
▶▶ Reference "7.4.14 [SCD Leak Check] Screen" P.242
 - 8 Press [Start] in [Pressure Check].
Pressure leak check starts.
When the result is "Fail", determine the cause of leak and resolve the problem. Then perform leak check again. When the result is "Pass", you can start SCD control.
▶▶ Reference "7.4.14 [SCD Leak Check] Screen" P.242
 - 9 Press  (HOME) - [Function] - [Diagnosis] - [Carrier Gas Leak Check].
[Carrier Gas Leak Check] screen appears.
 - 10 Press [Start].
Carrier Gas Leak Check starts.
▶▶ Reference "8.6.9 Carrier Gas Leak Check Function" P.440
-  **Hint** When you connect/disconnect the column, perform Carrier Gas Leak Check to check that the connection has no leak.
If you do not connect/disconnect the column, you can skip Carrier Gas Leak Check.
- 11 Press  (HOME) - [GC Start/Stop Sequence].
[GC Start Sequence] screen appears.
▶▶ Reference "7.1.1 [GC Start Sequence] Screen" P.143
 - 12 Set [Start Temp/Det] to [Enable].
 - 13 Set the period of time after flow control starts until temperature/detector control starts in [Start Time].
 - 14 Set other parameters related to the GC start.
 - 15 Press [Start GC] to start the GC.
The GC starts according to [GC Start Sequence] screen settings.
After the GC startup is completed, the status light illuminates in green and Monitor screen is displayed.

7

Check the instrument status on Monitor screen.

- 1 Wait until the baseline becomes stable.
- 2 Press  (Auto Zero).
The detector output is adjusted to 0 µV.

8

Inject the sample and start the analysis.**When using AOC**

▶▶ Reference For settings of AOC, refer to the AOC Instruction Manual.

- 1 Check the syringe, etc. of AOC and set the sample.
- 2 Set parameters related to AOC.
▶▶ Reference "7.3 AOC" P.165
- 3 If you are using AOC-20i, press [Start AOC].
If you are using AOC-30i, press the [START] button on the auto injector.
AOC starts and the instrument performs the analysis according to the set analysis conditions.
After the analysis is completed, the instrument goes into waiting mode.

For manual injection

▶▶ Reference "3.4 Sample Injection" P.38

! CAUTION

Instruction

Wear safety glasses during sample injection.

The sample may squirt and be got in your eyes causing damage of your eyes.

- 1 Charge the syringe with the sample.
- 2 Inject the sample.
- 3 Press  (START).

The instrument performs the analysis according to the set analysis conditions.
After the analysis is completed, the instrument goes into waiting mode.

9**Stop the GC.**

- 1 Display [GC Stop Sequence] screen.
▶▶ Reference "7.1.2 [GC Stop Sequence] Screen" P.146
- 2 Set the period of time after [Stop GC] is pressed until the instrument stops temperature/detector control in [Stop Time].
- 3 Set the period of time between the end of temperature/detector control and the end of flow control in [Flow Off Time].

▼ **NOTE** When the detector is BID, set [Flow Off Time] at a value more than 60 minutes because flow control should be stopped after helium purifier is cooled adequately. If flow control stops when helium purifier is hot, it accelerates degradation of helium purifier.

- 4 Set other parameters related to the GC stop.
- 5 Press [Stop GC] to stop the GC.
The GC stops according to [GC Stop Sequence] screen settings.

3**10****Press the power button on the front of the instrument to turn off the instrument.**

- ▼ **NOTE**
- When you set [Sleep] at [Enable], the instrument automatically goes into sleep mode after the time set in [Flow Off Time] elapses.
 - If you press the power button before the time set in [Flow Off Time] elapses, a message appears. Press [Ok] to turn off the power.

3.3 Preparation for Analysis

This section includes supplementary information about the parts which require preparation before analysis.

■ Glass insert

- There are two types of glass inserts, one for split analysis and the other for splitless/WBI analysis. Select the correct type based on the sample injection method. Although a glass insert for split analysis can be used for splitless analysis, it is recommended to use a glass insert for splitless analysis (inactivated) when you inject easily decomposable or adsorbable sample using splitless method.
- The quantity and position of the glass wool filled in the insert directly affects the repeatability of results.

▶▶ **Reference** Guide for packing position of silica wool in Maintenance Help.

■ Column

- Ensure that carrier gas is flowing for enough time to flush the air in the column before increasing the column temperature. Otherwise, the column liquid phase becomes oxidized, and cannot separate compounds properly. This is especially important for polar columns because they are sensitive to oxidation. Ensure that the air in the column is completely replaced with the carrier gas before increasing the column temperature. When you set [Start Time] on [GC Start Sequence] screen, the carrier gas flows for the set time prior to temperature control of the parts.
- Selection of the analysis column is very important in GC analysis. In general, select a liquid phase whose polarity and chemical characteristics are similar to those of the analysis target compound to obtain good peak shape. However, highly polar columns require low temperatures and do not last long. Therefore, when analyzing an unknown sample, analyze it with a neutral column which resists higher temperatures and then switch to a more polar column if necessary.

■ Capillary column installation

- Secure the ferrule to the capillary column using adjuster and nuts or Pre-Fix Tool (optional). Before securing the ferrule, ensure that there are no clogging in the column end and the edge of the cut is completely straight.
- For a graphite ferrule, use the nuts for graphite ferrules. Use a nut without a slit on the injection port side, and use a nut with a slit on the detector side. Before securing the ferrule on the injection port side, slide the column through a nut without slit. For a graphite Vespel® ferrule, use the nuts for graphite Vespel® ferrules. Before securing a graphite Vespel® ferrule, slide the column through a nut. For ClickTek ferrule (optional), use ClickTek connector both on the injection port side and the detector side.
- The column adjuster cannot be used for splitless analysis with wide bore columns because the different length of column should be inserted. (The column adjuster can be used on the detector side.)

■ Packed column installation

When connecting glass columns, ensure that the direction of the back ring used at the sealing part is correct.

The direction depends on the sealing material.

▶▶ **Reference** Installation of glass column in Maintenance Help.

■ Sample injection modes

Split injection

Capillary columns have small inner diameters and low capacity of the sample load. Unlike packed columns, sample of a few microliters cannot be introduced at one time. The split injection mode only allows part of the injected sample to enter the column.

Use the split injection mode first to develop analytical conditions for unknown samples. Set the split ratio at approximately 1:50 for the narrow column (ex. 0.25 mm I.D.). If the target peak is too large, increase the split ratio. If the target peak is too small or cannot be detected, decrease the split ratio. Select a proper split ratio in this way. The standard to set the split ratio is $[\text{Column Flow Rate} + \text{Split Flow Rate}] \geq 30 \text{ mL/min}$. The value varies depending on the columns' inner diameter and flow. It is recommended to start with the total flow of approximately 50 mL/min.

If the desired sensitivity cannot be achieved at

$[\text{Column Flow Rate} + \text{Split Flow Rate}] < 20 \text{ mL/min}$, consider other injection methods.

Splitless injection

In the splitless injection mode, almost all of the sample amount injected is introduced in the column. This method is effective for analyzing a low concentration sample which cannot be easily detected by the split injection mode. Create a temperature ramp program to reduce peak broadening of the target component introduced in the column in splitless mode. Set the column initial temperature to a temperature lower than the boiling point of the sample solvent to condensate and vaporize the sample in the column. The high pressure injection can reduce the volume of vaporized sample solution and improve the analysis repeatability.

Direct injection

In the direct injection mode, almost all of the sample amount injected is introduced in the wide bore column. Because the inner diameter of the wide bore column is 0.45 mm or more, separation is not as good as that of a column with smaller inner diameter. Because the peak shape becomes broad, sensitivity may not be good enough.

■ Temperature settings

The temperatures of the injection port, the column oven and the detector can be set individually. Usually, the injection port and the detector are set at a temperature higher than the column oven. Set the injection port at a temperature where an injected sample instantaneously evaporates (the temperature varies depending on the target substances). Always set the detector temperature higher than the column oven temperature. Never set the column oven temperature higher than the detector temperature because the detector could become contaminated. When creating a column oven temperature program, be careful not to set the final oven temperature higher than that of the detector.

■ Column oven temperature program

Use this temperature program mainly to analyze samples with a wide boiling point range. When you develop analytical conditions for an unknown sample or cannot expect the chromatogram, start the analysis using a temperature program with a low initial temperature (40 °C to 50 °C) and a temperature increase rate of approximately 10 °C/min. Based on the results, check the temperature range in which the peaks appear, then examine the analytical conditions. This procedure facilitates time program development.

■ Analysis counter

Press  (HOME) - [Function] - [Diagnosis] - [Analysis Counter] to display [Analysis Counter] screen. On this screen, you can set the threshold of septum, glass insert and syringe counter use and reset the counter. The septum, glass insert and syringe requires inspection and replacement periodically. Set the threshold on [Analysis Counter] screen. It helps to know when you should replace them. When the number of injections exceeds the threshold (actually the instrument counts the number of reception of the start signal), a message appears on the screen and AOC stops injection. When [Batch Behavior at Threshold] is set at [Stop], AOC stops injection if it exceeds the threshold while the batch schedule is running.

The cycle of replacement of the septum, glass insert and syringe are different depending on the analytical conditions and samples. For analysis in which the glass insert is easily contaminated (when analyzing samples which include large amount of non-volatile compounds for example), set [Threshold] in [Liner Counter] at a small value and perform inspection in a short cycle. On the other hand, when analyzing samples which do not include non-volatile compounds (standard sample for example), the threshold can be increased.

■ Start GC

Press  (HOME) - [GC Start/Stop Sequence] to display [GC Start Sequence] screen. You can set parameters related to the GC startup such as start time and clean up. When you press [Start GC], the instrument starts to control parts of the instrument according to the settings. Clean up function runs a GC program without injecting sample to remove contaminations that may be caused by the last analysis before an analysis.

Set [GC Start Setting] at [Auto Start] to automatically start the GC after the instrument is turned on; this helps with instrument recovery after a power failure.

The initial step in the start sequence should be turning on the carrier gas flow to avoid contamination of the detector and column damage. After the first step, increase the injection port and detector temperatures and then increase the column oven temperature. When you set [Start Time], the carrier gas flows for the set time and then the instrument automatically starts the temperature control. The instrument controls the temperatures so that the column temperature never increases above the detector temperature, even if all temperatures are set to increase at the same time.

■ Stop GC

Press  (HOME) - [GC Start/Stop Sequence] while the GC is turned on to display [GC Stop Sequence] screen. When you press [Stop GC], the instrument stops the temperature control after the time set in [Stop Time] elapses, flows the carrier gas for the time set in [Flow Off Time], and then stops GC.

When shutting down the GC, the temperatures of parts should be decreased at first, then the carrier gas should be stopped to protect columns. Set [Stop Time] and [Flow Off Time] to shut down the GC safely.

Do not shut down the GC in an improper manner and turn off the instrument. This may cause a malfunction.

■ For good repeatability

- Auto injector is recommended for liquid samples.
- If several injection ports are installed but you do not perform dual injection, do not control the temperature of the unused injection port (by not configuring the unused injection port in the analytical line for example).
- Use the instrument at recommended room temperatures (18 °C to 28 °C). Room temperatures above 28 °C will negatively impact repeatability for some analytical conditions. Even if room temperature is within the recommended range, repeatability may become poor when room temperature fluctuates considerably. When the air conditioner blows directly on the instrument, repeatability may become poor.

3.4 Sample Injection

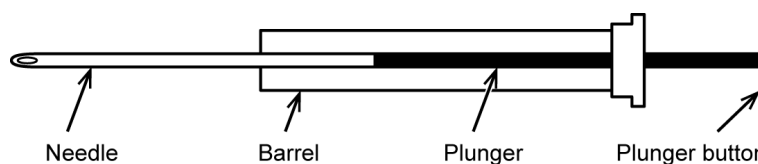
This section describes the procedure of analysis with manual injection.

►► **Reference** For auto sample injection with auto injector, refer to the AOC Instruction Manual.

Required devices

- Micro syringe
- Sample
- Rinse organic solvent (such as acetone and hexane)
- Liquid waste container
- Safety glasses

Precautions for micro syringe use



- Do not bend the plunger and keep it clean.
- Do not bend the needle.

1

Clean the syringe with organic solvent.

- 1 Place the syringe into the rinse organic solvent. Pull the plunger to aspirate approximately 8 to 10 μL of organic solvent. (When using 10 μL syringe)
- 2 Expel the organic solvent into the liquid waste container.
- 3 Repeat the above procedure about 3 to 5 times.

2

Clean the syringe with sample.

- 1 Place the syringe into the sample. Pull the plunger to aspirate approximately 8 to 10 μL of sample.
- 2 Expel the sample into the liquid waste container.
- 3 Repeat the above procedure about 3 to 5 times.

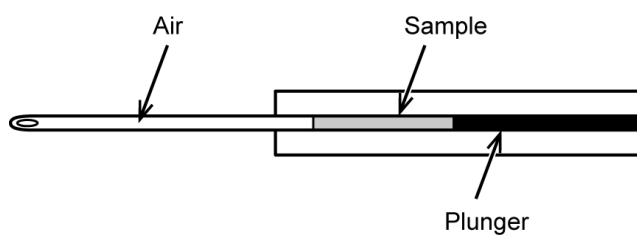
3

Charge the syringe with the sample.

- 1 With the needle in the sample vial, pump the plunger to eliminate air bubbles inside the syringe (pumping).
- 2 After air bubbles are eliminated, aspirate an exact amount of necessary sample (e.g. 1 μL).
- 3 Wipe off the sample on the needle with a clean lint-free paper.
- 4 Lift the plunger and aspirate the air so that no sample will remain in the needle.



Hint Aspirate slowly and discharge quickly for higher effectiveness.



4

Inject the sample.

! CAUTION

Instruction

Wear safety glasses during sample injection.

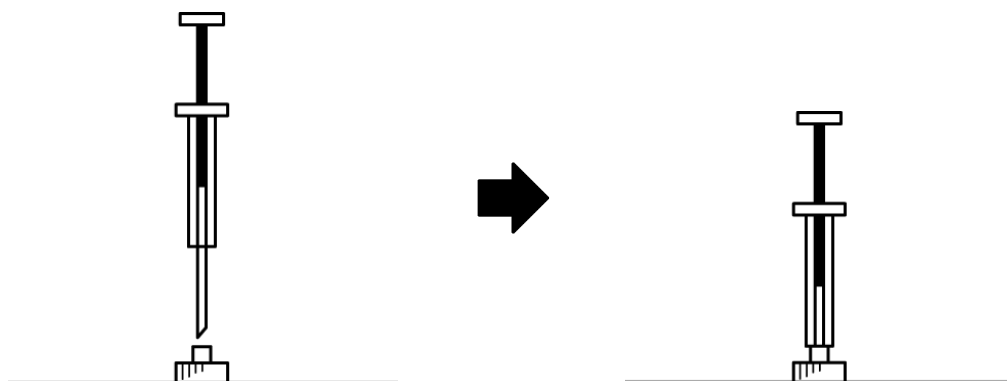
The sample may squirt and be got in your eyes causing damage of your eyes.



Instruction

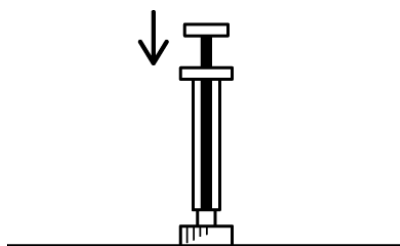
Make sure to attach the inlet cover when manually injecting the sample in the injection port.

- 1 Insert syringe until it touches needle guide (the end of the needle).

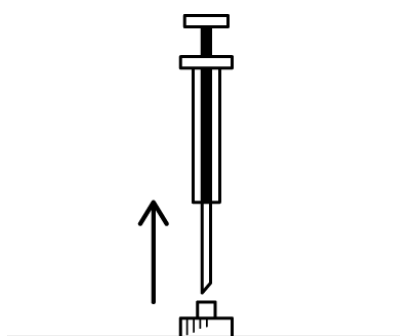
**Hint**

When you insert the syringe unit, the plunger may project due to the inlet pressure. Support the plunger button with fingers during injection to avoid plunger projection.

- 2 Push the plunger button to inject sample promptly. At the same time, press  (START) key on the instrument.



- 3 Promptly pull out the syringe.



3

3.5 Starting and Stopping Analysis

■ Starting analysis

When the status light illuminates in green and the instrument status is [READY], you can start analysis. Press  (START) to start temperature program, time program, pressure program, flow program and linear velocity program. At the same time, start signal is sent to the data processing unit and the instrument starts to obtain data. When you set pre-run program, the instrument executes it, starts the analysis programs, and then sends start signal to the data processing unit.

■ Stopping analysis

After a sequence of the analysis is completed, the instrument automatically goes into waiting mode. Press  (STOP) to force the analysis or programs to terminate. When you press  (STOP), the instrument returns to the initial state and the instrument status changes from "NOT READY" to "READY".

■ Data processing unit operation

When using LabSolutions

Use [Start Single Analysis] or [Start Batch Analysis] button on LabSolutions to start analysis.

Press [Stop] button on LabSolutions to stop analysis.

▶▶ **Reference** For LabSolutions operation, refer to LabSolutions Instruction Manual.

When using CHROMATOPAC

[START] and [STOP] key on CHROMATOPAC can control CHROMATOPAC, but not the instrument.

Use  (START) and  (STOP) button on the instrument to start and stop analysis.

When you press  (START), CHROMATOPAC starts to collect data automatically.

However,  (STOP) button cannot stop the data collection by the CHROMATOPAC. Press [Stop] key on CHROMATOPAC to stop CHROMATOPAC.

▶▶ **Reference** On "[Analog Output Start Signal] Screen" P.348 screen, you can set the channel of the analogue terminal which sends signals to CHROMATOPAC when  (START) is pressed.

4 Maintenance and Inspection

Periodic inspection and replacement are required to maintain the instrument performance for a long time and obtain correct analytical data.

This chapter describes items which require periodic inspections.

If the inspections reveal any abnormality of the instrument, stop the operation and contact your Shimadzu sales/service representative.

If you make a maintenance contract with us, Shimadzu service personnel performs periodic inspection. Ask your Shimadzu sales/service representative about the maintenance contract.

4.1 Precautions for Maintenance and Inspections

WARNING



Instruction

Ensure that the column oven temperature drops below 40 °C on [Temp Monitor] screen.

Ensure that the temperatures of the injection port and the detector drop below 50 °C on [Temp Monitor] screen.

- Temperatures of parts may be high immediately after the GC stops. Operate them after temperatures of parts drops to a temperature where you can perform maintenance.
- Operation at a high temperature may cause burns. Tightening the nut or ClickTek connector (optional) at a high temperature may cause the seizing (galling) of the sliding part.

▶▶ Reference "7.2.3 [Temp Monitor] Screen" P.163



Instruction

For parts replacement, use items listed in "[2.1 Standard Accessories](#)" P.3, "[Gas Chromatograph Accessories and Supplies](#)", and "[Maintenance Help](#)".

When you use items not on the lists, the part may be damaged and may not operate properly. It may also cause malfunction or injury.

▶▶ Reference "[4.5 Consumables](#)" P.50

! CAUTION

Instruction

Wear gloves and use proper tools.

- If you directly touch parts, the parts may be contaminated affecting the analytical data.
- Remove dirt of tools with a gauze, etc. moistened with acetone before use.



Instruction

Place removed parts on a clear tray or sheet.

Pay attention not to lose or contaminate them.



Prohibition

Do NOT perform maintenance or inspection while the inlet pressure is high.

Septum and O-ring may project. And, rapid change of the inlet pressure may cause misalignment of the silica wool. This may cause incorrect analytical result.

4.2 Recommended Inspection Cycle

Inspect the parts based on the recommended inspection/replacement cycle.

▶▶ **Reference** See Maintenance Help for the maintenance of the parts.**NOTE**

- Recommended number of analysis and inspection cycles should be used for reference only. They are not warranty period.
- Inspect all items when you analyze a new sample or change analytical method.
- Inspection cycle is different depending on the instrument usage and the samples to be analyzed. Inspect the instrument according to the situation.
- Contact your Shimadzu sales/service representative for inspection of detectors (TCD, PTCd, ECD, and BID).

Inspection items	Inspection/replacement cycle						Corrective action
	1 month	3 months	6 months	1 year	2 years	Other	
Septum						✓	When using syringe for AOC, replace it after approx. 100 analyses. When using gastight syringe with thick needle tip, replace it after approx. 50 analyses.
Glass insert						✓	Inspect or replace it after approx. 100 analyses. If the position of the silica wool is correct and glass insert/wool is not contaminated, they can be used again.
Insert O-ring						✓	Replace it when you replace the glass insert. Not reusable.

Inspection items	Inspection/replacement cycle						Corrective action
	1 month	3 months	6 months	1 year	2 years	Other	
Syringe						✓	Clean it after approx. 500 analyses. Check that there is no problem with the following 2 points after the cleaning. • The plunger moves smoothly. • The sample is ejected straight from the needle end.
Split filter	✓		✓				Inspect it once a month and replace it every about 6 months.
Capillary column						✓	Perform conditioning when you install the column.
SUS column						✓	Perform conditioning when you install the column.
Glass column						✓	Perform conditioning when you install the column.
Graphite ferrule						✓	Check it when you install the column. Replace it if there is no space between the back ring and side ring.
Graphite Vespel [®] ferrule						✓	Check it when you install the column.
ClickTek ferrule						✓	Check it for dust and damage when you install the column. Replace it after approx. 5 attaching/detaching. Up to 10 attaching/detaching is allowable.
ClickTek adapter						✓	Replace it once every 3 years.
ClickTek connector						✓	Replace it once every 3 years.
FID igniter				✓			Replace it once a year.
FID collector				✓			Replace it once a year. Replace it if noise becomes large.
FID jet				✓			Replace it once a year. Replace it if noise becomes large.
FTD collector						✓	Recondition or replace the alkaline source if the desired sensitivity cannot be achieved or there is spike noise on the minus side on standby.
FTD jet				✓			Replace it once a year. Replace it if noise becomes large.
FPD interference filter			✓			✓	Inspect it once every 6 months. Clean or replace it if it is contaminated.
FPD photomultiplier					✓		Replace it once every 2 years.
FPD igniter				✓			Replace it once a year.

Inspection items	Inspection/replacement cycle						Corrective action
	1 month	3 months	6 months	1 year	2 years	Other	
FPD quartz tube			✓		✓		Inspect it once every 6 months and replace it every about 2 years.
FPD lens			✓			✓	Inspect it once every 6 months or when you replace the interference filter. Clean or replace it if it is contaminated.
O-ring inside the FPD filter			✓			✓	Inspect it once every 6 months or when you replace the interference filter. Clean or replace it if it degenerates.
SCD inner pyrotube						✓	Replace it once every 1000 hours. Replace it when desired sensitivity cannot be obtained. Early replacement may be required depending on usage conditions.
SCD outer pyrotube						✓	Used in combination with the three inner pyrotubes provided with the product and the consumable set. When using a tube other than the provided inner pyrotubes, also replace the existing outer pyrotube at the same time. Otherwise, sufficient performance may not be obtained. Early replacement may be required depending on usage conditions.
SCD ozone scrubber				✓			Replace it once a year. You can replace only the filler, but we recommend to replace the ozone scrubber itself.
SCD vacuum pump				✓			Maintain it once a year. Contact your Shimadzu sales/service representative.
Gas filter				✓			Replace it once a year.
PTV liner						✓	Inspect or replace it after approx. 100 analyses. If the position of the silica wool is correct and glass insert/wool is not contaminated, they can be used again.
OCI liner						✓	Inspect or replace it after approx. 100 analyses.
OCI glass liner						✓	Inspect or replace it after approx. 100 analyses.
OCI-2030 NX liner						✓	Inspect or replace it after approx. 100 analyses.
Hydrogen sensor (Ver.2) filter				✓			Replace it once a year.

4.3 Important Points for Inspection

4.3.1 Injection Port

■ Septum

Repeated injections can deteriorate the septum, interfering with its sealing ability and causing carrier gas leaks.

This can cause retention time shifts and poor repeatability. In addition, septum fragments can fall into the glass insert, causing ghost peaks.

Replace the septum if the repeatability of retention time or peak area is poor or ghost peaks are detected. If ghost peaks are detected after septum replacement although no septum fragments are found in the glass insert, condition the septum or use a different type of septum (for example, use a septum of which bleeding does not appear in positions that interfere with the peaks of the target compounds).

■ Glass insert

If the repeatability of retention time or peak area is poor or ghost peaks are detected, the silica wool may be out of position or the inside of the glass insert may be contaminated.

Remove and inspect the glass insert. Replace the glass insert if the position of the silica wool is correct, the glass insert is not contaminated, and the problem cannot be solved even after cleaning.

■ O-ring

When operating the instrument for long hours at the injection port temperature more than 350 °C, the durability decreases. Therefore, check the carrier gas leakage every week.

You can use O-ring several times if there is no leakage, however, it is recommended that you replace it concurrently with the glass insert replacement.

4.3.2 Column Oven

■ Column

When the sample component remains in the columns, the baseline may be unstable or ghost peaks may be detected. Condition or replace the column. For capillary columns, contamination may be removed by cutting the end of the column.

■ Graphite ferrule

Graphite is a soft material and easily changes its form, therefore it is easy to handle. When graphite reduces, the carrier gas may leak. When there is no space between the back ring and the side ring and the ferrule cannot be fixed, replace it with a new graphite ferrule.

■ ClickTek ferrule

ClickTek ferrule can be used for analyses repeatedly without loosening. It has good sealing performance. However, once ClickTek ferrule is attached to a column, you cannot remove the ferrule or attach it to another column.

■ Graphite Vespel® ferrule

Use a graphite Vespel® ferrule for SCD or MS where a high vacuum level is required. However, once the graphite Vespel® ferrule is attached to a column, you cannot remove the ferrule and attach it to another column.

4.3.3 Detector

If the detector parts is clogged or contaminated, remove it with a slender, long wire or a cotton swab moistened with organic solvent such as acetone.

■ FID

Inspect the following 3 points for FID.

- Whether the igniter filament is not broken.
- Whether the inside of the collector is not clogged or contaminated.
- Whether the jet is not clogged or contaminated, and the jet is not broken.

If you fail to ignite even after the contamination is removed, or the flame is extinguished frequently during analysis, replace it.

■ FTD

Inspect the following 3 points for FTD.

- Whether silica is not precipitated out of the alkaline source inside the collector cover and it does not close the exhaust hole.
- Whether the jet is not clogged or contaminated, and the jet is not broken.
- Whether the collector is not contaminated and the alkaline source is not consumed.

If noise level increases or sensitivity decreases even after the contamination is removed, replace it.

■ FPD

Inspect the following 3 points for FPD.

- Whether the igniter filament is not broken.
- Whether the interference filter is not contaminated.
- Whether the quartz cylinder is not contaminated or broken.

If noise level increases or sensitivity decreases even after the contamination is removed, replace it.

■ SCD

Inspect the following 2 points for SCD.

- Whether the inner pyrotube or outer pyrotube is not contaminated.
- Whether the inner pyrotube or outer pyrotube is not broken.

If a problem is found in the above points, replace the part.

4.3.4 AFC

■ Split filter

Replacement every 6 months is recommended, however, the cycle should be shorter than 6 months when you plan for several analyses of samples which contain large amount of high-boiling components or which are solid at room temperature. Change the inspection cycle depending on the situation.

Check whether the split filter is not clogged by the following procedures:

- 1 Press  (HOME) - [Injection Port].
[INJ/FLOW] screen appears.
- 2 Set [Purge Flow] at "0".
- 3 When the inner diameter of the column is greater than 0.32 mm, remove the column on the injection port and seal the connection with a graphite ferrule (with wire) and column nut.

 **Hint** When the inner diameter of the column is 0.32 mm or less, leave the column.

- 4 Set [Injection Mode] to [Split].
- 5 Set [Inlet Press] and [Total Flow] at the following values.
 - Inlet Press : 1.0 kPa
 - Total Flow : 400.0 mL/min
- 6 Check the actual measured value of [Inlet Press].
When the inlet pressure is 50 kPa or greater, replace the split filter.

■ Gas leak

Gas leak causes poor repeatability. It also wastes the carrier gas. Perform gas leak check periodically to check gas leak from AFC.

▶▶ Reference ["Carrier gas leak check \(Capillary\)" P.54](#)

4.4 Replacement Procedure of the Parts

Refer to Maintenance Help for the replacement procedure of the parts.

4.5 Consumables

For consumables, see the standard accessory list of the instrument.

▶▶ Reference ["2.1 Standard Accessories" P.3](#)

Shimadzu provides various parts other than the standard accessories.

The parts required for analysis are listed in "Gas Chromatograph Accessories and Supplies" or "Maintenance Help".

You can download "Gas Chromatograph Accessories and Supplies" the latest version at the following site.

<https://www.shimadzu.com/an/products/gas-chromatography/gc-consumables/gc-columns-consumables/index.html>

Contact Shimadzu representative to purchase consumables or maintenance parts.

4.6 Parts to be Replaced Periodically

To maintain the performance of the gas chromatograph, it is recommended to replace the following parts periodically.

- NOTE**
- Replacement cycles shown below are for your reference only. The guarantee period is 1 year.
 - The replacement cycle depends on the installation environment and usage conditions of the instrument.
 - Contact your Shimadzu sales/service representative for the replacement.

Part name	Recommended replacement cycle
Air inlet fan	6 years
INJ/DET fan	3 years
Hydrogen sensor, sensor part	3 years
Hydrogen sensor, pump part	3 years
Oven Light	6 years
Touch panel	6 years
Helium purifier for BID* ¹	6 years
Helium purifier HP2* ¹	6 years

*¹ The helium purifier has a heater built in and its deterioration may be accelerated if the gas supply stops at a high temperature. Replace the gas in the line for more than 60 minutes before its startup, and then turn on the helium purifier. To stop the gas supply, leave the instrument for more than 60 minutes after turning off the helium purifier for cooling, and then shut off the gas.

For the following parts, a message to warn you to replace them appears on the touch panel after a certain period of time.

Part name	Usage time	Remarks
Oven fan motor	61320 hours	• When using it for 8 hours per day: about 21 years • 24-hours continuous operation: about 7 years
Column oven sensor* ¹	26280 hours	• When using it for 8 hours per day: about 9 years • 24-hours continuous operation: about 3 years (300 °C, standard)
INJ/DET sensor* ¹	26280 hours	• When using it for 8 hours per day: about 9 years • 24-hours continuous operation: about 3 years (300 °C, standard)
SCD furnace temp sensor* ²	17520 hours	• When using it for 8 hours per day: about 6 years • 24-hours continuous operation: about 2 years (800 °C, standard)

*¹ It is recommended to replace the heater and the sensor simultaneously.

*² Installed on SCD-2030.

4.7 Cleaning

4.7.1 Cleaning the Touch Panel

The touch panel is a sensitive electronic part.

When the panel gets dirty, wipe it lightly with a soft rag or a rag soaked with a neutral detergent or a small amount of ethanol, and remove the dirt.

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

4.7.2 Cleaning the Exterior

When the exterior of the instrument becomes dirty, wipe the dirt with a dry, soft rag or a piece of tissue paper.

If the dirt is significant, remove the dirt according to the following procedure.

1

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

2

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

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

5 Trouble Shooting

When the result of analysis is not good, check first the following points.

- Whether the glass insert and the silica wool are not contaminated
- Whether the O-ring of the glass insert does not degrade
- Whether the septum has no leak
- Whether the length of the inserted column is correct
- Whether the graphite ferrule is fixed
- Whether the connections of gas lines have no leak
- Whether the supplied gas pressure is proper

- ▶▶ Reference
- ["4.2 Recommended Inspection Cycle" P.44](#)
 - ["4.3 Important Points for Inspection" P.47](#)
 - Maintenance Help

This chapter describes possible problems during analysis and their causes and solutions. If the problem is not solved by the recommended solutions, or if other problems occur, contact your Shimadzu sales/service representative.

5.1 Gas and Pressure Settings

5.1.1 When the Pressure/Flow Rate Cannot Be Set or Does Not Reach the Set Value

Cause	Solution	See also
No gas is supplied.	• Open gas cylinder main valve to supply gas. • Turn [On] the detector/injection port control. • Turn [On] the detector gas control.	P.247 P.185 P.227
Supply pressure is low.	Change the supply pressure of the gas. • Carrier gas: 300 to 980 kPa • Detector gas: 300 to 980 kPa • Hydrogen: 150 to 300 kPa • Air: 300 to 500 kPa	P.402
Gas leaks.	• Check for gas leaks, and tighten leaking connections. • Replace gasket or septum. • Additionally tighten the graphite ferrule. If there is leakage even after additional tightening, replace it.	P.54
Set value is incorrect.	Set pressure at a proper value.	P.427
Set value is outside controllable range.		

Cause	Solution	See also
Carrier gas type or column information is incorrect.	Set carrier gas type or column information correctly.	P.247 P.292
Total flow is too low, and pressure cannot increase.	Increase the total flow.	P.427
Split ratio is set at a low value and total flow is low.	Increase split ratio to increase total flow.	
Split vent trap is clogged.	Replace the filter of the split line.	Maintenance Help
Even if total flow is increased, the actual flow of the split vent is low and the pressure is high.		

5.1.2 When Gas Leaks Cannot Be Stopped

Cause	Solution	See also
Part is incorrectly installed.	Install part correctly.	-
Graphite ferrule or other seal such as O-ring is damaged.	• Replace O-ring. • Additionally tighten the graphite ferrule. If there is leakage even after additional tightening, replace it.	Maintenance Help
Tubing including pipes and joints is damaged.	Replacement of the tubing part is required. Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-

■ Carrier gas leak check (Capillary)

Gas leak causes poor repeatability. It also wastes the carrier gas. Check that there is no carrier gas leak.

1

Prepare the instrument.

- When the GC operates

- 1 Press  (HOME) - [GC Start/Stop Sequence] to display [GC Stop Sequence] screen.
- 2 Set [Flow Control] at [On].
- 3 Press [Stop GC].

- When the GC stops

- 1 Press  (HOME) - [GC Start/Stop Sequence] to display [GC Start Sequence] screen.
- 2 Set [Start Temp/Det] at [Disable].
- 3 Press [Start GC].

2 Press  (Monitor).

Monitor screen appears.

3 Wait until the temperatures of the injection port and the detector drops below 50 °C.

4 Ensure that the column oven temperature drops below 40 °C.

5 Press the icon of the Injection port.

[INJ/FLOW] screen appears.

6 Turn [Off] the flow controller control.

7 Set [Purge Flow] at "0" mL/min.

8 Open the column oven door and remove the column on the inlet side.

9 Seal the connection of the column in the injection port.

5

10 Install a blank nut (G-type (P/N: S221-35566-92)) and a column gasket (P/N: S201-35184) on the purge vent. For SPL or PTV, install a blank nut also on the split vent.

11 Ensure that actual value of [Carrier Gas Primary Pressure] is above "300 kPa".

12 Set parameters at the following values.

Injection Mode	:	Split
Control Mode	:	Press
Inlet Press	:	150 kPa
Total Flow	:	100 mL/min

13 Turn [On] the flow controller control.

14 Wait for [Inlet Press] to rise to 150 kPa or higher, and then turn the control for the flow controller to [Off].

15 Record actual value of [Inlet Press].**16** Wait about 10 minutes and check the decrease of the value. Compare it with actual value of the inlet pressure recorded in step 15.

The followings indicate the presence of a leak.

Actual value of [Inlet Press] in step 15	Leak judgment
Below 150 kPa	The decrease is more than 2.5 kPa
150 to 450 kPa	The decrease is more than 5.0 kPa
450 to 600 kPa	The decrease is more than 7.5 kPa
600 to 750 kPa	The decrease is more than 10.0 kPa
Above 750 kPa	The decrease is more than 12.5 kPa

17 If gas leak is found, resolve it.

▶▶ Reference ["Solutions for gas leaks" P.58](#)

18 Return the connection and settings to original state.

Set [Start Temp/Det] on [GC Start Sequence] screen at [Enable] to start temperature control after you return the settings.

■ Carrier gas leak check (Packed)

Gas leak causes poor repeatability. It also wastes the carrier gas. Check that there is no carrier gas leak.

1 Prepare the instrument.

- When the GC operates

- 1 Press  (HOME) - [GC Start/Stop Sequence] to display [GC Stop Sequence] screen.
- 2 Set [Flow Control] at [On].
- 3 Press [Stop GC].

- When the GC stops

- 1 Press  (HOME) - [GC Start/Stop Sequence] to display [GC Start Sequence] screen.
- 2 Set [Start Temp/Det] at [Disable].
- 3 Press [Start GC].

2 Press  (Monitor).

Monitor screen appears.

3 Wait until the temperatures of the injection port and the detector drops below 50 °C.

4 Ensure that the column oven temperature drops below 40 °C.

5 Press the icon of the Injection port.

[INJ/FLOW] screen appears.

6 Turn [Off] the flow controller control.

7 Open the column oven door and remove the column on the inlet side.

 **NOTE** When removing the column, pull the adapter straight down to avoid breaking the tip of the glass insert.

8 Seal the connection of the column in the injection port.

9 Set [Column Flow] at "100" mL/min.

10 Turn [On] the flow controller control.

11 Wait for [Inlet Press] to rise to 150 kPa or higher, and then turn the control for the flow controller to [Off].

12 Record actual value of [Inlet Press].

13

Wait about 10 minutes and check the decrease of the value. Compare it with actual value of the inlet pressure recorded in step 12.

The followings indicate the presence of a leak.

Actual value of [Inlet Press] in step 12	Leak judgment
Below 150 kPa	The decrease is more than 2.5 kPa
150 to 450 kPa	The decrease is more than 5.0 kPa
450 to 600 kPa	The decrease is more than 7.5 kPa
600 to 750 kPa	The decrease is more than 10.0 kPa
Above 750 kPa	The decrease is more than 12.5 kPa

14

If gas leak is found, resolve it.

▶▶ Reference "Solutions for gas leaks" P.58

15

Return the connection and settings to original state.

Set [Start Temp/Det] on [GC Start Sequence] screen at [Enable] to start temperature control after you return the settings.

Solutions for gas leaks

Check whether the following parts have gas leaks using leak detector or Snoop.

- Septum
- Around the injection port
- Connections of tubing
- Split vent (Around the blank nut)
- Purge vent (Around the blank nut)
- Column connection

WARNING



Instruction

Take precautions when using Snoop or similar soap solution not to drip onto electronic parts or wiring.

This may cause electric shock.

CAUTION



Prohibition

Do not use the leak detecting fluid nor soapy water for gas leak check on the connections above the carrier and detector gas controllers (AFC/APC).

The drips may damage the controller.

If the leak position is found, perform the following actions.

►► **Reference** See Maintenance Help for the replacement procedure of the parts.

Item	Corrective action
Septum	Replace the septum.
Around the injection port	Replace O-ring of the glass insert.
Split vent	Replace the seal of blank nut.
Purge vent	Replace blank nut.
Column connection	Replace ferrule, column nut, or ClickTek connector (optional).

- **NOTE**
- In some sensitive analyses, Snoop can interfere with proper detection. In those situations, use a leak detector.
 - The instrument allows 0.2 mL/min leakage from split/purge vent.

5.2 Temperature Control

5.2.1 When the Temperature Does Not Increase or Reach the Set Value

Cause	Solution	See also
• GC has not started yet. • Press  (HOME) - [GC Start/Stop Sequence]. [GC Start Sequence] screen appears.	Press [Start GC] on [GC Start Sequence] screen to start the GC.	P.143
Because start time is too long, heating has not started yet.	Set start time at a lower value.  Hint Immediately after this setup value is changed, the new value is in effect.	P.143
Heat loss is large.	• Close the oven door. • Close the hole of the insulation.	-
Because maximum temperature is set at a very low value, an overheat error occurs.	• Increase the maximum temperature setting for the column and other units. • Set [Max Usable Temp] on [Column Information] screen correctly.	P.336 P.292
Detector temperature is lower than the set value of column temperature.	Set detector temperature larger than column temperature.	P.185

5.3 Detector (Common)

5.3.1 No Peaks or Extremely Small Peaks (for all detectors)

Cause	Solution	See also
Signal cable of the detector is connected incorrectly.	Connect signal cable correctly.	Maintenance Help
Detector control is turned [Off].	Turn [On] the detector control.	P.185
Signal cable of the data processing unit is connected incorrectly.	Connect signal cable correctly.	P.457
There is a leak at the connection of the detector with the column.	Check for gas leaks, and tighten leaking connections.	P.54
The length of the inserted column on the detector side is incorrect.	Install the column correctly.	Maintenance Help
Detector attenuation, range, or current is not appropriate.	Set detector attenuation, range, and current at appropriate values.	P.185
Zero level is far below "0".	Check the signal level on Monitor screen and perform Auto Zero.	P.156
Injection volume is too low. Or sample concentration is low.	• Increase injection volume. (Normally, less than 2 μL for liquid samples and less than 1 mL for gas samples.)  NOTE Large injection volume may contaminate the injection port. • Increase sample concentration.	-
Split ratio is too high. (For split analysis)	Reduce split ratio.	P.247 P.260
Sample is injected incorrectly.	• Check the clogging or leaks of the syringe and repair it. • Replace syringe.	Maintenance Help
Component is adsorbed in the glass insert.	• Replace the glass insert with inactivated one. • Replace the glass insert with acid or alkaline treated one depending on the component.	Maintenance Help
Detector gas flow is incorrect.	Set it at a proper (recommended) value.	Maintenance Help
Detector filter time constant is incorrect.	Set it at a proper (recommended) value.	P.229
Another analytical condition, such as temperature or column flow is incorrect.	Change the analytical conditions.	-
Detector gas controller (APC) fails.	Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-

5.3.2 Baseline Noise Is High (for all detectors)

Cause	Solution	See also
Column is contaminated.	• Condition column. • Seal the column fittings and check the baseline. When noise is small, the column is contaminated or degrades. Replace it with a new column.	Maintenance Help
Glass insert or silica wool is contaminated.	Replace glass insert or silica wool.	Maintenance Help
Carrier gas or detector gas quality is poor.	• Replace the gas with higher purity one. • Provide filters in carrier gas line and each detector gas line. • If above measures cannot resolve the problem, replacement of the tubing part is required. Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	Maintenance Help
Gas filter is contaminated.	Replace gas filter.	-
Signal cable of the detector is connected incorrectly.	Connect signal cable correctly.	Maintenance Help
Detector gas flow is incorrect.	Set it at a proper (recommended) value.	Maintenance Help
Detector filter time constant is incorrect.	Set it at a proper (recommended) value.	P.229
Detector gas controller (APC) fails.	Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-

5.3.3 Baseline Drift or Long-term Fluctuation (for all detectors)

Cause	Solution	See also
Column is contaminated.	Condition column.	Maintenance Help
Glass insert or silica wool is contaminated.	Replace glass insert or silica wool.	Maintenance Help
Carrier gas or detector gas quality is poor.	• Replace the gas with higher purity one. • Provide filters in carrier gas line and each detector gas line. • If above measures cannot resolve the problem, replacement of the tubing part is required. Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	Maintenance Help

Cause	Solution	See also
Gas filter is contaminated.	Replace gas filter.	-
There is a leak at the connection of the detector with the column.	Check for gas leaks, and tighten leaking connections.	P.54
The length of the inserted column on the detector side is incorrect.	Install the column correctly.	Maintenance Help
Room temperature is not within the recommended range and/or is fluctuating considerably.	Keep the room temperature within the recommended range and reduce the fluctuation.	-
Temperatures of parts are unstable.	Check temperatures of parts on [Temp Monitor] screen. If they are unstable after a certain period of time, turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	P.163
Flow is unstable.	Check pressure and flow of AFC and APC on [Flow Monitor] screen. If they are unstable after a certain period of time, turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	P.164
The air conditioner blows on the instrument.	Change the instrument installation site.	-
Signal cable of the detector is connected incorrectly.	Connect signal cable correctly.	Maintenance Help
APC fails.	Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-

 **NOTE** Baseline may fluctuate because temperatures or flows of parts are unstable. Check displayed value on the monitor screen. If the baseline fluctuates, contact your Shimadzu sales/service representative.

5.3.4 Zero Adjustment Error (for all detectors)

Cause	Solution	See also
Data processing unit is connected improperly.	Connect it properly.	P.457
Hydrogen flame of FID or FPD does not ignite, or settings for the detector are not correct.	• Ignite it. • Correct settings for the detector.	P.186 P.207

5.4 Detector (FID)

WARNING



Instruction

Shut off the hydrogen gas supply before inspection.

Large amount of hydrogen leak may cause explosion.

5.4.1 No Peaks or Extremely Small Peaks (FID)

►► Reference "5.3.1 No Peaks or Extremely Small Peaks (for all detectors)" P.60

Cause	Solution	See also
Hydrogen flame does not ignite.	Check flows of hydrogen, air and detector gas and ignite it again.	P.186
High pressure brush is installed incorrectly.	Install high pressure brush correctly.	Maintenance Help
Detector sensitivity is low.	Set [Signal Range] at [x1].	P.229
Jet or cable is damaged.	Replace jet or cable.	Maintenance Help

5.4.2 Cannot Ignite or Flame Is Extinguished (FID)

Cause	Solution	See also
Column is not connected.	Connect column.	Maintenance Help
The length of the inserted column is not correct.	Ensure that the length of the column inserted in the detector is 72 mm. If not, adjust the length with ferrule adjuster.	Maintenance Help
Jet is clogged.	Perform maintenance for the jet or replace it.	Maintenance Help
Igniter filament is broken.	Replace the igniter.	Maintenance Help
Hydrogen, air, or detector gas is not supplied or their flow are not correct.	Supply them and set the flows at proper values.	P.186
Detector temperature is low.	Set detector temperature at a higher value.	P.186
The air in the tubing is not adequately replaced with hydrogen gas.	Repeat ignition sequence several times to replace the air completely.	P.190

Cause	Solution	See also
(When using a packed column) The total flow rate of carrier gas and makeup gas is too low/high.	- Adjust the total flow rate of carrier gas and makeup gas to 20 to 50 mL/min. - If it is necessary to increase the flow rate, increase hydrogen flow by a few mL to 10 mL. - If it is impossible, first adjust the total flow rate of carrier gas and makeup gas to 20 to 50 mL/min, ignite the flame, and then set the desired flow rate.	Maintenance Help

5.4.3 Baseline Noise Is High (FID)

▶▶ Reference "5.3.2 Baseline Noise Is High (for all detectors)" P.61

Cause	Solution	See also
There is dust at the bottom of quartz jet.	Blow air on the jet to remove dust.	Maintenance Help
Jet is damaged.	Replace the jet.	Maintenance Help
Collector is contaminated.	Clean or replace the collector.	Maintenance Help
Gases include large amounts of organic components.	- Check purity of each gas and the pressure regulator. - Connect molecular sieve filter (Super-Clean gas filter) in gas lines. - Perform maintenance for molecular sieve filter. - Change pressure regulator or tubing. To change pressure regulator or tubing, contact your Shimadzu sales/service representative.	-

5.4.4 Baseline Drift or Long-term Fluctuation (FID)

▶▶ Reference "5.3.3 Baseline Drift or Long-term Fluctuation (for all detectors)" P.61

Cause	Solution	See also
Compressed air is contaminated. (check whether the baseline fluctuates according to the compressor pressure)	- Install a silica gel trap on both ends of the pressure regulator. - Use air from a gas cylinder instead. - Use AGE-1000.	-
The air in the tubing is not adequately replaced with hydrogen gas.	Repeat ignition sequence several times to replace the air completely.	P.190

5.5 Detector (TCD, PTCD)

5.5.1 No Peaks or Extremely Small Peaks (TCD, PTCD)

▶▶ Reference "5.3.1 No Peaks or Extremely Small Peaks (for all detectors)" P.60

Cause	Solution	See also
Current set value is too low.	• Increase current setting. • Decrease TCD temperature, and increase maximum working current.	P.192
Detector sensitivity is low.	Set [Signal Range] at [x1].	P.229
Detector gas flow is high.	Set it at a proper value (About 8.0 mL/min for capillary TCD).	P.192

5.5.2 Baseline Noise Is High (TCD, PTCD)

▶▶ Reference "5.3.2 Baseline Noise Is High (for all detectors)" P.61

Cause	Solution	See also
Current set value is too high.*1	Decrease current setting.	P.192
Detector gas flow is low.	Increase the flow.	P.192
Gases include large amounts of impurities.	• Install molecular sieve filter in gas lines. • Replace the gas with higher purity one.	-

*1 Excessively high current can damage the filament and cause significant noise. If the filament is damaged, the cell should be replaced. Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.

5.5.3 Baseline Drift or Long-term Fluctuation (TCD, PTCD)

▶▶ Reference "5.3.3 Baseline Drift or Long-term Fluctuation (for all detectors)" P.61

Cause	Solution	See also
Current set value is too high.	Decrease current setting.	P.192
Cell is contaminated.	• Inject solvent a few times to clean cell. • Condition TCD cell. For TCD cell inspection, contact your Shimadzu sales/service representative.	-

5.5.4 Zero Adjustment Error (TCD, PTCO)

▶▶ Reference "5.3.4 Zero Adjustment Error (for all detectors)" P.62

Cause	Solution	See also
The baseline is unstable.	Wait for a few minutes and then perform zero adjustment again.	-
Current does not pass through filament.	Set the current value properly.	P.192
Current set value is too high.	Decrease current setting.	P.192
Filament is broken.*1	Cell should be replaced. Contact your Shimadzu sales/service representative.	-

*1 Turning on the TCD current when air (oxygen) is present in the cell can oxidize or blow out the filament, making it impossible to perform zero adjustment.

5.5.5 TCD Cell Error Is Displayed (TCD, PTCO)

You need to turn off the main power to clear the error.

Cause	Solution	See also
Current set value is not proper.	Set the current value properly.	P.192
The air in TCD cell is not adequately replaced.	- Supply carrier gas and detector gas for more than 10 minute and then turn [On] TCD control or set TCD current. - Set [Start Time] at more than 10 minute and press [Start GC].	P.143 P.192
Carrier gas or detector gas leaks.	- Check for gas leaks, and tighten leaking connections. - Replace tubing or septum.	P.54 Maintenance Help
Settings for gas type and TCD current are not proper.	Check settings for supply gas and gas type, and set TCD current properly.	P.192

5.6 Detector (FTD)

WARNING



Instruction

Shut off the hydrogen gas supply before inspection.

Large amount of hydrogen leak may cause explosion.

5.6.1 No Peaks or Extremely Small Peaks (FTD)

►► Reference "5.3.1 No Peaks or Extremely Small Peaks (for all detectors)" P.60

Cause	Solution	See also
Collector screw is loose.	Tighten collector screw.	Maintenance Help
The air is supplied by a compressor.	Use a cylinder of high-purity air and a pressure regulator for high-purity gases.	-
Detector gas flow is not optimized.	Set the gas flow at a recommended value for target component (nitrogen or phosphorus compound) and adjust background current.	Maintenance Help
Background current adjustment is performed while there are many vapors (bleeding) from column liquid phase.	• Perform column aging adequately and then adjust background current. • Decrease set value of column oven temperature and then adjust background current.	Maintenance Help P.285 P.200
Detector temperature or detector gas flow is changed after background current adjustment.	Adjust background current again.	P.200
Set value for background current is too low.	Set background current at a higher value.	P.200
Detector sensitivity is low.	Set [Signal Range] at [x1].	P.229
Alkaline source is contaminated.	Condition alkaline source.	Maintenance Help
Alkaline source is consumed and the desired sensitivity cannot be achieved.	When the desired sensitivity cannot be achieved, recondition the collector with "FTD Collector Repair Kit" or replace it.	Maintenance Help
Collector filament is broken.	Replace the collector.	Maintenance Help
Jet is contaminated.	Perform maintenance for the jet or replace it.	Maintenance Help

5.6.2 Baseline Noise Is High (FTD)

▶▶ Reference "5.3.2 Baseline Noise Is High (for all detectors)" P.61

Cause	Solution	See also
Collector screw is loose.	Tighten collector screw.	Maintenance Help
Metal plate on the collector cover opens.	Rotate the metal plate and cover the hole.	Maintenance Help
Alkaline source is contaminated.	Condition alkaline source.	Maintenance Help
The distance between jet and alkaline source is too short.	Adjust the distance between jet and alkaline source.	Maintenance Help
The air is supplied by a compressor.	Use a cylinder of high-purity air and a pressure regulator for high-purity gases.	-
Gases include large amounts of organic components.	• Check purity of each gas and the pressure regulator. • Connect molecular sieve filter (Super-Clean gas filter) in gas lines. • Perform maintenance for molecular sieve filter. • Change pressure regulator or tubing. To change pressure regulator or tubing, contact your Shimadzu sales/service representative.	-
Column is not proper.	Do not use columns having cyanopropyl liquid phases (such as XE-60, OV-25, OV-1701, OV-1301).	-

5.6.3 Baseline Drift or Long-term Fluctuation (FTD)

▶▶ Reference "5.3.3 Baseline Drift or Long-term Fluctuation (for all detectors)" P.61

Cause	Solution	See also
Alkaline source is contaminated.	Condition alkaline source.	Maintenance Help
Jet is contaminated.	Perform maintenance for the jet or replace it.	Maintenance Help

5.6.4 There Is Spike Noise on the Minus Side of Baseline (FTD)

Cause	Solution	See also
Alkaline source is consumed.	When the desired sensitivity cannot be achieved, recondition the collector with "FTD Collector Repair Kit" or replace it.	Maintenance Help

5.6.5 Peaks Go Off Scale in Minus Direction After Sample Injection (FTD)

Cause	Solution	See also
Alkaline source is contaminated.	Condition alkaline source.	Maintenance Help
A large amount of component which cannot be detected by FTD is injected.	If target component cannot be separated, consider conditions for separation using FID or TCD.	-
Halogen-rich sample is injected.	- Remove halogen during pretreatment. - If you use halogen compound as solvent, change the solvent or consider conditions for separation.	-

5.7 Detector (FPD)

WARNING



Shut off the hydrogen gas supply before inspection.
Large amount of hydrogen leak may cause explosion.

Instruction

5

5.7.1 No Peaks or Extremely Small Peaks (FPD)

▶▶ Reference "5.3.1 No Peaks or Extremely Small Peaks (for all detectors)" P.60

Cause	Solution	See also
Hydrogen flame does not ignite.	Check flows of hydrogen and air and ignite again.	P.207
Filter is wrong.	Check filter and change it.	Maintenance Help
Detector gas flow is not optimized.	Set the gas flow at a recommended value for target component (phosphorus, sulfur, or tin compound) and ignite the flame again.	Maintenance Help
Detector sensitivity is low.	Set [Signal Range] at [x1].	P.229
Light leaks in.	Cover the instrument with a blackout curtain, etc. to determine where light leaks in, and correct it.	-
Detector part (quartz cylinder, filter, or photomultiplier) is contaminated.	Clean or replace it.	Maintenance help
Position of hydrogen flame is wrong.	Extinguish the hydrogen flame, check the detector gas flow and ignite again.	P.207

Cause	Solution	See also
Photomultiplier degenerates.	Replace photomultiplier.	Maintenance Help
Quenching occurs and target compound is not separated.	If target component cannot be separated, consider conditions for separation using FID or TCD.	-

5.7.2 Cannot Ignite or Flame Is Extinguished (FPD)

Cause	Solution	See also
Column is not connected.	Connect column.	Maintenance Help
The length of the inserted column is not correct.	Ensure that the length of the column inserted in the detector is 82 mm. If not, adjust the length with ferrule adjuster.	Maintenance Help
Jet is clogged.	Perform maintenance for the jet or replace it.	Maintenance Help
Igniter filament is broken.	Replace the igniter.	Maintenance Help
Hydrogen or air is not supplied or the flow is not correct.	Supply them and set the flows at proper values.	Maintenance Help
Detector temperature is low.	Set detector temperature at a higher value.	P.207
The air in the tubing is not adequately replaced with hydrogen gas.	Repeat ignition sequence several times to replace the air completely.	P.210

5.7.3 Baseline Noise Is High (FPD)

▶▶ Reference "5.3.2 Baseline Noise Is High (for all detectors)" P.61

Cause	Solution	See also
Light leaks in.	Cover the instrument with a blackout curtain, etc. to determine where light leaks in, and correct it.	-
Detector part (quartz cylinder, filter, or photomultiplier) is contaminated.	Clean or replace it.	Maintenance Help
There is a water droplet on the vent.	Purge the vent adequately to remove a water droplet.	-

Cause	Solution	See also
Gases include large amounts of organic components.	• Check purity of each gas and the pressure regulator. • Connect molecular sieve filter (Super-Clean gas filter) in gas lines. • Perform maintenance for molecular sieve filter. • Change pressure regulator or tubing. To change pressure regulator or tubing, contact your Shimadzu sales/service representative.	-

5.7.4 Baseline Drift or Long-term Fluctuation (FPD)

▶▶ Reference "5.3.3 Baseline Drift or Long-term Fluctuation (for all detectors)" P.61

Cause	Solution	See also
Compressed air is contaminated. (check whether the baseline fluctuates according to the compressor pressure)	• Install a silica gel trap on both ends of the pressure regulator. • Use air from a gas cylinder instead. • Use AGE-1000.	-
The air in the tubing is not adequately replaced with hydrogen gas.	Repeat ignition sequence several times to replace the air completely.	P.210
Light leaks in.	Cover the instrument with a blackout curtain, etc. to determine where light leaks in, and correct it.	-

5

5.7.5 Zero Adjustment Error (FPD)

▶▶ Reference "5.3.4 Zero Adjustment Error (for all detectors)" P.62

Cause	Solution	See also
Light leaks in.	Cover the instrument with a blackout curtain, etc. to determine where light leaks in, and correct it.	-

5.8 Detector (ECD)

5.8.1 No Peaks or Extremely Small Peaks (ECD)

▶▶ Reference "5.3.1 No Peaks or Extremely Small Peaks (for all detectors)" P.60

Cause	Solution	See also
ECD current set value is too low.	Increase ECD current setting.	P.212

Cause	Solution	See also
Detector gas is improper.	• Use nitrogen (argon + methane). • Optimize detector gas flow.	Maintenance Help
Detector sensitivity is low.	Set [Signal Range] at [x1].	P.229
Cell is contaminated.	Check for cell contamination and request cleaning as needed.	P.74
Inserted column length is different.	Confirm that the inserted column length is correct. If it is different make the necessary adjustments.	Maintenance Help

5.8.2 Baseline Noise Is High (ECD)

▶▶ Reference "5.3.2 Baseline Noise Is High (for all detectors)" P.61

Cause	Solution	See also
Gases include large amount of oxygen.	Install oxygen traps in gas lines.	-
Gases include large amounts of organic components.	• Check purity of each gas and the pressure regulator. • Connect molecular sieve filter (Super-Clean gas filter) in gas lines. • Perform maintenance for molecular sieve filter. • Change pressure regulator or tubing. To change pressure regulator or tubing, contact your Shimadzu sales/service representative.	-
Column is contaminated.	Condition column.	Maintenance Help
Cell is contaminated.	Check for cell contamination and request cleaning as needed.	P.74

5.8.3 Baseline Drift or Long-term Fluctuation (ECD)

▶▶ Reference "5.3.3 Baseline Drift or Long-term Fluctuation (for all detectors)" P.61

Cause	Solution	See also
The air in carrier gas line or detector gas line is not replaced adequately.	Flow carrier gas and detector gas to replace the air completely.	Maintenance Help
Carrier gas or detector gas does not flow and air gets into flow line.	Flow carrier gas and detector gas and purge flow line adequately.	-

5.8.4 Zero Adjustment Error (ECD)

▶▶ Reference "5.3.4 Zero Adjustment Error (for all detectors)" P.62

Cause	Solution	See also
Detector gas is improper.	• Use nitrogen (argon + methane). • Optimize detector gas flow.	Maintenance Help
Air remains in flow line.	Purge air adequately.	Maintenance Help
Carrier gas or detector gas does not flow and air gets into flow line.	Flow carrier gas and detector gas and purge flow line adequately.	-
Column is contaminated.	Condition column.	Maintenance Help
A large amount of component to which ECD is highly sensitive is injected.	Increase column flow and detector gas flow, and wait until the component is ejected from ECD.	P.212
Cell is contaminated.	Check for cell contamination and request cleaning as needed.	P.74
ECD current set value is too high.	Decrease ECD current setting.	P.212

5.8.5 Calibration Curve Is Far From Straight, Especially High Concentration Side Is Saturated (ECD)

Cause	Solution	See also
ECD current set value is too high.	Decrease ECD current setting.	P.212
Detector gas is improper.	• Use nitrogen (argon + methane). • Optimize detector gas flow.	Maintenance Help
Carrier gas or detector gas includes many impurities.	• Purge air in flow line adequately. • Replace filters (split filter, gas filter, oxygen trap, etc.). • Replace tubing parts. To change tubing parts, contact your Shimadzu sales/service representative. • Replace the gas with higher purity one.	Maintenance Help
Column is contaminated.	Condition column.	Maintenance Help
Cell is contaminated.	Check for cell contamination and request cleaning as needed.	P.74
Detector gas flow is low.	Increase detector gas flow.  NOTE It is noted that the sensitivity will decrease.	P.212
Inserted column length is different.	Confirm that the inserted column length is correct. If it is different make the necessary adjustments.	Maintenance Help

■ Check of ECD cell (with current value)

When the inside of ECD cell is contaminated with sample component, etc., background becomes high and baseline signal level increases. Even in these cases, if zero adjustment can be performed when you press  (Auto Zero) on monitor screen, analysis can be performed.

Decrease current value to decrease background and baseline signal level. In this case, output signal (peak) level also decreases.

▶▶ Reference You can check ECD cell according to "Check of ECD cell (with self-diagnosis function)" P.75.

1

Configure ECD in the analytical line.

▶▶ Reference "7.8.2 [Line Configuration] Screen" P.314

2

Set column, various temperatures, flow, and current as analytical conditions.

3

Press  (HOME) - [Monitor].

Monitor screen appears.

4

Wait until the baseline becomes stable.

5

Press  (Zero Free) and check displayed detector signal level.

If signal level (μV) in step 5 is less than the following values, cell is not contaminated.

When ECD current is : Set value of current (nA) × 90000 μV
higher than 0.3 nA (For example, less than 90000 μV when set value is 1 nA)

When ECD current is : 27000 μV
lower than 0.3 nA

However, even if the signal level is higher than the above values, you can perform analysis when the desired sensitivity is achieved with a smaller current value.

■ Check of ECD cell (with self-diagnosis function)

▶▶ **Reference** You can check ECD cell according to "[Check of ECD cell \(with current value\)](#)" P.74.

1 Ensure that the GC stops.

2 Press  (HOME) - [Function] - [Diagnosis] - [Standard Diagnosis] and press [Diagnosis Setting] on the screen.
[Diagnosis Setting] window appears.

3 Check [ECD Frequency].

 **Hint** The instrument diagnoses all checked items. Deselect other items to check only ECD cell.

4 Press [Return].
[Standard Diagnosis] screen appears.

5 Press [Start Diagnosis].
After the diagnosis, test result and number of problems are displayed.

6 Press [Result Details] to check diagnosis result of ECD frequency.
If the result is [Fail], cell cleaning (radiation source replacement) is recommended.

▶▶ **Reference** For details about self-diagnosis, see "[\[Diagnosis Report \(Details\)\] Screen](#)" P.372.

 **NOTE** Default threshold of ECD frequency for standard diagnosis is 40 kHz for 2 nA. You can change this value when you select system check specifications on ECD Configurations while Labsolutions is connected. You cannot change it on this instrument.
ECD frequency is proportional to detector signal level. 40 kHz of output frequency corresponds to 2,500,000 μ V of signal level.

5.9 Detector (BID)

5.9.1 No Peaks or Extremely Small Peaks (BID)

▶▶ Reference "5.3.1 No Peaks or Extremely Small Peaks (for all detectors)" P.60

Cause	Solution	See also
Plasma is turned off.	Check detector gas flow and turn on plasma again.	P.217
Detector gas is improper.	Optimize detector gas flow.	Maintenance Help
Detector sensitivity is low.	Set [Signal Range] at [x1].	P.229
Carrier gas or detector gas includes many impurities.	• Purge air in flow line adequately. • Replace the gas with higher purity one. Recommended purity is higher than 99.9999 %. • If the problem is not resolved about 12 hours after cylinder replacement, "Helium Purifier Assy" filter may be saturated. Turn off the main power of the instrument and contact your Shimadzu sales/service representative.	-
Position of plasma is improper.	Turn off plasma, check detector gas flow, and turn on plasma again.	P.217
Cell is contaminated.	Contact your Shimadzu sales/service representative.	-

5.9.2 Plasma Cannot Be Turned On (BID)

Cause	Solution	See also
Column is not connected.	Connect column.	Maintenance Help
Helium gas is not supplied or the flow is not correct.	Supply helium gas and set the flow at a proper value.	P.217
The tip of SUS column is bent.	Straighten tip side of column from graphite ferrule.	Maintenance Help
Detector temperature is low.	Set detector temperature at a higher value. (Recommended value: 150 °C to 300 °C)	P.217
Detector temperature is high.	Set detector temperature at a lower value. (Recommended value: 150 °C to 300 °C)	P.217
Water on detector interferes with turning on plasma.	Increase detector temperature to 350 °C, wait about 12 hours, and then turn on plasma again.	P.217

Cause	Solution	See also
Helium purity decreased because air gets into the line during cylinder replacement.	Wait until the gas in the line is completely replaced and purity of supply gas improves. If the problem is not resolved after about 12 hours, "Helium Purifier Assy" filter may be saturated and the filter should be replaced. Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-
BID and APC tubing are clogged.	Replacement of the tubing part is required. Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-
APC fails.	Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-
Plasma ON/OFF and BID controller have a problem.	Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-
Plasma generator fails.	Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-

5.9.3 Baseline Noise Is High (BID)

▶▶ Reference "5.3.2 Baseline Noise Is High (for all detectors)" P.61

Cause	Solution	See also
Carrier gas or detector gas includes many impurities.	- Purge air in flow line adequately. - Replace the gas with higher purity one. Recommended purity is higher than 99.9999 %. - If the problem is not resolved about 12 hours after cylinder replacement, "Helium Purifier Assy" filter may be saturated. Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-
Column is contaminated.	Condition column.	Maintenance Help
Cell is contaminated.	Contact your Shimadzu sales/service representative.	-

5.9.4 Baseline Drift or Long-term Fluctuation (BID)

▶▶ Reference "5.3.3 Baseline Drift or Long-term Fluctuation (for all detectors)" P.61

Cause	Solution	See also
Contaminant or water is eluted from the inside of the parts such as O-ring.	Increase detector temperature and wait about 12 hours for stable operation. If they are unstable after a certain period of time, turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-
BID and APC tubing are clogged.	Replacement of the tubing part is required. Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-
Carrier gas or detector gas includes many impurities.	• Purge air in flow line adequately. • Replace the gas with higher purity one. Recommended purity is higher than 99.9999 %. • If the problem is not resolved about 12 hours after cylinder replacement, "Helium Purifier Assy" filter may be saturated. Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-

5.9.5 Zero Adjustment Error (BID)

▶▶ Reference "5.3.4 Zero Adjustment Error (for all detectors)" P.62

Cause	Solution	See also
Air remains in detector.	Flow detector gas and wait more than 1 hour.	-
Cell is contaminated.	Contact your Shimadzu sales/service representative.	-

5.9.6 Retention Times of All Peaks Shift to the Same Direction (BID)

Cause	Solution	See also
Detector gas flow fluctuates.	Calibrate APC.	P.438
Trap ASSY has a problem.	Replace trap ASSY and calibrate APC. To replace trap ASSY, contact your Shimadzu sales/service representative.	P.438

Cause	Solution	See also
APC fails.	Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-

5.9.7 Abnormal Peak Shape (BID)

Cause	Solution	See also
Plasma is temporarily shielded because injection volume or sample concentration is too high, causing a problem in ionization.	- Decrease injection volume or sample concentration. - Increase split ratio. (For split analysis)	P.247
The column tip on the detector side is carbonized and component is adsorbed in it.	Cut carbonated column tip and set it at correct length. If possible, set the detector temperature below 300 °C.	P.217

5.10 Detector (SCD)

WARNING



Instruction

Shut off the hydrogen gas supply before inspection.

Large amount of hydrogen leak may cause explosion.

5

5.10.1 No Peaks or Extremely Small Peaks (SCD)

▶▶ Reference "5.3.1 No Peaks or Extremely Small Peaks (for all detectors)" P.60

Cause	Solution	See also
The ferrule of the inner pyrotube is not inserted correctly.	Check that the ferrule is inserted in the inner pyrotube and that there is no abnormality in the ferrule.	Maintenance Help
The back ring is not installed on the inner pyrotube.	Install the back ring on the inner pyrotube.	Maintenance Help
Carrier gas or detector gas leaks.	- Check for gas leaks, and tighten leaking connections. - Replace tubing or septum.	P.54 Maintenance Help
Sample is injected incorrectly.	- Check the clogging or leaks of the syringe and repair it. - Replace syringe.	Maintenance Help
There is a leak at the connection of the column on the detector side.	Additionally tighten the graphite Vespel®.	Maintenance Help

Cause	Solution	See also
The length of the inserted column on the detector side is not proper.	Re-install the graphite Vespel®.	Maintenance Help
The column is not properly tightened.	• Check the tightening condition of the nut. • Additionally tighten it.	Maintenance Help
• The inner or outer pyrotube is broken. • The inner or outer pyrotube is contaminated.*1	Replace the inner or outer pyrotube.	Maintenance Help
The degree of vacuum is inadequate.	Maintain the vacuum pump. If the problem is not resolved after maintaining the vacuum pump, replace the vacuum pump.	Maintenance Help
There is a leak between the vacuum pump and ozone scrubber.	Additionally tighten the connection.	-
Conditioning after replacing the pyrotube is inadequate.	After the SCD startup is completed, condition it for about 12 hours under the analysis conditions.	-
There is a leakage in the SCD.	Perform pressure check on the [SCD Leak Check] screen and compare the pressure check results with the reference value. If there is a significant difference, check that the pressure inside the instrument has returned to atmospheric pressure, then turn off the main power of the instrument, and additionally tighten the connections of the inner pyrotube, outer pyrotube, ozone scrubber, and vacuum pump respectively. If the problem persists, turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	P.242

*1 If a sample including halogen compounds is analyzed, the pyrotube inside the instrument may be damaged resulting in significant decrease of the sensitivity.

5.10.2 Furnace and Detector Pressure Do Not Decrease (SCD)

Cause	Solution	See also
The inner pyrotube is broken.	Replace the inner pyrotube.	Maintenance Help
The back ring is not installed on the inner pyrotube.	Install the back ring on the inner pyrotube.	Maintenance Help
The ferrule of the inner pyrotube is not inserted correctly.	Check that the ferrule is inserted in the inner pyrotube and that there is no abnormality in the ferrule.	-

Cause	Solution	See also
The column is not properly tightened.	• Check the tightening condition of the nut. • Additionally tighten it.	Maintenance Help
The vacuum pump is not turned on.	Turn on the switch.	-
The degree of vacuum is inadequate.	Maintain the vacuum pump. If the problem is not resolved after maintaining the vacuum pump, replace the vacuum pump.	Maintenance Help
There is a leak between the vacuum pump and ozone scrubber.	Additionally tighten the connection.	-

5.10.3 Baseline Noise Is High (SCD)

►► Reference "5.3.2 Baseline Noise Is High (for all detectors)" P.61

Cause	Solution	See also
Conditioning of the inner or outer pyrotube is inadequate.	Condition the inner or outer pyrotube.	P.240
• The inner or outer pyrotube is broken. • The inner or outer pyrotube is contaminated.*1	Replace the inner or outer pyrotube.	Maintenance Help
Column is contaminated.	• Condition column. • Seal the column fittings and check the baseline. When noise is small, the column is contaminated or degrades. Replace it with a new column.	Maintenance Help
Glass insert or silica wool is contaminated.	Replace glass insert or silica wool.	Maintenance Help
Carrier gas or detector gas quality is poor.	• Replace the gas with higher purity one. • Insert a filter immediately before the gas supply inlet of the SCD.	Maintenance Help

Cause	Solution	See also
There is a leakage in the SCD.	Perform pressure check on the [SCD Leak Check] screen and compare the pressure check results with the reference value. If there is a significant difference, check that the pressure inside the instrument has returned to atmospheric pressure, then turn off the main power of the instrument, and additionally tighten the connections of the inner pyrotube, outer pyrotube, ozone scrubber, and vacuum pump respectively. If the problem persists, turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	P.242

*1 If a sample including halogen compounds is analyzed, the pyrotube inside the instrument may be damaged resulting in significant decrease of the sensitivity.

5.10.4 Baseline Drift or Long-term Fluctuation (SCD)

▶▶ Reference "5.3.3 Baseline Drift or Long-term Fluctuation (for all detectors)" P.61

Cause	Solution	See also
Conditioning of the inner or outer pyrotube is inadequate.	Condition the inner or outer pyrotube.	P.240
Column is contaminated.	• Condition column. • Seal the column fittings and check the baseline. When noise is small, the column is contaminated or degrades. Replace it with a new column.	Maintenance Help
Glass insert or silica wool is contaminated.	Replace glass insert or silica wool.	Maintenance Help
Carrier gas or detector gas quality is poor.	• Replace the gas with higher purity one. • Insert a filter immediately before the gas supply inlet of the SCD.	Maintenance Help

Cause	Solution	See also
There is a leakage in the SCD.	Perform pressure check on the [SCD Leak Check] screen and compare the pressure check results with the reference value. If there is a significant difference, check that the pressure inside the instrument has returned to atmospheric pressure, then turn off the main power of the instrument, and additionally tighten the connections of the inner pyrotube, outer pyrotube, ozone scrubber, and vacuum pump respectively. If the problem persists, turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	P.242

5.10.5 Presence of Ghost Peaks (SCD)

Cause	Solution	See also
- The inner or outer pyrotube is broken. - The inner or outer pyrotube is contaminated.	Replace the inner or outer pyrotube.	Maintenance Help
Column is contaminated.	- Condition column. - Seal the column fittings and check the baseline. When noise is small, the column is contaminated or degrades. Replace it with a new column.	Maintenance Help
Glass insert or silica wool is contaminated.	Replace glass insert or silica wool.	Maintenance Help
Carrier gas purity is low.	Replace the gas with higher purity one.	Maintenance Help

5.10.6 Peaks of Components Without Sulfur Appear (SCD)

Cause	Solution	See also
Conditioning of the inner or outer pyrotube is inadequate.	Condition the inner or outer pyrotube.	P.240
- The inner or outer pyrotube is broken. - The inner or outer pyrotube is contaminated.	Replace the inner or outer pyrotube.	Maintenance Help
Detector gas flow fluctuates.	Perform offset calibration of the detector gas flow controller.	P.235

Cause	Solution	See also
Carrier gas or detector gas quality is poor.	- Replace the gas with higher purity one. - Insert a filter immediately before the gas supply inlet of the SCD.	Maintenance Help
Flow of nitrogen is high.	Decrease flow of nitrogen (to prolong residence time of the sample in the furnace).	-
Flow of hydrogen is low.	Increase flow of hydrogen (to burn radical components other than sulfur).	-
Flow of oxygen for the furnace is low.	Increase flow of oxygen for the furnace (to burn radical components other than sulfur).  NOTE When flow is changed, it may influence on response at high concentrations.	-

5.10.7 Calibration Curve Is Not Straight (SCD)

Cause	Solution	See also
- The inner or outer pyrotube is broken. - The inner or outer pyrotube is contaminated.	Replace the inner or outer pyrotube.	Maintenance Help
Detector gas flow fluctuates.	Perform offset calibration of the detector gas flow controller.	P.235
Glass insert or silica wool is contaminated.	Replace glass insert or silica wool.	Maintenance Help
Carrier gas or detector gas leaks.	- Check for gas leaks, and tighten leaking connections. - Replace tubing or septum.	P.54 Maintenance Help
Sample is injected incorrectly.	- Check the clogging or leaks of the syringe and repair it. - Replace syringe.	Maintenance Help
Column is contaminated.	Condition column.	Maintenance Help

5.10.8 High Concentration Side Is Saturated (SCD)

Cause	Solution	See also
Detector gas flow fluctuates.	Perform offset calibration of the detector gas flow controller.	P.235
Split ratio is low.	Increase split ratio.	-
Injection volume is high.	Decrease injection volume.	-

Cause	Solution	See also
Hydrogen/oxygen ration is not optimal.	Increase flow of hydrogen slightly or decrease flow of oxygen for the furnace slightly.  NOTE When flow of oxygen for the furnace is changed, it may influence on selectivity.	-

5.10.9 When Light Leakage Error Occurs (SCD)

Cause	Solution	See also
The ozone scrubber is not connected.	Check the connection of the ozone scrubber.	-

5.11 Chromatogram

5.11.1 Presence of Ghost Peaks

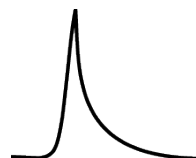
Cause	Solution	See also
Septum purge is not flowing.	Flow septum purge.	P.247
Components which did not elute during previous analysis is detected.	Increase column oven temperature and column flow to eliminate sample remaining inside column.	P.285
Sample is contaminated.	Prepare a new sample.	-
Micro syringe is dirty.	Clean or replace micro syringe.	Maintenance Help
Carrier gas purity is low.	• Replace the gas with higher purity one. • Provide filters in carrier gas line and each detector gas line.	-
Substances of high boiling point accumulated at column inlet end are flowing out.	• Replace or condition capillary column. • Cut the end of capillary column.	Maintenance Help
Injection port is dirty.	• Clean or replace glass insert. • Replace or condition septum.	Maintenance Help
Tubing and pressure regulator are contaminated with oil, etc.	Replace them with clean ones.	-
Impurities from septum affect the result.	Replace or condition septum.	Maintenance Help
Septum chips are present inside glass insert or column.	• Take off septum chips. • Clean or replace glass insert. • Cut the end of capillary column.	Maintenance Help

Cause	Solution	See also
The graphite ferrule is not fixed.	Additionally tighten the graphite ferrule. If it cannot be fixed even after additional tightening, replace it.	Maintenance Help

5.11.2 Abnormal Peak Shape

■ Tailing

Once the peak has eluted, the baseline does not immediately return to its zero level. The second half peak area is higher.



Cause	Solution	See also
Column is contaminated.	Condition column.	Maintenance Help
Glass insert or silica wool is contaminated.	Replace glass insert or silica wool.	Maintenance Help
Septum purge is not flowing or is too low.	• Flow septum purge. • Increase septum purge flow.	P.429
Septum chips are present inside glass insert or column.	• Take off septum chips. • Clean or replace glass insert. • Cut the end of capillary column.	Maintenance Help
Injection port temperature is low.	Increase injection port temperature.	P.247
The length of the inserted column on the detector side is incorrect.	Install the column correctly.	Maintenance Help
Component is adsorbed in the glass insert.	• Replace the glass insert with deactivated one. • Replace the glass insert with acid or alkaline treated one depending on the component.	Maintenance Help
The liquid phase of the column is not proper.	Use optimum liquid phase for the target component.	-

■ Fronting (leading)

The peak increases slowly. The first half peak area is higher.



Cause	Solution	See also
Column is overloaded.	• Decrease injection volume. • Dilute sample. • Increase split ratio. (For split analysis) • Use a column with a greater film thickness.	P.247 Maintenance Help
Column temperature is low.	Increase column temperature.	P.285
Injection port temperature is low.	Increase injection port temperature.	P.247

■ Peak splitting

Cause	Solution	See also
Several peaks are not separated and appear as one peak.	• Change conditions to improve separation. • Replace column.	P.247
Injection volume is high.	Decrease injection volume.	-
Sample is injected in two steps (twice).	Inject sample correctly.	-

5.11.3 Poor Retention Time Repeatability

Cause	Solution	See also
Gas supply pressure is fluctuating because the carrier gas cylinder is almost empty.	Replace the gas cylinder with one of at least 3 MPa pressure.	-
Carrier gas flow is fluctuating due to a gas leak.	• Tighten leaking connections. • Replace tubing or septum.	P.54 Maintenance Help
Column is overloaded.	• Decrease injection volume. • Dilute sample. • Increase split ratio. • Use a column with a greater film thickness.	P.247 Maintenance Help
• Room temperature is not within the recommended range. • Room temperature is fluctuating considerably.	Keep the room temperature within the recommended range and reduce the fluctuation.	-
Syringe tip is clogged, and sample is not properly injected.	Clean or replace syringe.	Maintenance Help
Impurities from septum affect the result.	Replace or condition septum.	Maintenance Help
Glass insert is contaminated.	• Clean or replace glass insert. • Check the presence, amount, and position of silica wool.	Maintenance Help

 **NOTE** If the gas supply pressure is fluctuating due to failure of the gas cylinder pressure regulator, repair or replacement is required. Contact your Shimadzu sales/service representative.

5.11.4 Poor Peak Area Repeatability

Cause	Solution	See also
Gas supply pressure is fluctuating because the carrier gas cylinder is almost empty.	Replace the gas cylinder with one of at least 3 MPa pressure.	-
Carrier gas flow is fluctuating due to a gas leak.	• Tighten leaking connections. • Replace tubing or septum.	Maintenance Help
Syringe has a leak or clogging and the amount of injection (aspiration) is not constant.	Clean or replace syringe.	Maintenance Help
Sample collection or injection is incorrect.	• Inject sample correctly. • Clean or replace syringe.	Maintenance Help
Column is overloaded.	• Dilute sample. • Increase split ratio. • Use a column with a greater film thickness.	-
• Room temperature is not within the recommended range. • Room temperature is fluctuating considerably.	Keep the room temperature within the recommended range and reduce the fluctuation.	-
Syringe tip is clogged, and sample cannot be aspirated well.	Clean or replace syringe.	Maintenance Help
Syringe tip is clogged, and sample is not properly injected.	Clean or replace syringe.	Maintenance Help
Syringe plunger does not move smoothly.	• Clean syringe barrel and plunger. • Clean or replace syringe.	Maintenance Help
Silica wool inside glass insert is packed incorrectly.	Pack the silica wool correctly.  Hint Repeatability may improve by smoothing the top surface of silica wool.	Maintenance Help
Carrier gas leaks from the split filter.	Ensure that the split filter is installed correctly.	Maintenance Help
Impurities from septum affect the result.	Replace or condition septum.	Maintenance Help
Glass insert is contaminated.	• Clean or replace glass insert. • Check the presence, amount, and position of silica wool.	Maintenance Help

 **NOTE** If the gas supply pressure is fluctuating due to failure of the gas cylinder pressure regulator, repair or replacement is required. Contact your Shimadzu sales/service representative.

5.12 LCD

5.12.1 Touch Screen Responds Inaccurate

Cause	Solution	See also
Your touches are detected inaccurately.	Calibrate the screen.	P.90

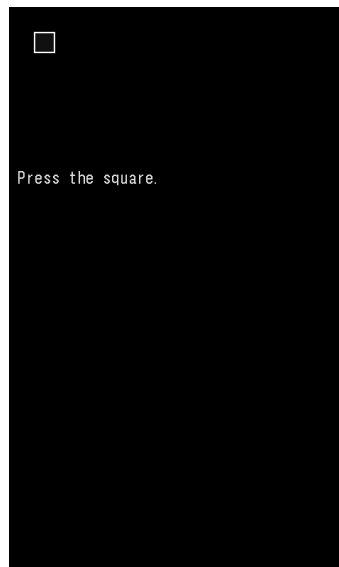
NOTE When using touch panel, touch detection may become misaligned. Screen calibration resets the touch detection.

■ To calibrate the screen

1

Press  (HOME) 5 times.

The following screen appears.

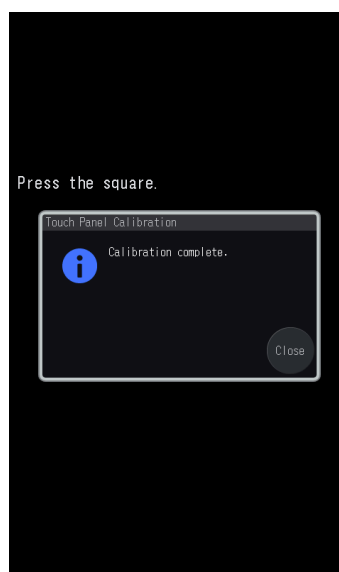
**2**

Press  in the upper left of the screen.

3

In the same way as step 2, press  in the upper right, lower left, lower right, and the middle of the screen.

Calibration is completed if the following message appears.



5.12.2 The Instrument Suddenly Goes into Sleep Mode and the Screen Is Turned Off

Cause	Solution	See also
An error (error code 2322 to 2327) has occurred.	Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	P.116

5

5.12.3 The Screen Is Not Displayed When You Press the Power Button While the Power Button Illuminates in Orange

Cause	Solution	See also
An error (error code 2322 to 2327) has occurred.	Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	P.116

5.12.4 The Screen Is Not Displayed While the Power Button Illuminates in White

Cause	Solution	See also
The LCD is damaged.	Turn off the main power of the instrument, shut off gas supplies, and contact your Shimadzu sales/service representative.	-

5.13 Gas Selector

5.13.1 Analysis Results Are Significantly Different After Gas Switching

Cause	Solution	See also
Waiting time set for gas switching is too short.	Change the waiting time for gas switching to 15 minutes. If the analysis results are affected even when the time is set at 15 minutes, increase the time until the analysis results are not affected, for example, to 20 minutes.	P.306
When the detector is TCD, analysis is started before the baseline becomes stable.	Do not perform analysis until the baseline becomes stable. NOTE Since the current is turned off temporarily when switching the gas, wait for the baseline to stabilize after switching the gas.	-

5.13.2 [CAR1 to 4 prim is out of range] Error Occurs

Cause	Solution	See also
The set primary pressure is incorrect.	Set [Primary Pressure] on the [Other Configurations] screen correctly. For example, when [Supply Gas Press] on the [Gas Selector] screen is [300 kPa], set it at [300-500 kPa].	P.350
There is a leak at the connecting lines between the gas selector and carrier gas flow controller.	Check for gas leaks, and tighten leaking connections.	-

5.13.3 The Gas Type of the Connected Flow Controller Is Not Changed After Supply Gas Switching

Cause	Solution	See also
The settings on the [Gas Selector Connect Settings] screen is incorrect.	Check the connected flow controller on the [Gas Selector Connect Settings] screen.	P.311

5.13.4 The Gas Is Not Automatically Changed When an Error Occurs With the Gas Selector

Cause	Solution	See also
[Action on Supply Gas Error] is set at [None].	Set [Action on Supply Gas Error] at [Gas Switch].  NOTE When an error occurs with the main or sub gas, eliminate the cause of the error and press [Reset]. While  is displayed, the gas is not switched. For example, when an error occurs with the main gas and the gas is switched to the sub gas, and then the error with the main gas is resolved and the gas can be supplied correctly, if [Reset] is not pressed, the gas is not switched to the main gas when an error occurs with the sub gas.	P.306

5.13.5 The Gas Selector Enters the READY State Before the Gas Switching Wait Time Does Not Elapse

Cause	Solution	See also
Ready Check for the gas selector is disabled.	Check the gas selector on the [Ready Check] screen.	P.340

6 Error Messages

The instrument is programmed to diagnosis certain errors. When an error is detected, a beep sound and one of the error messages shown below is displayed. The detected errors are recorded in the error log.

When error screens appear, select one of the following actions:

Item	Description
Reset	Restores the conditions prior to the error and resumes instrument control. If the cause of the error is removed, the error screen will not appear again.
Ignore	Select this action to keep the instrument as it is. Check for the error to resolve it. When [Ignore] is pressed, an icon appears at the top of monitor screen. Press the icon to check the current error.

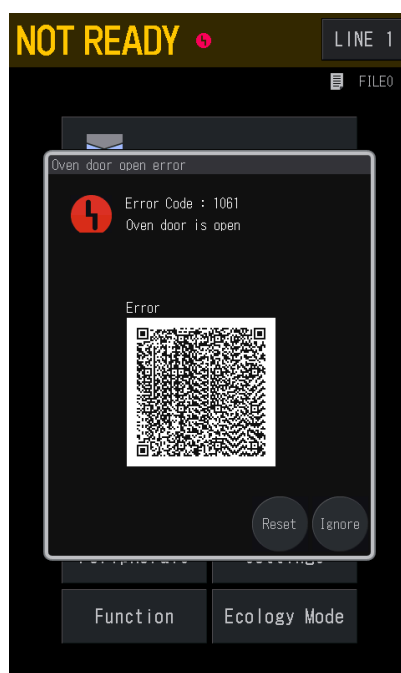
 **Hint** When beep sound is turned [Off], you will not hear a beep.

▶▶ Reference "[Other Configurations] Screen" P.350

The codes provided with the errors help the service representative identify the errors. Provide the code when contacting your Shimadzu sales/service representative. These codes are also recorded in the error log.

 **NOTE** When the startup screen does not change to HOME screen more than 1 minute after the power is turned on, a problem occurs. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.

 **Hint** You can check the detailed solutions by accessing the QR code displayed on the error code screen.



6.1 System Errors

Code	Message	Cause	Solution	Note
1	DC5V is out of range	The power source may have failed.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
2	DC24V is out of range			
5	Room temperature is out of range	If this error is displayed when the actual room temperature and air pressure is within the operation range, sensors installed on the instrument may have failed.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
6	Atm. press is out of range			
7 8 9 10	DET#n PCB error	PCB may have failed.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4
11 12 53 54	CARm AFC PCB error			m=1 to 4
13 14 15 16	DetAPCn PCB error			n=1 to 4
23 24 25 26 27 28	APCa-b PCB error			a-b=1-3, 4-6, 7-9, 10-12, 13-15, 16-18
29	Clock is initialized	Built-in clock is reset.	Battery for the clock is depleted or the hardware fails. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-

Code	Message	Cause	Solution	Note
30	Column oven A/D converter error	A/D converter may have failed.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
31	Room temp, Atm. press A/D error			
32	AUX3-AUX5 A/D error			
35	Cooling fan error	Cooling fan of the GC does not operate correctly.	The performance decreases in this situation. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
38	CPU register error	Electronics may have a problem.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
39	PRG current error	PCB may have failed.		
40	Power controller board error	PCB may have failed.		
51	Detected hydrogen leak	Hydrogen gas leaks.	• Stop the hydrogen gas supply. • Check that the column connections have no leak. • Check that the column is not broken. • Check the tubing connections when using hydrogen gas in a system using AUX-APC, such as Advanced Flow Technology. • Check that the hydrogen sensor filter is not clogged. If the error appears even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-

Code	Message	Cause	Solution	Note
59 62 65 68 71 74	Flow# DC24V was out of range	PCB may have failed.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	#=1 to 6
60 63 66 69 72 75	Flow# DC12V was out of range	PCB may have failed.		#=1 to 6
61 64 67 70 73 76	Flow# DC5V was out of range	PCB may have failed.		#=1 to 6
77	Hydrogen sensor init error	Hydrogen sensor may have failed.		-
78	Hydrogen sensor is not installed	- Hydrogen sensor is set to be used although hydrogen sensor is not connected. - The hydrogen sensor may be not recognized.	- When not using hydrogen sensor, set hydrogen sensor at [N/A]. ▶▶ Reference P.300 - When using hydrogen sensor, the hardware fails. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
79	TC was broken	Thermocouple for overheat protection may be broken.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
91 92	Gas Selector# PCB error	PCB may have failed.		#=1 to 2
106	Relay Input 1 error	An error signal was detected from an external device connected to the GC.	Remove the cause of the error in the external device connected to the GC. If there is no abnormality in the external device, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
107	Relay Input 2 error			
108	Relay Input 3 error			
109	Relay Input 4 error			

Code	Message	Cause	Solution	Note
116	Hydrogen sensor is disconnected.	The connector cable of the hydrogen sensor has been disconnected, or there is a problem with the hydrogen sensor.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
117	Hydrogen sensor thermistor error	There is a problem with the thermistor in the hydrogen sensor.		-
118	Oven suction pump error. Stop the instrument.	There is a problem with the oven suction pump.		-
119	Hydrogen sensor setting is incorrect.	• The setting for the hydrogen sensor is incorrect. • There is a problem with the thermistor in the hydrogen sensor.	• Check that the hydrogen sensor is configured correctly. ▶▶ Reference P.300 • Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-

6.2 Operation Errors

Code	Message	Cause	Solution	Note
5006 5007 5008 5070 5071 5072 5101 5105	CARn calculated pressure out of range	The column inlet pressure calculated from the inputted linear velocity and column flow is outside the set range.	• Set the linear velocity and column flow so that the column inlet pressure is within the AFC control range. ▶▶ Reference P.434 • Check the inputted column information (inner diameter, length, and film thickness). • Check the initial column temperature setting.	x=1 to 4

Code	Message	Cause	Solution	Note
5009 5010 5011 5073 5074 5077 5078 5102 5106 5107 5110 5111	CARn calculated flow out of range	The total flow calculated from the inputted split ratio, column inlet pressure, column flow, linear velocity, and purge flow is outside the set range.	- Set the split ratio, column flow, and purge flow so that the total flow is within the AFC control range. ▶▶ Reference P.434 - Total flow is calculated with the following equation: $(\text{Total flow}) = (\text{Column flow}) + (\text{Column flow} * \text{Split ratio}) + (\text{Purge flow})$	x=1 to 4
5042 5043 5044 5067 5068 5069 5103 5104	CARn septum purge calculated pressure out of range	The inputted purge flow is outside the set range.	Set the purge flow within the AFC control range. ▶▶ Reference P.434	n=1 to 4
5075 5076 5108 5109	CARn calculated ratio out of range	The carrier gas total flow calculated from split ratio program, etc. is outside the set range.	Change the split ratio so that the following equation is satisfied. $(\text{Total flow}) = (\text{Column flow}) + (\text{Column flow} * \text{Split ratio}) + (\text{Purge flow})$	m=1 to 4

Code	Message	Cause	Solution	Note
5112	Analysis waiting	The analysis was started while the PREP RUN function is active and the instrument is in the waiting status. 1.3.5	• Set [Prep Run Wait Time] longer. ▶▶ Reference P.381 The PREP RUN is activated when using the following functions. • Splitless (split in standby) • Carrier gas saver (saved in standby) • CRG (coolant blowing stops in standby) • High pressure injection (normal pressure in standby) • Back flush (back flush in standby) The instrument will go into a standby state if no analysis starts when the [Prep Run Wait Time] elapses after the analysis preparation starts, due to extended pre-run time, etc. It is therefore necessary to set [Prep Run Wait Time] longer than pre-run time. For headspace analysis, set [Prep Run Wait Time] longer than heat-retention time.	-

6.3 Optional Device Errors (AOC)

One of the following messages appears when an error has occurred in the AOC.

►► **Reference** For solutions, refer to the AOC Instruction Manual.

Code	Message	Note
6001, 6023	AOCm rack error	m=1 to 2 1: Main AOC 2: Sub AOC
6002, 6024	AOCm syringe error	
6003, 6025	AOCm plunger error	
6004, 6026	AOCm can not start	
6005, 6027	AOCm RAM initialized	
6006, 6028	AOCm ROM error	
6007, 6029	AOCm CH2 command error	
6008, 6030	AOCm sample vial is not set	
6009, 6031	AOCm RAM error	
6010, 6032	AOCm installation error	
6011, 6033	AOCm CH1 error	
6012, 6034	AOCm CH2 error	
6013, 6035	AOCm waste vial is not set	
6014	AOC-20s rotating error	
6015	AOC-20s exp. and ctrl. error	
6016	AOC-20s up/down error	
6017	AOC-20s can not start	
6018	AOC-20s vial setting error	
6019	AOC-20s vial returning error	
6020	AOC-20s holding error	
6021	AOC-20s sample vial removed	
6022	AOC-20s vial is not set	
6036, 6041	AOCm solvent vial is not set	
6037, 6042	AOCm L2 vial is not set	
6038, 6043	AOCm L3 vial is not set	
6039, 6044	AOCm turret step out	
6040, 6045	AOCm vial sensor error	

6.4 Transmission Errors

Code	Message	Cause	Solution	Note
4001	Transmission time out	Failed to communicate with external devices (such as PC).	For Ethernet connection, replace the LAN cable. For USB connection, replace the USB cable, or change the USB cable connection port. If the error persists even after performing the actions above, check the connection with external devices, turn on the instrument again, restart the PC software, and retry the communication. If the error appears even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	For transmission error, the link is automatically disconnected.
4003	Message is not accepted			
4005	Command is invalid			
4006	Param by TRS is out of range			
4007	Transmission port is shut down			
4008	Transmission file error			
4009	AOC command is invalid	Communication with AOC failed or an error occurred during communication. These errors are issued not only when a communication failure or device malfunction occurs, but when the cable is unplugged while energized. (See the note below.)	Turn off the AOC power, reconnect the cable, and turn on the AOC again. If the error appears even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	For transmission error, the link is automatically disconnected.
4010	AOC set value out of range			
4011	AOC time out			
4012	AOC2 transmission error			
4013	AOC link error			
 NOTE These errors are issued not only when a communication failure or device malfunction occurs, but when the cable is unplugged while energized. Be sure to turn off the instrument before unplugging the cable.				
4021 4022 4023 4024 4025 4026	Flow# command stopped due to error	A command is sent to the flow controller while the flow controller has an error.	When any of these errors occurs, another error should have occurred regarding the flow controller. Check the actions necessary for the error.	#=1 to 6

Code	Message	Cause	Solution	Note
4045	Power controller board com. failed	POWER PCB may have failed.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
4046	AOC model does not match	The AOC model no. and the AOC model no. registered in the GC do not match.	Register the model no. of the AOC being used. ▶▶ Reference P.314	-
4047	AOC was disconnected	• Analysis was started with the AOC registered to a line while no AOC is actually connected. • AOC power has not been turned off and back on after disconnecting and reconnecting the AOC cable. • AOC or GC may have failed.	• When not using the AOC, remove the AOC from line registration. • After disconnecting and reconnecting the AOC cable, turn the AOC power back on. • If the AOC is not recognized even after turning the power back on, AOC or GC may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-

6.5 Detector Errors

Code	Message	Cause	Solution	Note
4101 4102 4103 4104	DET#n TCD overcurrent detected	Detector current is abnormal. If the resistance of the filament becomes abnormally high when the TCD or the FTD is in use, the protection circuit is actuated to prevent damage to the filament.	Turn off the main power of the instrument, and confirm the following items. • The set value of the current exceeds the maximum operating current. • The makeup gas is not flowing. • A gas leak occurs. • A significant amount of air is present in the flow line. Remove the cause of the error, then turn on the instrument. If the error cannot be resolved, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4
4105 4106 4107 4108	DET#n FTD overcurrent detected		Turn off the main power of the instrument, and confirm the following items. • The set value of the current exceeds the maximum operating current. • The makeup gas is not flowing. • A gas leak occurs. Remove the cause of the error, then turn on the instrument. If the error cannot be resolved, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	

Code	Message	Cause	Solution	Note
4109 4110 4111 4112	DET#n flame is out	The flame of the detector (FID, etc.) went off.	• Check that the column is connected. Check also that there is no leak at column connections. • Check that the column insertion length is appropriate. • Check that hydrogen gas, makeup gas, and air are supplied properly. Check also that their flow rates are appropriate. • The tubing inside may not be sufficiently replaced with hydrogen gas immediately after its connection, etc. Try ignition several times to fully replace the inside with hydrogen gas. • If the flame went off during detection of the solvent peak, decrease the injection volume of the solvent, or change the nozzle to the one with a larger inner diameter. • Check that the nozzle is not clogged. If any clog is found, maintain or replace the nozzle. • If the flame went off during back flush, decrease the back flush pressure. • If the column flow is high, e. g. , when using a wide bore column, decrease the column flow or makeup gas flow. If it is difficult to change the column flow, increasing the hydrogen gas flow may prevent flame extinguishment. • Set a high detector temperature. If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4
 NOTE In case of a flame error, hydrogen and air supplies stop automatically.				

Code	Message	Cause	Solution	Note
4121 4122 4123 4124	DET#n FPD cooling fan error	FPD cooling fan has a problem.	Turn off the main power of the instrument and check the installation status of the cooling fan. If it is installed correctly, the hardware fails. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4
4125 4126 4127 4128	DET#n FPD overcurrent detected	FPD photomultiplier current is abnormal.	Ensure that strong light does not leak in photomultiplier current from the connection. If the error cannot be resolved after you cut off the light with blackout curtain, the hardware fails. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4
4129 4130 4131 4132	DET#n BID short-circuit in discharge cell	Output from plasma generation circuit of BID shorted out.	Turn off the main power and then turn on the instrument again. If the error occurs repeatedly, cables may be damaged. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4
4133 4134 4135 4136	DET#n PTC overvoltage detected in cell power	The voltage of the PTC cell power is abnormal.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4
4149 4150 4151 4152	DET#n FTD adjustment failed	It cannot be adjusted because FTD power (%) is [0] or [100].	Check that connection of electrode connector is correct and collector fixing knurled screws are tightened. When connections are correct, recondition or replace FTD alkaline source. If the error cannot be resolved after the above actions, contact your Shimadzu sales/service representative.	n=1 to 4

Code	Message	Cause	Solution	Note
4201	TCD signal was out of range	Zero adjustment cannot be performed because the TCD baseline is unstable. The detector controller unit may have failed.	Perform zero adjustment again after the TCD baseline becomes stable. See "5.5.4 Zero Adjustment Error (TCD, PTCD)" P.66 when the problem persists. When the problem persists after troubleshooting, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
4203 4204 4205 4206	DET#n ignition failed	FID or FPD ignition failed.	Check the following items. • The column is connected and the column insertion length is appropriate. • Hydrogen is supplied at a proper flow. • Air is supplied at a proper flow. ▶▶ Reference P.434 • Ignite the flame on the detector again (since the tubing inside is not sufficiently replaced with detector gas after tubing connection). • FID jet is not clogged. • Set the detector temperature to 200 °C or higher (since ignition may be difficult at low detector temperature). • Unused FID control is not set at [On]. • Filament in igniter is intact. If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4

 **NOTE** In case of a flame error, hydrogen and air supplies stop automatically.

Code	Message	Cause	Solution	Note
4207	H2, AIR APC are not ready	The hydrogen gas or air flow is unstable during FID ignition sequence.	• Check that the supply pressures of hydrogen gas and air are within the ranges below. ▶▶ Reference P.402 • Check that the supply pressures are sufficient for hydrogen gas and air to flow. ▶▶ Reference P.434 • Check that the gas supply pressure is stable. • Check that no tubing connections are loose and there is no leak. • Contact your Shimadzu service representative to check the inner diameter and length of used tubing. If the error appears repeatedly even after checking the above, the flow controller may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
4208 4209 4210 4211	DET#n failed to start plasma	BID Plasma cannot be turned on.	• Check that the detector gas flow is appropriate. ▶▶ Reference P.434 • Ignition may be difficult when gas replacement is insufficient immediately after tubing connection. Supply the detector gas for about 1 hour, and ignite the plasma again. • Check that there is no leak at column connections or tubing connections. If ignition is impossible even after checking the above, the helium purifier may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4

Code	Message	Cause	Solution	Note
4212	Discharge gas APC are not ready	The BID detector gas flow is unstable.	• Check that the BID detector gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the supply pressure is sufficient for the BID detector gas to flow. ▶▶ Reference P.434 • Check that the gas supply pressure is stable. • Check that no tubing connections are loose and there is no leak. • Contact your Shimadzu service representative to check the inner diameter and length of used tubing. If the error appears repeatedly even after checking the above, the flow controller may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
4213	Discharge gas flow rate is not enough	The pressure or flow rate may have not reached the set value due to the following reasons. • The gas supply pressure is insufficient. • There is a leak at tubing connections. • The resistance of supply tubing is large (since the tubing connected is long or its inner diameter is small).	• Check that the gas main valve is open. • Check that the gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the supply pressure is sufficient for the BID detector gas to flow. ▶▶ Reference P.434 • When using the helium purifier HP2, check that there is no leak at tubing connections. • Check that no tubing connections are loose and there is no leak. • Contact your Shimadzu service representative to check the inner diameter and length of used tubing.	-

Code	Message	Cause	Solution	Note
6101	SCD furnace temperature sensor is down	The temperature sensor of the furnace is down and measurement cannot be conducted.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative to ask for part replacement.	-
6103	SCD furnace temperature sensor error	Measurement values on the temperature sensor of the furnace are unstable.		
6104	SCD furnace temperature exceeds the limit	The temperature of the furnace exceeds the upper limit of the specification.		
6105	SCD furnace temperature controller error	The temperature of the furnace does not increase even after [Heater] is set to [On].		
6106	SCD furnace temperature set point not reached	Although 90 minutes has elapsed after temperature control of the furnace started, the temperature does not reach the set value.		
6111	SCD furnace abs. press fell below lower limit	The pressure of the furnace is low while the gas is flowing.		
6112	SCD furnace abs. press was exceeded upper limit	The pressure of the furnace is high. The inner pyrotube may be clogged.	Replace the inner pyrotube. If the error is displayed even after the tube is replaced, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
6113	SCD exhaust for vacuum error	A leak has occurred inside the SCD.	Determine the cause of the leak by referring to section 5.10.2. If the error persists, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative to ask for part replacement.	-

Code	Message	Cause	Solution	Note
6121	SCD fan error	The cooling fan does not operate correctly.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative to ask for part replacement.	-
6122	SCD ozonier voltage was exceeded upper limit	The voltage of the ozone generator exceeds the upper limit.		
6123	SCD ozonier voltage fell below lower limit	The voltage of the ozone generator is lower than the lower limit.		
6124	SCD PSU-24V error	The power source may have failed.		
6135	SCD thermistor temperature exceeds the limit	The thermistor detected abnormal high temperature.		
6141	SCD thermistor error	The thermistor may have failed.		
6142	SCD H2 solenoid valve has been fixed to ON	The solenoid valve cannot be closed.		
6143	SCD furnace leak error	The pressure of the furnace is high.		
6144	SCD detector leak error	The pressure of the detector part is high.		
6145	SCD AD converter initialization was failed	A/D converter may have failed.		
6146	SCD oxygen primary pressure is not enough	The oxygen supply pressure is lower than the lower limit.	• Check that the gas main valve is open. • Check that the gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the supply pressure is sufficient for the SCD detector gas to flow. ▶▶ Reference P.434 • Check that no tubing connections are loose and there is no leak. • Contact your Shimadzu service representative to check the inner diameter and length of used tubing.	-

Code	Message	Cause	Solution	Note
6147	SCD hydrogen primary pressure is not enough	The hydrogen supply pressure is lower than the lower limit.	• Check that the hydrogen gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the supply pressure is sufficient for the hydrogen gas to flow. ▶▶ Reference P.434 • Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
6148	SCD WDT error	The instrument is reset for some reason.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative to ask for part replacement.	-
6149	SCD heater relay has been fixed to ON	The heater relay of the furnace cannot be closed.		
6151	SCD flow controller#1 was not connected	Connection cannot be established with the flow controller for SCD gas control.		
6152	SCD flow controller#2 was not connected			
6154	SCD PMT light was leaked	Light leaks in the photomultiplier from the outside.		
6155	SCD furnace temperture is low	Auto Start is executed when the furnace temperature is set lower than 750 °C.	Set the furnace temperature at 750 °C or higher.	-
6156	SCD ozone source oxygen flow is low	Auto Start is executed when flow of oxygen for ozone is set lower than 16.0 mL/min.	Set flow of oxygen for ozone at 16.0 mL/min or higher.	-

Code	Message	Cause	Solution	Note
6163	SCD hydrogen control irregularity	The flow controller for SCD hydrogen gas control does not operate correctly.	• Check that the hydrogen gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the supply pressure is sufficient for the hydrogen gas to flow. ▶▶ Reference P.434 • Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
6164	SCD hydrogen was overpressure	Excessive hydrogen is supplied in the SCD detector since the hydrogen gas supply pressure is too high or the tubing is clogged.	Check that the gas supply pressure is within the range below. ▶▶ Reference P.402 If the gas supply pressure is appropriate, the hardware may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
6167	SCD nitrogen control irregularity	The flow controller for SCD nitrogen gas control does not operate correctly.	• Check that the nitrogen gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the supply pressure is sufficient for the nitrogen gas to flow. ▶▶ Reference P.434 • Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-

Code	Message	Cause	Solution	Note
6168	SCD nitrogen was overpressure	Excessive nitrogen is supplied in the SCD detector since the nitrogen gas supply pressure is too high or the tubing is clogged.	Check that the gas supply pressure is within the range below. ▶▶ Reference P.402 If the gas supply pressure is appropriate, the hardware may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
6171	SCD furnace oxygen control irregularity	The flow of the flow controller to control oxygen gas for the SCD furnace is unstable.	• Check that the oxygen gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the supply pressure is sufficient for the oxygen gas to flow. ▶▶ Reference P.434 • Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, the flow controller may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
6172	SCD furnace oxygen was overpressure	Excessive oxygen is supplied in the SCD detector since the oxygen gas supply pressure is too high or the tubing is clogged.	Check that the gas supply pressure is within the range below. ▶▶ Reference P.402 If the gas supply pressure is appropriate, the hardware may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-

Code	Message	Cause	Solution	Note
6175	SCD ozone source oxygen control irregularity	The flow of the flow controller to control oxygen gas for the SCD ozone generator is unstable.	- Check that the oxygen gas supply pressure is within the range below. ▶▶ Reference P.402 - Check that the supply pressure is sufficient for the oxygen gas to flow. ▶▶ Reference P.434 - Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, the flow controller may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
6176	SCD ozone source oxygen was overpressure	Excessive oxygen is supplied in the SCD detector since the oxygen gas supply pressure is too high or the tubing is clogged.	Check that the gas supply pressure is within the range below. ▶▶ Reference P.402 If the gas supply pressure is appropriate, the hardware may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
6177	SCD flow controller#1 error	An unexpected error has occurred on the flow controller for SCD gas control.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative to ask for part replacement.	-
6178	SCD flow controller#2 error			
6181	DET#4 SCD overcurrent detected	Strong light has leaked into the photomultiplier or the current of the photomultiplier is abnormal due to its failure.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-

6.6 Other Errors

Code	Message	Cause	Solution	Note
80 81 82 83	CARx septum counter error	The number of analysis exceeded the set threshold.	Replace the consumables and then reset the counter on [Analysis Counter] screen.	x=1 to 4
84 85 86 87	CARx insert counter error			
88 89	AOCn syringe counter error			n=1 to 2
1001	Heat is escaping	• Oven door opens. • Heat loss is large because the insulation of the oven has a hole.	• When oven door opens, close the door and press [Reset]. • When the insulation of the oven has a hole, turn off the main power of the instrument and close the hole. If the error appears even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-
1002 1003 1004 1005 1006 1007 1008 1009 1053	xxx temperature exceeds the limit	Temperature exceeds the maximum allowable value.	Press [Ignore] and change the maximum allowable value. After changing the value, press [Reset].	xxx=COL, INJ1, DET1, INJ2, DET2, AUX3, AUX4, AUX5, SAT

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Code	Message	Cause	Solution	Note
1036	Overheat is sensed	Temperature control circuit has a problem.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	Overheat detected by thermocouple
1037	xxx			Overheat detected by software xxx=COL, INJ1, DET1, INJ2, DET2, AUX3, AUX4, AUX5, SAT
1038	temperature			
1039	controller error			
1040				
1041				
1042				
1043				
1044				
1057				
1045	Column oven relay error	Relay or heater control circuit has a problem.		-
1046	INJ1-DET2 relay error			
1047	AUX3-AUX5 relay error			
1049	DET#n set	Detector temperature is set at a lower value than column temperature.	To prevent detector contamination, set a detector temperature higher than the column oven temperature. When setting a detector temperature lower than the column oven temperature, turn off the contamination prevention function. ▶▶ Reference P.336	n=1 to 4
1050	temperature is			
1051	low			
1052				
1061	Oven door is open	Column oven door opens.	Close column oven door and press [Reset]. If the error appears even with the oven door closed, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	-

Code	Message	Cause	Solution	Note
2014 2017 2020 2023	DetAPCn makeup set point not reached	The pressure or flow rate may have not reached the set value due to the following reasons. • The gas supply pressure is insufficient. • There is a leak at tubing connections. • The resistance of supply tubing is large (since the tubing connected is long or its inner diameter is small).	• Check that the gas main valve is open. • Check that the gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the supply pressure is sufficient for the makeup gas to flow. ▶▶ Reference P.434 • Check that no tubing connections are loose and there is no leak. • Contact your Shimadzu service representative to check the inner diameter and length of used tubing.	n=1 to 4
2015 2018 2021 2024	DetAPCn hydrogen set point not reached		• Check that the gas main valve is open. • Check that the gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the supply pressure is sufficient for the hydrogen gas to flow. ▶▶ Reference P.434 • Check that no tubing connections are loose and there is no leak. • Contact your Shimadzu service representative to check the inner diameter and length of used tubing.	

Code	Message	Cause	Solution	Note
2016 2019 2022 2025	DetAPCn air set point not reached	The pressure or flow rate may have not reached the set value due to the following reasons. • The gas supply pressure is insufficient. • There is a leak at tubing connections. • The resistance of supply tubing is large (since the tubing connected is long or its inner diameter is small).	• Check that the gas main valve is open. • Check that the gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the supply pressure is sufficient for the air gas to flow. ▶▶ Reference P.434 • When using a silica gel container, check that there is no leak from the container. • Check that no tubing connections are loose and there is no leak. • Contact your Shimadzu service representative to check the inner diameter and length of used tubing.	n=1 to 4
2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043	APCy set point not reached		• Check that the gas main valve is open. • Check that the gas supply pressure is higher than the set pressure. • Check that no tubing connections are loose and there is no leak. • Contact your Shimadzu service representative to check the inner diameter and length of used tubing.	y=1 to 18

Code	Message	Cause	Solution	Note
2048 2049 2050 2202	CARx purge valve not completely closed	There is a leak inside the purge flow control valve of the AFC.	Check that the purge line outlet is not blinded. If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	x=1 to 4 To thoroughly check whether the valve has failed, see P.121 .
2057 2060 2063 2066	DetAPCn makeup valve not completely closed	There is a leak inside the makeup gas control valve of the APC for the detector.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	
2058 2061 2064 2067	DetAPCn hydrogen valve not completely closed	There is a leak inside the hydrogen control valve of the APC for the detector.		
2059 2062 2065 2068	DetAPCn air valve not completely closed	There is a leak inside the air control valve of the APC for the detector.		

Diagnosis of valve failure

NOTE

- For AFC:
Close the main valve of the cylinder for safety. Open the column connection of the injection port and check that the column inlet pressure on the monitor decreases. (If the pressure value on the monitor does not decrease, perform offset calibration.) When the pressure value on the monitor decreases, connect the column to the column connection again (or seal it) and check whether the column inlet pressure increases when supplying the gas to the AFC. When the column inlet pressure increases, the valve or board may have failed.
- For DETAPC (ECD/BID):
The setting value for the bypass unit of ECD or BID may be misaligned significantly. Close the manual valve of the bypass unit of ECD or BID totally. Then, check whether the APC flow on the monitor decreases. When the APC flow does not decrease, the valve or board may have failed.
- For DETAPC (other than ECD/BID):
Close the main valve of the cylinder for safety. Check whether the APC flow on the monitor decreases. When the APC flow does not decrease, the valve or board may have failed.
- For AUX-APC:
Close the main valve of the cylinder for safety. Ensure that the AUX-APC outlet opens to the atmosphere. When the pressure value on the monitor does not decrease while the APC outlet opens to the atmosphere, the valve or board may have failed.

Code	Message	Cause	Solution	Note
2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086	APCy valve not completely closed	There is a leak inside the pressure control valve of the AUX-APC.	Check that the tubing connection destination of the AUX-APC is not blinded. If it is blinded, remove the blind to open the line to atmosphere. If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	y=1 to 18 To thoroughly check whether the valve has failed, see P.121 .
2272 2273 2274 2275	DAMCn makeup set point not reached	The pressure or flow rate may have not reached the set value due to the following reasons.	• Check that the gas main valve is open. • Check that the gas supply pressure is within the range below. ▶▶ Reference P.402	n=1 to 4
2276 2277 2278 2279	DAMCn reference gas set point not reached	• The gas supply pressure is insufficient. • There is a leak at tubing connections. • The resistance of supply tubing is large (since the tubing connected is long or its inner diameter is small).	• Check that the supply pressure is sufficient for the makeup gas to flow. ▶▶ Reference P.434 • Check that no tubing connections are loose and there is no leak. • Contact your Shimadzu service representative to check the inner diameter and length of used tubing.	

Code	Message	Cause	Solution	Note	
2087 2088 2089 2090	DAMCn makeup control irregularity	Component does not operate correctly.	• Check that the supply pressure to each unit is within the range below. ▶▶ Reference P.402	n=1 to 4	
2091 2092 2093 2203	CARn purge control irregularity		• Check that the supply pressure is sufficient for the gas of each unit to flow. ▶▶ Reference P.434		
2094 2095 2096 2097	DAMCn reference gas control irregularity		• Check that the gas supply pressure is stable.		
2100 2103 2106 2109	DetAPCn makeup control irregularity		If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.		
2101 2104 2107 2110	DetAPCn hydrogen control irregularity				
2102 2105 2108 2111	DetAPCn air control irregularity				
2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129	APCy control irregularity				y=1 to 18

Code	Message	Cause	Solution	Note
2130 2131 2204 2205	CARm AFC set point not reached	The pressure or flow rate may have not reached the set value due to the following reasons. • The gas supply pressure is insufficient. • There is a leak at tubing connections. • The resistance of supply tubing is large (since the tubing connected is long or its inner diameter is small).	• Check that the gas main valve is open. • Check that the set values of the column inlet pressure and total flow are within the AFC control range. ▶▶ Reference P.434 • Check that no tubing connections are loose and there is no leak. • Contact your Shimadzu service representative to check the inner diameter and length of used tubing.	m=1 to 4
2132 2133 2206 2207	CARm AFC valve not completely closed	There is a leak inside the purge flow control valve of the AFC.	Check that the split line outlet and purge line outlet are not blinded. If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	m=1 to 4 To thoroughly check whether the valve has failed, see P.121 .
2134 2135 2136 2137 2208 2209 2210 2211	CARm AFC control irregularity	Each unit does not operate correctly.	• Check that the supply pressure to the AFC is within the range below. ▶▶ Reference P.402 • Check that the supply pressure is sufficient for the AFC gas to flow. ▶▶ Reference P.434 • Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	m=1 to 4

Code	Message	Cause	Solution	Note
2138 2139 2140 2212	CARx prim is out of range	The carrier gas supply pressure is incorrect.	- Check that the carrier gas supply pressure is within the primary pressure range in the configuration described below. ▶▶ Reference P.350 - An error will occur if the primary pressure goes below the following values. [300-500 kPa] : 150 kPa [500-900 kPa] : 350 kPa [900 kPa-] : 750 kPa	x=1 to 4
2141 2142 2143 2213	CARm is not controlled	Temperature control started when the carrier gas control was turned off.	Turn on the carrier gas control or remove unused carrier gas line from the analytical line.	m=1 to 4
2144 2145 2146 2147	DetAPCn discharge gas set point not reached	The pressure or flow rate may have not reached the set value due to the following reasons. - No column is connected. - The gas supply pressure is insufficient. - There is a leak at tubing connections. - The resistance of supply tubing is large (since the tubing connected is long or its inner diameter is small).	- Check that the column is connected. - Check that the gas main valve is open. - Check that the gas supply pressure is within the range below. ▶▶ Reference P.402 - Check that the supply pressure is sufficient for the detector gas to flow. ▶▶ Reference P.434 - Check that no tubing connections are loose and there is no leak. - Contact your Shimadzu service representative to check the inner diameter and length of used tubing.	n=1 to 4

Code	Message	Cause	Solution	Note
2148 2149 2150 2151	DetAPCn discharge gas valve not completely closed	The sweep gas flow supplied from the bypass line is unstable, or there is a leak inside the BID gas control valve of the APC for the detector.	Close the knob of the bypass unit of BID totally with the BID DCG flow set off. Then, check whether the BID DCG flow on the monitor decreases. When the BID DCG flow on the monitor decreases to less than 1 mL/min, turn the knob on the bypass unit to readjust the sweep gas flow so that the BID DCG flow on the monitor reads 5 to 10 mL/min. ▶▶ Reference P.217 If the BID DCG flow on the monitor does not decrease to less than 1 mL/min, the hardware may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4 To thoroughly check whether the valve has failed, see P.121 .
2152 2153 2154 2155	DetAPCn discharge gas control irregularity	The flow of the flow controller to control the BID detector gas is unstable.	• Check that the BID detector gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the supply pressure is sufficient for the BID detector gas to flow. ▶▶ Reference P.434 • Check that the gas supply pressure is stable. • Check that the BID sweep gas flow is about 5 to 10 mL/min. To check and adjust the sweep gas flow, see below. ▶▶ Reference P.217 If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4

Code	Message	Cause	Solution	Note
2156 2157 2158 2159	DetAPCn ECD gas set point not reached	The pressure or flow rate may have not reached the set value due to the following reasons. • The gas supply pressure is insufficient. • There is a leak at tubing connections. • The resistance of supply tubing is large (since the tubing connected is long or its inner diameter is small).	• Check that the gas main valve is open. • Check that the gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the supply pressure is sufficient for the detector gas to flow. ▶▶ Reference P.434 • Check that no tubing connections are loose and there is no leak. • Contact your Shimadzu service representative to check the inner diameter and length of used tubing.	n=1 to 4
2160 2161 2162 2163	DetAPCn ECD gas valve not completely closed	The detector gas flow supplied from the bypass line is unstable, or there is a leak inside the ECD gas control valve of the APC for the detector.	Close the knob of the bypass unit of ECD totally with the ECD gas flow set off. Then, check whether the ECD gas flow on the monitor decreases. When the ECD gas flow on the monitor decreases to less than 1 mL/min, turn the knob on the bypass unit to readjust the sweep gas flow so that the ECD gas flow on the monitor reads 5 to 10 mL/min. ▶▶ Reference P.212 If the ECD gas flow on the monitor does not decrease to less than 1 mL/min, the hardware may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4 To thoroughly check whether the valve has failed, see P.121 .

Code	Message	Cause	Solution	Note
2164 2165 2166 2167	DetAPCn ECD gas control irregularity	The flow of the flow controller to control the ECD detector gas is unstable.	• Check that the ECD detector gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the supply pressure is sufficient for the ECD detector gas to flow. ▶▶ Reference P.434 • Check that the gas supply pressure is stable. • Check that the ECD sweep gas flow is about 5 to 10 mL/min. To check and adjust the sweep gas flow, see below. ▶▶ Reference P.212 If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4
2214 2215 2216 2217	CARn was overpressure	Excessively high pressure is applied to the injection port. These errors may occur when supply gas pressure is changed during AFC operation.	• Do not open or close the main valve of the supply gas during AFC operation. • Restart the GC with the gas supplied. • Check that the gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4

Code	Message	Cause	Solution	Note
2218 2219 2220 2221	CARn septum purge was overpressure	Excessively high pressure is applied to the purge line.	• Check that the purge line is not blinded. • Do not open or close the main valve of the supply gas during AFC operation. • Restart the GC with the gas supplied. • Check that the gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4
2222 2225 2228 2231	DetAPCn makeup was overpressure	Makeup flow exceeded the specified value. These errors may occur when supply gas pressure is changed during APC operation.	• Do not open or close the main valve of the supply gas during APC operation. • Restart the GC with the gas supplied. • Check that the makeup gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, the control system of the APC may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4

Code	Message	Cause	Solution	Note
2223 2226 2229 2232	DetAPCn hydrogen was overpressure	Hydrogen flow exceeded the specified value. These errors may occur when supply gas pressure is changed during APC operation.	• Do not open or close the main valve of the supply gas during APC operation. • Restart the GC with the gas supplied. • Check that the hydrogen gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, the control system of the APC may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4
2224 2227 2230 2233	DetAPCn air was overpressure	Air flow exceeded the specified value. These errors may occur when supply gas pressure is changed during APC operation.	• Do not open or close the main valve of the supply gas during APC operation. • Restart the GC with the gas supplied. • Check that the air gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, the control system of the APC may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4

Code	Message	Cause	Solution	Note
2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251	APCx was overpressure	Excessively high pressure is applied to the AUX-APC. These errors may occur when supply gas pressure is changed during AUX-APC operation.	- Do not open or close the main valve of the supply gas during AUX-APC operation. - Restart the GC with the gas supplied. - Check that the gas supply pressure is within the range below. ▶▶ Reference P.402 - Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	x=1 to 18
2264 2265 2266 2267	DetAPCn discharge gas was overpressure	BID detector gas flow exceeded the specified value. These errors may occur when supply gas pressure is changed during APC operation.	- Do not open or close the main valve of the supply gas during APC operation. - Restart the GC with the gas supplied. - Check that the BID gas supply pressure is within the range below. ▶▶ Reference P.402 - Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, the control system of the APC may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4

Code	Message	Cause	Solution	Note
2268 2269 2270 2271	DetAPCn ECD gas was overpressure	ECD detector gas flow exceeded the specified value. These errors may occur when supply gas pressure is changed during APC operation.	• Do not open or close the main valve of the supply gas during APC operation. • Restart the GC with the gas supplied. • Check that the ECD gas supply pressure is within the range below. ▶▶ Reference P.402 • Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, the control system of the APC may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4
2288 2289 2290 2291	DAMCn makeup was overpressure	Excessively high pressure is applied to the DAMC makeup line.	• Check the supply gas pressure. • If the supply pressure is correct, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4
2292 2293 2294 2295	DAMCn reference gas was overpressure	Excessively high pressure is applied to the reference line of the APC for the detector.		
2296 2297 2298 2299	CARn hydrogen flowing over the specified value	There is a program that requires hydrogen gas flow more than the specified value, or the component does not operate correctly.	Ensure that the set values in programs such as Column Oven Temperature Program and Pressure Program are proper. When the set values in the programs are proper, the control system of the AFC may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 4

Code	Message	Cause	Solution	Note
2300 2301 2302 2303	DetAPCn hydrogen flowing over the specified value	Hydrogen flow exceeded the specified value. These errors may occur when supply gas pressure is changed during APC operation.	Do not open or close the main valve of the supply gas during APC operation.	n=1 to 4
2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321	APCn hydrogen flowing over the specified value		- Restart the GC with the gas supplied. - Check that the hydrogen gas supply pressure is within the range below. ▶▶ Reference P.402 - Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, the control system of the APC may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	n=1 to 18
2322 2323 2324 2325 2326 2327	Flow# valve control irregularity		The valve of the flow controller or board may have failed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	When the gas type is set to H2 for H2 carrier, H2 line of FID/FTD/FPD, H2 makeup of TCD, or AUX-APC, the instrument goes into sleep mode for safety when this error is detected. #=1 to 6
2338 2339 2340 2341 2342 2343	Flow# press/flow offset value is shifted		An error may occur on the pressure sensor. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	#=1 to 6

Code	Message	Cause	Solution	Note
2346 2347	Gas Selector# main set point not reached	The pressure does not increase to the set value due to an error in pressure control (leak).	Check whether gas is supplied and whether gas is not leaking from connections. Gas leaks may be occurring in several locations (other than displayed site).	#=1 to 2
2348 2349	Gas Selector# purge set point not reached			
2350 2351	Gas Selector# sub set point not reached			
2352 2353	Gas Selector# main valve not completely closed	There is a leak inside the main-side valve of the gas selector.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	#=1 to 2 To thoroughly check whether the valve has failed, see P.121 .
2354 2355	Gas Selector# purge valve not completely closed	There is a leak inside the purge valve of the gas selector.		
2356 2357	Gas Selector# sub valve not completely closed	There is a leak inside the sub-side valve of the gas selector.		
2358 2359	Gas Selector# main control irregularity	Did not operate correctly.	• Check that the set pressure for the gas selector is lower than the supply pressure. • Check that the supply pressure to the gas selector is within the range below. ▶▶ Reference P.402 • Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	#=1 to 2
2362 2363	Gas Selector# sub control irregularity			

Code	Message	Cause	Solution	Note
2360 2361	Gas Selector# purge control irregularity	The gas selector does not operate correctly.	• Check that the supply pressure to the gas selector is within the range below. ▶▶ Reference P.402 • Check that the gas supply pressure is stable. If the error appears repeatedly even after checking the above, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	#=1 to 2
2364 2365	Gas Selector# main was overpressure	Excessively high pressure is applied to the gas selector.	• Check the supply gas pressure. • If the supply pressure is correct, turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	#=1 to 2
2368 2369	Gas Selector# sub was overpressure			
2366 2367	Gas Selector# purge was overpressure	Overpressure or clogging in the tubing may occur.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative.	
2370 2371	Can not switch gas because of gas selector# main error occurring	You tried to set the supply gas to main while there is an error with the main of the gas selector.	Check whether the main gas is supplied and whether gas is not leaking from connections. After resolving the problem, press [Reset].	#=1 to 2
2372 2373	Can not switch gas because of gas selector# sub error occurring	You tried to set the supply gas to sub while there is an error with the sub of the gas selector.	Check whether the sub gas is supplied and whether gas is not leaking from connections. After resolving the problem, press [Reset].	#=1 to 2
4301	Settings were changed	Setting is changed while program is running.	If you changed the part which is not executed, the instrument continues the analysis according to the changed program. Check the setting.	-

Code	Message	Cause	Solution	Note
4302	Program time error	Program time is longer than the upper limit "9999.99 min".	Do not set the total time longer than 9999.99 min.	The analysis can be performed even after this message is displayed, however, the program finishes after 9999.99 minutes elapses.
4303	Clean up program time error			
4304	Pre-Run program time error			
4305	Clean up program start error	Clean up program cannot be started because oven temperature is not ready.	Set the initial temperature of the column oven at higher values than room temperature. ▶▶ Reference P.285	-

6.7 Warning Messages

Code	Message	Cause	Solution	Note
9000	Column oven CRG use time warning	Exceeded the set threshold.	Replace the coolant and then reset the counter. ▶▶ Reference P.377	-
9002	Fan use time warning	Risk of current leakage, heat, smoke, and ignition increases because usage time exceeds the set value.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative to ask for part replacement. ▶▶ Reference P.367	-
9004 9005 9006 9052	CARx septum counter warning	Exceeded the set threshold.	Replace the septum and then reset the counter. ▶▶ Reference P.375	x=1 to 4
9007 9008 9009 9053	CARx insert counter warning		Replace the insert and then reset the counter. ▶▶ Reference P.375	
9059 9060	AOCm syringe counter warning		Replace the syringe and then reset the counter. ▶▶ Reference P.375	m=1 to 2
9010	System is not ready	The analysis was started while the system was not ready.	Start the analysis after the system is ready. If this message appears when all the parameters including temperature and flow are ready, check the following items. • Ready check function is not turned on for unused components. • The equilibration time is not too long.	-
9011	Ignition finished(retried)	Detector ignition sequence was re-attempted, because the ignition failed initially.	If this message appears frequently, diagnose ignition pulse and ignition sequence by standard diagnosis. ▶▶ Reference P.367 Also check for gas leaks and verify the gas flows. If set values are correct, contact your Shimadzu sales/service representative.	-

Code	Message	Cause	Solution	Note
9012 9013 9014 9015 9016 9017 9018 9019 9024	xxx sensor use time warning	Risk of current leakage, heat, smoke, and ignition increases because usage time exceeds the set value.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative to ask for part replacement.	xxx=COL, INJ1, DET1, INJ2, DET2, AUX3, AUX4, AUX5, SAT
9020	Temp. is not controlled	Ignition or illumination was started when the GC did not start temperature control.	Set [Start Temp/Det] at [Enable] on [GC Start Sequence] screen, start the GC, and then start ignition or illumination again. ▶▶ Reference P.143	-
9021	Detector is not controlled	Ignition or illumination was started when the detector control was set to [Off].	Turn [On] the detector control and then start ignition or illumination again. ▶▶ Reference P.185	-
9054	Processing, unable to start	The analysis was started when the instrument status is "RUN".	-	-
9055 9056 9057 9058	CARn septum purge is not controlled	The analysis was started when the purge control was set to [Off].	Set [Septum Purge] to [On] on [Purge Flow Program] screen, and then start the analysis. ▶▶ Reference P.279	n=1 to 4

Code	Message	Cause	Solution	Note
9061	Not execute this operation	The following operation was executed while the GC stopped. • Ignition/Illumination • FTD Feedback • Start analysis • Batch • Clean Up • PREP RUN • Easy sTop	Press [Start GC] on [GC Start/Stop Sequence] screen before executing the listed operations. ▶▶ Reference P.143	-
		The following operation was executed while the GC started. • Standard Diagnosis • Carrier gas leak check • Offset calibration of flow controller	Press [Stop GC] on [GC Start/Stop Sequence] screen before executing the listed operations. ▶▶ Reference P.143	
		Time program setting was changed while time program was running.	Change the setting after time program is completed.	
		Pre-Run program setting was changed while pre-run program was running.	Change the setting after pre-run program is completed.	
		AOC control was attempted when the instrument and AOC were not connected.	Connect the instrument and AOC.	
		You cannot perform calibration when: • The GC operates • FLOW is turned ON • The pressure higher than the specified value has already been applied when the calibration is performed.	Check the following items before calibration. • Stopping GC • Turn Off FLOW. • Open each unit to the atmosphere.	

Code	Message	Cause	Solution	Note
9062	Prep run wait time elapsed	No analysis started after PREP RUN was inputted and the instrument became ready.	• For manual injection analyses, introduce the sample within the [Prep RUN Wait Time]. • For analyses with extended pre-run time, such as for HS warming, set [Prep RUN Wait Time] longer than the pre-run time. ▶▶ Reference P.381	-
9063 9064 9065 9066	CARx prim is out of range	Carrier gas is not supplied correctly.	Check the amount of remaining gas in the cylinder and tubing.	x=1 to 4
9071	SCD vacuum pump use time warn.	The number of analysis exceeded the set threshold.	Replace or maintain the vacuum pump and then reset the counter.	-
9072	SCD ozone scrub. use time warn.	The count exceeded the set threshold value. The risk of ozone entering the exhaust from the vacuum pump increases.	Replace the filling materials of the ozone scrubber and then reset the counter.	-
9073	SCD in pyrotube use time warn.	The number of analysis exceeded the set threshold.	Replace the inner pyrotube and then reset the counter.	-
9074	SCD out pyrotube use time warn.	The number of analysis exceeded the set threshold.	Replace the outer pyrotube and then reset the counter.	-
9075	SCD furnace temp sensor warn.	The count exceeded the set threshold value. The risk of current leakage, heat, smoke, and ignition increases.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative to ask for part replacement.	-
9076	SCD induc. tube use time warn.	The number of analysis exceeded the set threshold.		
9077	SCD furnace abs. press warning	The absolute pressure of the SCD furnace increases and exceeds the threshold due to degradation of the inner pyrotube.	Replace the inner pyrotube.	-

Code	Message	Cause	Solution	Note
9078	SCD unable to auto start	The SCD cannot be started due to failure in a leak check in section 7.4.14, etc.	If a leak check has failed, determine the cause of the leak by referring to section 5.10.2, and perform a leak check again. If any other error has occurred, refer to the explanation of each error.	-
9079	SCD detector abs. press is high	The SCD detector absolute pressure sensor has failed.	Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative to ask for part replacement.	-
9080	SCD detector abs. press is low			-
9081	The dual AOC version does not match with each other	A dual AOC configuration is used, but the ROM versions of the main and sub AOCs do not match.	If the ROM version is not the same, correct operation is not guaranteed. Turn off the main power of the instrument, stop gas supply, and contact your Shimadzu sales/service representative to ask for an update.	-

7

Screens Displayed on Touch Panel and Their Functions

HOME screen is displayed when you turned on the instrument.

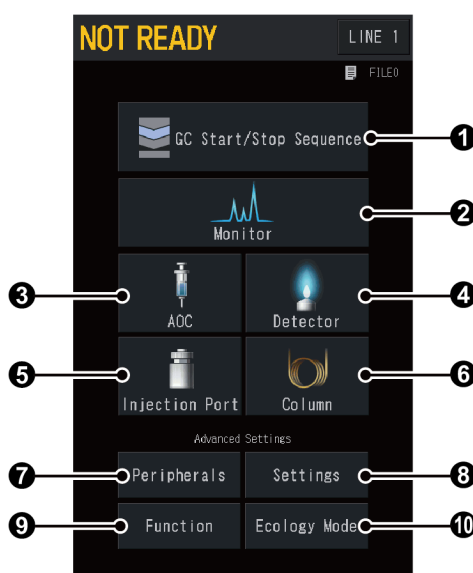
HOME screen is also displayed when you press  (HOME) on the control panel while the instrument is turned on.

This chapter describes screens displayed on the touch panel when transiting from HOME screen and their functions.

▶▶ **Reference** See "[Displayed items on the touch panel](#)" P.23 for details about displayed items on the touch panel.

■ **NOTE** Do not turn off the main power for 10 seconds after you change the setting. If you turn off the main power within 10 seconds, the changed setting may not be reflected.

■ HOME



No.	Item	Description	See also
①	GC Start/Stop Sequence	Sets parameters related to the GC start and stop.	P.143
②	Monitor	You can check conditions of injection ports, columns, and detectors and the baseline.	P.156
③	AOC	Sets AOC.	P.165
④	Detector	Sets detector temperature, conditions for the detector gas, and signal output.	P.185
⑤	Injection Port	Sets inlets temperature and various conditions for the carrier gas.	P.247
⑥	Column	Sets column temperature, column information (inner diameter, length, etc.), and temperature program.	P.285
⑦	Peripherals	Sets optional devices (CRG, AUX-APC, etc.).	P.295

No.	Item	Description	See also
8	Settings	Sets line settings and frequently changed conditions (various temperatures, the carrier gas, detectors, etc.) by batch.	P.313
9	Function	Sets configuration and time program.	P.317
10	Ecology Mode	Sets carrier gas saver and auto stop/start of the instrument.	P.383

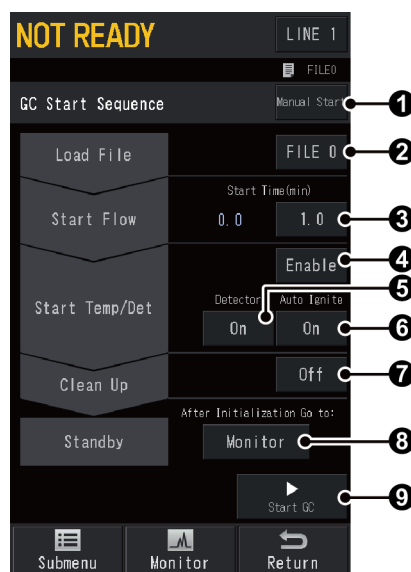
7.1 GC Start/Stop Sequence

You can set parameters related to the GC start and stop. The screen changes depending on the instrument status.

7.1.1 [GC Start Sequence] Screen

Press  (HOME) - [GC Start/Stop Sequence] while the GC is turned off to display [GC Start Sequence] screen.

You can set parameters related to the GC startup such as start time and clean up.



No.	Item	Description	
①	GC Start Sequence	Sets the GC start procedure after the instrument is turned on.	
		Items	• Manual Start The GC does not start after the instrument is turned on. Press ⑨ [Start GC] on [GC Start Sequence] screen to start the GC. • Auto Start The GC starts automatically after the power is turned on. • Semi-Auto Control of only carrier gas, detector gas (excluding hydrogen, air, oxygen) and AUX-APC gas starts after the power is turned on. Press ⑨ [Start GC] on [GC Start Sequence] screen to start the GC.
		Default	Manual Start
②	Load File	Sets the file to be used. The GC will be controlled based on the parameters in the specified file.	
		Range	FILE 0 to FILE 9
		Default	FILE 0
③	Start Time	Sets the period of time after flow control starts until temperature/detector control starts. This can be set when ④ [Start Temp/Det] is set at [Enable]. Set the start time considering the polarity of the column and dead time (time spent until substances not adsorbed by the stationary phase elute). Examples for start time setting are shown below. • In the case of a 30 m neutral column and a 30 cm/sec linear velocity (dead time 100 sec.) : Approximately 5 min • In the case of a 60 m high-polar column and a 20 cm/sec linear velocity (dead time 300 sec.) : At least 10 min • If the instrument has been out of use for a time with no column connected : One to several hours NOTE • When the detector is ECD, set ③ [Start Time] at a value more than 10 minutes. If the temperature increases when the air in the cell is not replaced with nitrogen, it accelerates degradation of the cell. • When the detector is BID, extra caution should be exercised on ③ [Start Time] setting to avoid degradation of helium purifier. Normally, set it at 10 minutes. After piping installation or cylinder replacement, set it at about 60 minutes.	
		Range	0.0 to 6000.0 min
		Default	3.0 min

No.	Item	Description
④	Start Temp/Det	Select [Enable] to start temperature/detector control after the start time is finished. Select [Disable] to continuously flow the carrier gas and not to start temperature/detector control.
		Items Enable, Disable
		Default Enable
⑤	Detector	Select [On] to prepare the detector configured in analytical line for analysis while the GC starts.
		Items Off, On
		Default On
⑥	Auto Ignition	Select [On] to ignite the FID or FPD automatically while the GC starts.
		 Hint This setting is linked with the setting of [Auto Ignition] on [Detector] screen.
		▶▶ Reference For manual ignition of FID and FPD, see the following sections. "FID ignition" P.190 "FPD ignition" P.210
		 NOTE - For BID, plasma will start to be produced while the GC starts regardless of the setting in ⑥ [Auto Ignition]. - For TCD, ECD, and FTD, ignition will not start even the item is set at [On].
		Items Off, On
		Default On
⑦	Clean Up	Select whether to run the clean up program after the GC starts up.
		▶▶ Reference "7.1.4 [Clean Up] Screen" P.154
		Items - Off The instrument does not perform clean up. - On The instrument performs clean up using the clean up program.
⑧	After Initialization Go to:	Default Off
		Sets the screen to be displayed after the GC initialization.
		 NOTE If a screen other than [GC Start Sequence] screen is displayed when the GC starts up, the screen set here will not be displayed.
		Items GC Stop Seq., HOME, Monitor
		Default Monitor

No.	Item	Description
9	Start GC	When you press [Start GC], the GC will start according to [GC Start Sequence] screen settings. If you press [Start GC] while the instrument is starting up immediately after the power button is pressed, GC start is scheduled and [Abort] is displayed. Press [Abort] to cancel the GC start. During the GC startup, [GC Stop Seq.] is displayed. Press [GC Stop Seq.] to display [GC Stop Sequence] screen. ▶▶ Reference "7.1.2 [GC Stop Sequence] Screen" P.146

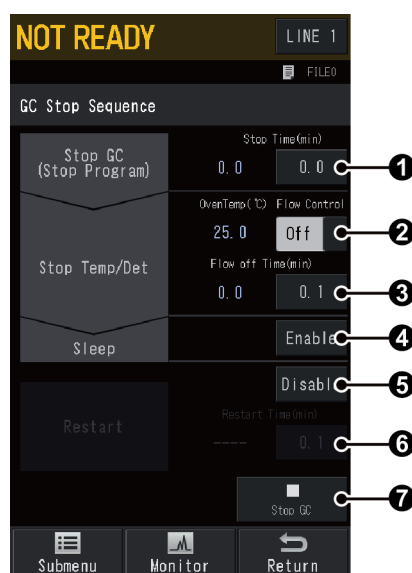
Submenu

Item	Description	See also
GC Stop Sequence	Displays [GC Stop Sequence] screen.	P.146
File	Displays [File Select] screen. You can change the file to be used.	P.150
Clean Up	Displays [Clean Up] screen. You can set parameters for clean up during the GC startup.	P.154

7.1.2 [GC Stop Sequence] Screen

Press  (HOME) - [GC Start/Stop Sequence] while the GC is turned on to display [GC Stop Sequence] screen.

You can set parameters related to the GC shutdown such as stop time, flow off time, and sleep time.



No.	Item	Description
❶	Stop Time	Sets the period of time after ❶ [Stop GC] is pressed until the instrument stops temperature/detector control.
		Range 0.0 to 6000.0 min
		Default 0.0 min
❷	Flow Control	Displays the current status of flow control. Press [Off] or [On] to switch the control status. Select [On] to continue the carrier gas flow after the GC shutdown. Select [Off] to end it after the GC shutdown. Select [Off] to stop gas flow after the time set in ❸ [Flow Off Time] elapses.
		Items Off, On
		Default On
❸	Flow Off Time	Sets the period of time between the end of temperature/detector control and the end of gas control. This can be set when ❷ [Flow Control] is [Off]. ▶▶ Reference "Examples for the GC stop" P.149
		NOTE - The system starts to count the flow off time after the temperature reaches the set value in [Makeup Gas Stop Temp] when the detector is TCD or SCD and in [ECD Gas Stop Temp] for ECD. - When the detector is BID, set ❸ [Flow Off Time] at a value more than 60 minutes because flow control should be stopped after helium purifier is cooled adequately. If flow control stops when helium purifier is hot, it accelerates degradation of helium purifier.
		Range 0.0 to 6000.0 min
		Default 0.0 min
❹	Sleep	When [Enable] is selected, the instrument will go into sleep mode automatically after the time set in ❸ [Flow Off Time] elapses. This can be set when ❷ [Flow Control] is [Off].
		Items Enable, Disable
		Default Disable

No.	Item	Description														
5	Restart	The action when [Disable] or [Enable] is selected are different depending on the settings in 4 [Sleep].														
		Sleep	Restart	Operations after the GC shutdown	Disable	Disable	None	Enable	Disable	The instrument goes into sleep mode.	Disable	Enable	The GC will automatically start after the time set in 6 [Restart Time] elapses.	Enable	Enable	The instrument will go into sleep mode after the time set in 3 [Flow Off Time] elapses. After the time set in 6 [Restart Time] elapses, the instrument will be automatically turned on and the GC will start.
		Sleep	Restart	Operations after the GC shutdown												
		Disable	Disable	None												
		Enable	Disable	The instrument goes into sleep mode.												
		Disable	Enable	The GC will automatically start after the time set in 6 [Restart Time] elapses.												
		Enable	Enable	The instrument will go into sleep mode after the time set in 3 [Flow Off Time] elapses. After the time set in 6 [Restart Time] elapses, the instrument will be automatically turned on and the GC will start.												
This can be set when 2 [Flow Control] is [Off].																
Items	Enable, Disable															
Default	Disable															
6	Restart Time	Sets the time until the instrument will be automatically turned on. Count starts after control of temperature and the detector is stopped. Count starts at the same timing as flow off time. This can be set when 5 [Restart] is set at [Enable]. When the time is set at a value lower than 3 [Flow Off Time], the instrument restarts instead of going into sleep mode even if 4 [Sleep] is set at [Enable].														
		Range	0.1 to 6000.0 min													
		Default	0.1 min													
7	Stop GC	When you press [Stop GC], the GC will stop according to [GC Stop Sequence] screen settings. If you press [Stop GC] while the instrument is performing analysis, GC stop is scheduled and [Abort] is displayed. Press [Abort] to cancel the GC stop. During the GC Shutdown, [GC Start Sequence] is displayed. Press [GC Start Sequence] to display [GC Start Sequence] screen. ▶▶ Reference "7.1.1 [GC Start Sequence] Screen" P.143														

Submenu

Item	Description	See also
GC Start Sequence	Displays [GC Start Sequence] screen.	P.143
File	Displays [File Select] screen. You can change the file to be used.	P.150
Clean Up	Displays [Clean Up] screen. You can set parameters for clean up during the GC startup.	P.154

Examples for the GC stop

The flow off time should be changed depending on the column oven temperature.

The following examples show various GC stop sequence adapted to the conditions of the instrument.

NOTE To protect columns, set the time so that the carrier gas flow stops after each parts is cooled during the GC shutdown.

- Turn off heater switch immediately and stop the carrier gas after 20 minutes.

Stop Time : 0 min
Flow Control : Off
Flow Off Time : 20 min

NOTE If the carrier gas stops while the column oven temperature is high, the liquid phase of the column may be degraded. The flow off time should be set at a value where the column oven temperature drops adequately.

- A column is conditioned (aging), and then the column oven is cooled. Carrier gas flow is then shut down.

Stop Time : Column conditioning time
Flow Control : Off
Flow Off Time : Approximately 20 min

- Turn off heater switch 10 minutes after [Stop GC] is pressed, keep the carrier gas flow, and restart the instrument after 20 hours (1200 minutes).

Stop Time : 10 min
Flow Control : Off
Flow Off Time : 1200 min (20 hours)
Sleep : Disable
Restart : Enable
Restart Time : 1200 min (20 hours)

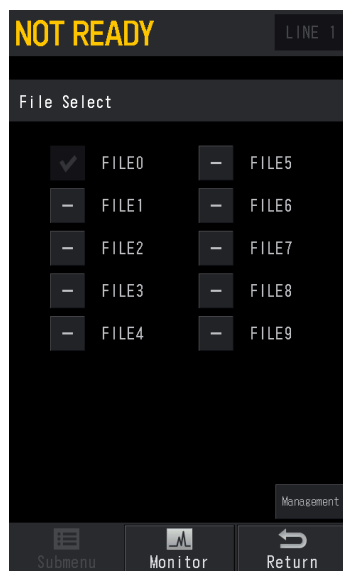
NOTE When the GC is turned off, the oven fan automatically stops based on settings in [Fan Off Temp].

▶▶ Reference "[Other Configurations] Screen" P.350

7.1.3 [File Select] Screen

Press  (HOME) - [GC Start/Stop Sequence] - [Submenu] - [File] to display [File Select] screen.

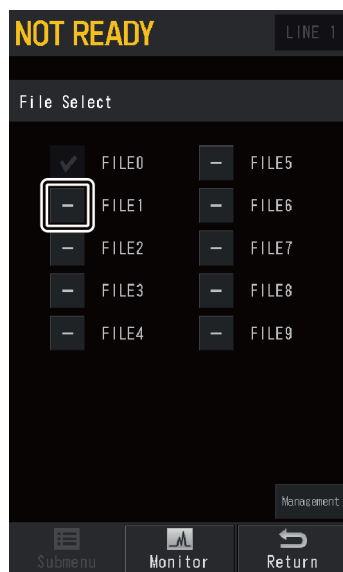
The parameters set in the system are automatically saved in a file. Use this screen to change the file to be used and its name.



To change the file (Ex: Change the file from FILE0 to FILE1)

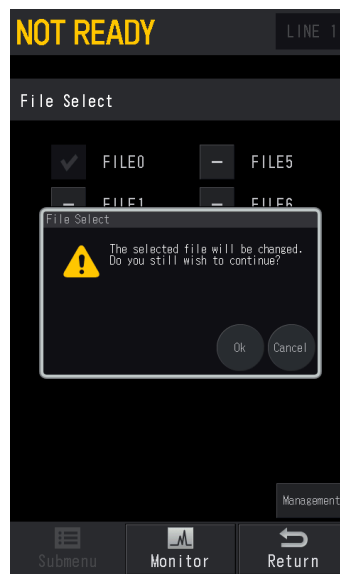
1

Press  on the left of [FILE1].

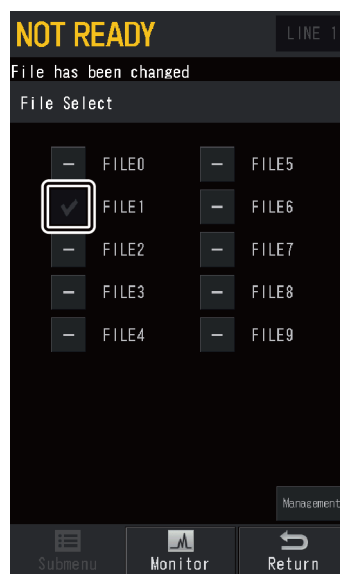


2

Press [Ok].

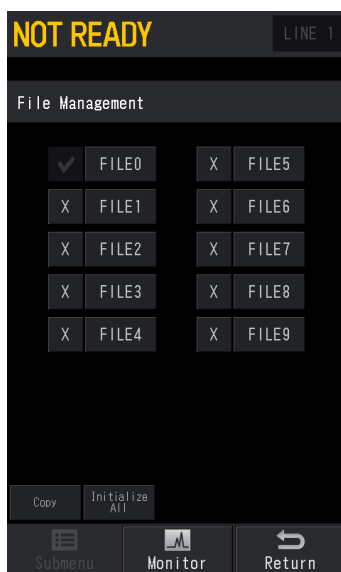


[FILE1] becomes check-marked and the change is confirmed.



■ [File Management] Screen

Press [Management] on [File Select] screen to display [File Management] screen.

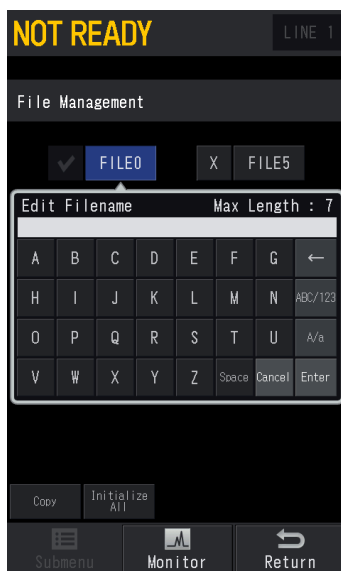


On [File Management] screen, you can make the following changes.

- "Change a file name"
- "Copy a file"
- "Initialization of a file"
- "Initialization of all files"

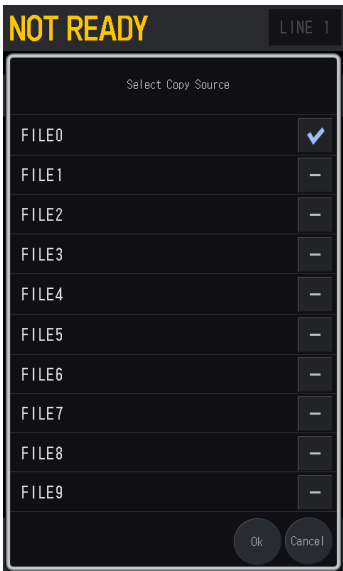
Change a file name

You can change the name by pressing each file name.

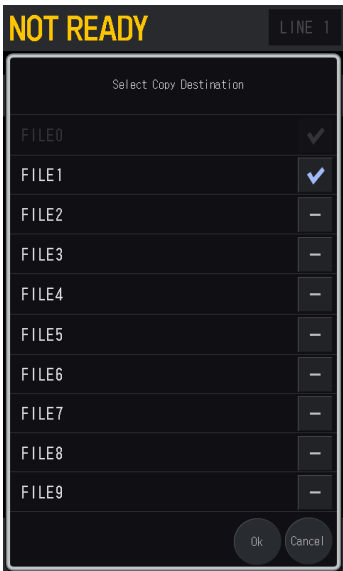


Copy a file

Press [Copy] to display a screen to specify copy source.
Specify a file and press [Ok].
Then a screen to specify a destination location appears.
Specify a file and press [Ok].



Specify copy source

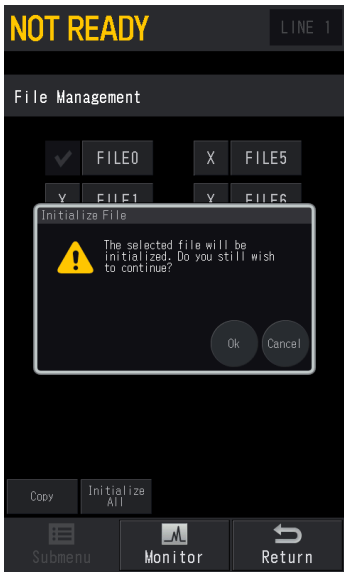


Specify a destination location

Initialization of a file

Press [x] of the file to be initialized.
Press [Ok] on confirmation screen to initialize specified file.

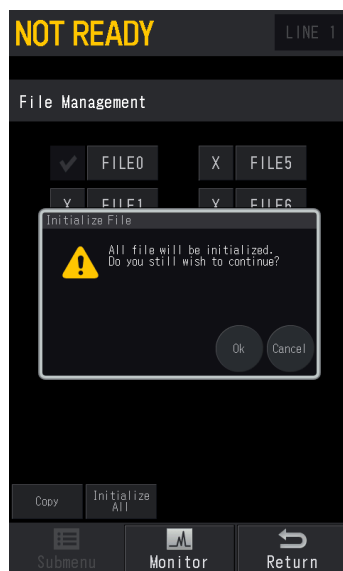
- NOTE
- The file currently selected cannot be initialized.
 - After the initialization, you cannot restore the original state.



Initialization of all files

Press [Initialize All] and press [Ok] on confirmation screen to initialize all files.

NOTE After the initialization, the file currently selected is also initialized. And you cannot restore the original state.



7.1.4 [Clean Up] Screen

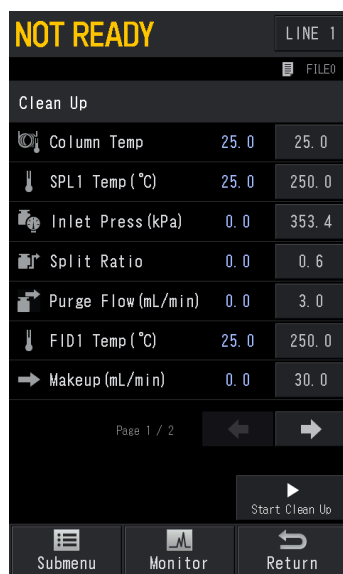
Press  (HOME) - [GC Start/Stop Sequence] - [Submenu] - [Clean Up] to display [Clean Up] screen.

Clean Up means that the system runs a GC program without injecting sample to remove contaminations that may be caused by the last analysis before an analysis.

Perform clean up before an analysis If the instrument has been out of use for a time or a new column is connected.

If [Clean Up] is set at [On] on [GC Start Sequence] screen, clean up will be performed according to [Clean Up] screen settings when the GC starts.

The items on the screen are different depending on the units installed on the instrument and settings.



NOTE Before Clean Up, you need to set column information and carrier gas type.

▶▶ Reference • "7.6.2 [Column Information] Screen" P.292

• "7.5 Injection Port" P.247

Programs available during clean up

Press [Submenu] on [Clean Up] screen to set one-ramp programs available during clean up.

The items on the screen are different depending on the units installed on the instrument and settings. Programs available during clean up are shown below.

NOTE You can set programs for clean up in the same way as analysis program. For details, see each program sections.

Item	Description	See also
Temperature Program	Displays [Clean Up Temperature Program] screen.	P.285
Pressure Program	Displays [Clean Up Pressure Program] screen. Displayed when [Flow Control Mode] in [INJ/FLOW] screen is set at [Press] or [Velocity].	P.267
Flow Program	Displays [Clean Up Column Flow Program] screen. Displayed when [Flow Control Mode] in [INJ/FLOW] screen is set at [Col Flow].	P.271

7.2 Monitor

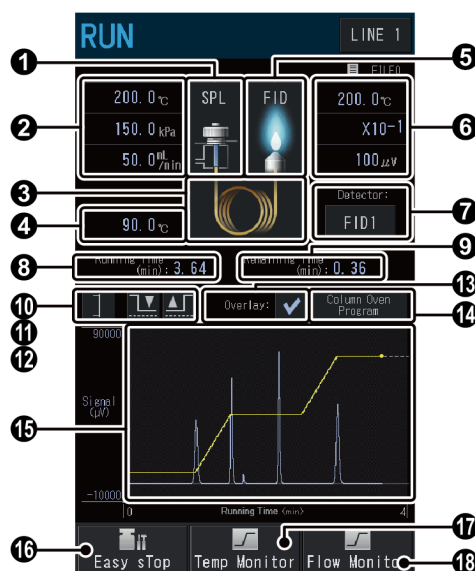
You can check conditions of injection port, column, and detector, chromatogram, and temperature program.

7.2.1 Monitor Screen

Press  (HOME) - [Monitor] to display the Monitor screen.

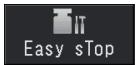
Upper half of the screen shows conditions of injection ports, columns, and detectors configured in analytical lines. Bottom half of the screen shows chromatograms and temperature programs, etc.

When several analytical line are configured, press [LINE] in the top-right of the screen to switch lines and make settings.



No.	Item	Description
①	Injection port	Displays the injection port configured in analytical line. Press the icon to set the injection port. ▶▶ Reference "7.5 Injection Port" P.247
②	Actual values related to the injection port	Displays actual values of temperature of the injection port, inlet press, and total flow.
③	Column	Press the icon to set the column oven. ▶▶ Reference "7.6 Column" P.285
④	Actual value related to the column oven	Displays actual value of the column oven temperature.
⑤	Detector	Displays detectors configured in analytical line. Press the icon to set the detector. ▶▶ Reference "7.4 Detector" P.185

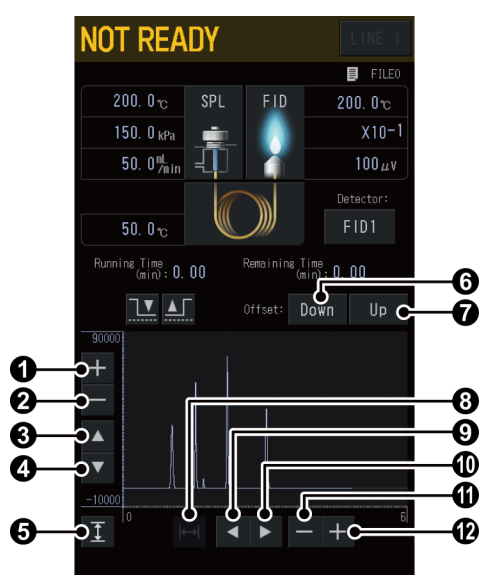
No.	Item	Description				
⑥	Actual value related to the detector	Displays actual values of the detector temperature, range, and signal. The instrument produces the voltage obtained by multiplying this value by range as an analogue output signal.				
⑦	Detector Switching	Displayed if several detectors are configured in one analytical line. You can change the detector to be displayed.				
⑧	Running Time	Displays the time elapsed after the analysis started.				
⑨	Remain time	The time obtained by subtracting the current analysis time from the longest program time is displayed. The longest program time indicates the total time of the longest program when comparing the temperature program, the pressure program, the flow rate program and the time program.				
⑩	 (Vertical axis switching)	Switches the display mode of the vertical axis.				
⑪	 (Auto Zero)	Moves the baseline to zero point.  Hint - Only the chromatogram of the detector displayed on the monitor screen will be changed. For detectors not displayed on the monitor, switch the detector using ⑦ [Detector Switching] to perform Auto Zero. - Auto Zero is effective not only for the chromatogram on the monitor screen, but also Chromatopac and LabSolutions. However, Auto Zero made on the Chromatopac does not adjust the chromatogram on the monitor screen.				
⑫	 (Zero Free)	Returns to the baseline level before Auto Zero.  Hint - Only the chromatogram of the detector displayed on the monitor screen will be changed. For detectors not displayed on the monitor, switch the detector using ⑦ [Detector Switching] before Zero Free. - Zero Free is effective not only for the chromatogram on the monitor screen, but also Chromatopac and LabSolutions. However, Zero Free made on the Chromatopac does not adjust the chromatogram on the monitor screen.				
⑬	Overlay	Check this item to overlay program set in ⑭ [Display Program Setting] on the graph during analysis.				
⑭	Display Program Setting	Selects the program to be overlaid on the graph during analysis. The items on the screen are different depending on settings of the injection port. <table><tr><td>Items</td><td>Oven Temperature Program, Pressure Program, Linear Velocity Program, Flow Program, Inj Temp Program</td></tr><tr><td>Default</td><td>Oven Temperature Program</td></tr></table>	Items	Oven Temperature Program, Pressure Program, Linear Velocity Program, Flow Program, Inj Temp Program	Default	Oven Temperature Program
Items	Oven Temperature Program, Pressure Program, Linear Velocity Program, Flow Program, Inj Temp Program					
Default	Oven Temperature Program					

No.	Item	Description
15	Graph	Displays the current status in graph form. Press the graph to enter Graph Edit mode. ▶▶ Reference "Graph edit mode" P.158
16	 (Easy sTop)	Displays [Easy sTop] screen. Use this for the maintenance of the injection port. ▶▶ Reference "7.2.2 [Easy sTop] Screen" P.161
17	 (Temp Monitor)	Displays [Temp Monitor] screen. ▶▶ Reference "7.2.3 [Temp Monitor] Screen" P.163
18	 (Flow Monitor)	Displays [Flow Monitor] screen. ▶▶ Reference "7.2.4 [Flow Monitor] Screen" P.164

Graph edit mode

When the graph is pressed on Monitor screen, the instrument enters Graph Edit mode and you can move the axis and change the scale.

Press the graph to return to the monitor screen.



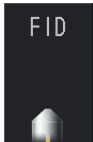
No.	Item	Description
1	 (Signal Axis Zoom)	Zooms the signal axis scale. Displayed area becomes narrow.
2	 (Signal Axis Unzoom)	Unzooms the signal axis scale. Displayed area becomes wide.
3	 (Signal Axis Up)	Moves the signal axis in the + direction.

No.	Item	Description
④	 (Signal Axis Down)	Moves the signal axis in the - direction.
⑤	 (Signal Axis Fitting)	Adjusts the signal axis according to the maximum value of the chromatogram displayed now.
⑥	 (Decrease the baseline level)	Decrease the baseline level below the current level. The range of decrease depends on the scale of the vertical axis.
⑦	 (Increase the baseline level)	Increase the baseline level over the current level. The range of increase depends on the scale of the vertical axis.
⑧	 (Initialize the Time Axis Scale)	Initializes the time axis scale.
⑨	 (Time Axis Left)	Moves the time axis in the - direction.
⑩	 (Time Axis Right)	Moves the time axis in the + direction.
⑪	 (Time Axis Unzoom)	Unzooms the time axis scale. Displayed area becomes wide.
⑫	 (Signal Axis Zoom)	Zooms the time axis scale. Displayed area becomes narrow.

Detector Icons

For the following detectors, displayed icon changes depending on the detector status.

- FID

Extinguished	Ignited
	

• TCD

Detector: Off	Detector: On
	

• PTC

Detector: Off	Detector: On
	

• FPD

 **Hint** The color of the displayed icon is different depending on attached filter.

Extinguished			Ignited		
					

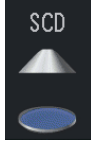
• FTD

Power controller: Off	Power controller: On Not adjusted	Power controller: On Adjusted
		

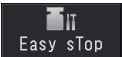
• BID

Not Illuminating	Illuminating
	

• SCD

When some units are not turned ON	When all units are turned ON
	

7.2.2 [Easy sTop] Screen

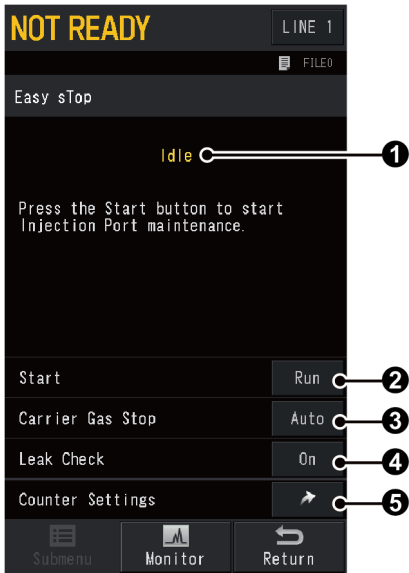
Press  (Easy sTop) on the monitor screen to display [Easy sTop] screen.

This screen allows you to replace the septum and glass insert by following the navigation.

▶▶ **Reference** Refer to Maintenance Help for the detailed procedure.

 **NOTE** If the AOC is removed after the start of Easy sTop and before the septum or insert can be replaced, an error message will appear and the instrument status will not be displayed correctly. Install the AOC to clear the error.

 **Hint** After the start of Easy sTop, the power of the AOC is automatically turned off when the septum or insert is ready to be replaced. After Easy sTop is completed, the power of the AOC is automatically turned on.



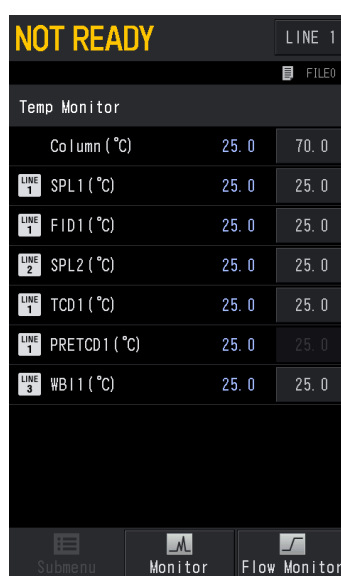
No.	Item	Description	
①	Status	Displays the current status of the instrument.	
		Screen display	Description
		Idle	The instrument is in a standby state before Easy sTop is performed.
		INJ Cooling (about X min remaining)	The instrument is performing an operation to decrease the temperature of the injection port and column oven to 70 °C or lower.
		Interface Cooling	The instrument is performing operation to decrease the interface temperature of the detector targeted for cooling by Easy sTop to 100 °C or lower.
		Carrier gas can now be stopped	The temperature of the injection port and column oven has reached 70 °C or lower.
		Carrier gas can now be stopped	Carrier gas is being stopped.
		Replacing	Septum or glass insert can be replaced.
		Leak Checking	The instrument is checking for carrier gas leak.
		Leak Check Failed	Carrier gas leak check failed, and gas leak occurred. Identify the gas leak location and eliminate the gas leak.
		Preparing (about X min remaining)	Resupply the gas to the injection port and resume temperature control.
②	Start/Cancel/Stop Carrier Gas/Complete	The display varies depending on the instrument status (as indicated in ①). When the GC is operating, press [Run] to automatically decrease the temperature of the injection port and automatically stop the carrier gas supply. When the instrument is in the state in which injection port maintenance can be performed, [Replacing] is displayed as the current status in ①. After injection port maintenance is complete, press [Run] to automatically supply the carrier gas and start the temperature control for the injection port and column oven. While [Cancel] is displayed, press [Run] to stop the Easy sTop operation that is currently being performed.	
③	Carrier Gas Stop	The carrier gas supply can also be stopped manually when Easy sTop is performed. Select [Manual] to stop manually.	
		Items	Auto, Manual
		Default	Auto
④	Leak Check	After replacing the septum or insert, you can select whether or not to perform a leak check before supplying the carrier gas. Select [On] to perform the leak check.	
		Items	On, Off
		Default	On

No.	Item	Description
⑤	Counter Settings	Displays [Analysis Counter] screen. After replacing a part, reset the counter for the part that was replaced. ▶▶ Reference "[Analysis Counter] Screen" P.375

7.2.3 [Temp Monitor] Screen

Press  (Temp Monitor) on the monitor screen to display [Temp Monitor] screen.

You can check temperatures and change their settings for the column oven and all injection ports and detectors installed on the instrument.



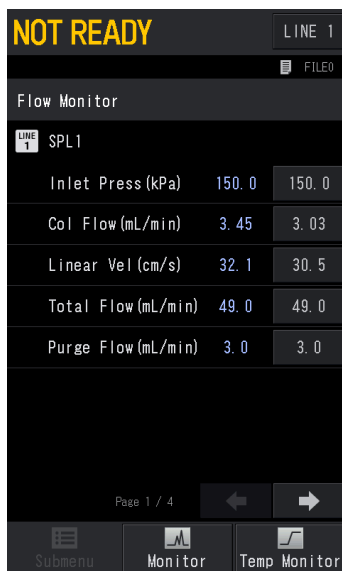
NOT READY		LINE 1
		FILE0
Temp Monitor		
Column (°C)	25.0	70.0
LINE 1 SPL1 (°C)	25.0	25.0
LINE 1 FID1 (°C)	25.0	25.0
LINE 2 SPL2 (°C)	25.0	25.0
LINE 1 TCD1 (°C)	25.0	25.0
LINE 1 PRETCD1 (°C)	25.0	25.0
LINE 3 WB11 (°C)	25.0	25.0
 Submenu  Monitor  Flow Monitor		

- ▶▶ Reference For details of displayed items, see sections describing column, injection port, and detector.
- "7.6 Column" P.285
 - "7.5 Injection Port" P.247
 - "7.4 Detector" P.185

7.2.4 [Flow Monitor] Screen

Press  (Flow Monitor) on the monitor screen to display [Flow Monitor] screen.

You can check flow rates and change their settings for all injection ports and detectors installed on the instrument.



- ▶▶ **Reference** For details of displayed items, see sections describing injection port and detector.
- ["7.5 Injection Port" P.247](#)
 - ["7.4 Detector" P.185](#)

7.3 AOC

Set this option when using the AOC.

Register the AOC model no. on the [Line Configuration] screen.

▶▶ Reference "7.8.2 [Line Configuration] Screen" P.314

7.3.1 AOC-20 Series

If [AOC-20] is selected on the [Line Configuration] screen, the following screen appears.

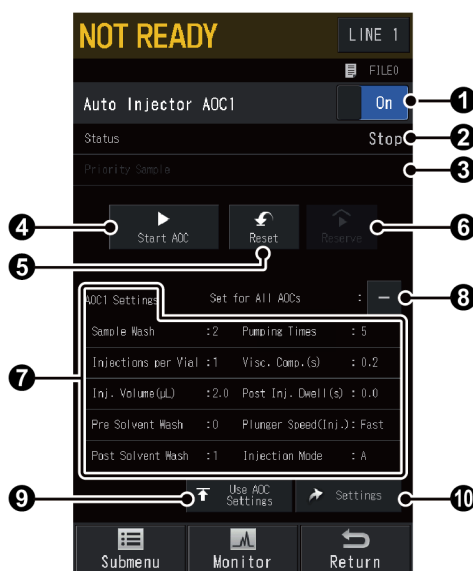
▶▶ Reference "7.8.2 [Line Configuration] Screen" P.314

■ [Auto Injector] Screen

To display [Auto Injector AOC], press  (HOME) - [AOC] after you install AOC-20 series on the instrument and configure AOC in the analytical line.

On this screen, you can check the status of AOC-20 series and set parameters for them. Install AOC-20 series on the instrument and then configure AOC1 in the analytical line. For dual configuration, configure AOC2 (sub) in the analytical line, and switch lines to set up them.

▶▶ Reference "7.8.2 [Line Configuration] Screen" P.314



No.	Item	Description	
①	Auto Injector Control	Select [On] to control AOC-20 series with the instrument.	
		Items	Off, On
		Default	Off

No.	Item	Description	
②	Status	Displays the current status of AOC-20 series.	
		Screen display	Status
		Stop	AOC is not operating.
		Taking vial	A vial is being picked up.
		Preparation	AOC is operating (before injection).
		Rinse	AOC is operating (after injection).
		Putting vial	The instrument is putting vial.
		Waiting	AOC is waiting for analysis.
③	Priority Sample	Displays vial No. of priority sample. Analysis for the displayed sample starts after the ongoing analysis are completed.	
④	Start AOC	Press [Start AOC] to start AOC-20 series operation and send a start signal to the GC upon an injection.	
⑤	Reset	Press [Reset] while AOC is working to terminate the injection sequence forcibly and return it to initial state. Press [Reset] during continuous analysis and then press [Start AOC] to start injection from the first sample. This function is available only when AOC-20 series is active.	
⑥	Reserve	Sets vial No. of reserve. Range is different depending on the type and the number of vials. This function is available only when AOC-20 series is active.	
		Range	- Without Autosampler AOC-20s - Short rack: 1 to 6 - Long rack, without additional rack: 1 to 12 - Long rack, with additional rack: 1 to 15 - With Autosampler AOC-20s 1.5 mL Vial: 1 to 150 4 mL Vial: 1 to 96
⑦	AOC1 Settings	Displays the current set values for AOC-20 series.	
⑧	Set for All AOCs	Check this item to operate main and sub AOC with same parameter when using a dual configuration of AOC-20 series.	
⑨	Use AOC Settings	Import parameters set on AOC-20 series to the instrument. Use this function when you change settings with AOC-20 series.	
⑩	Settings	Displays [AOC Settings] screen. Sets AOC-20 series. ▶▶ Reference "[AOC Settings] Screen" P.167	

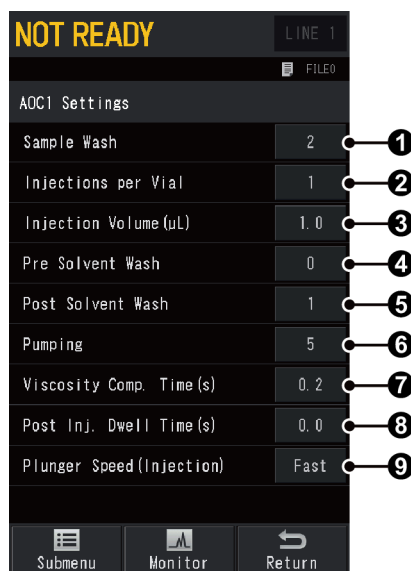
Submenu

Item	Description	See also
Overlap	Displays [Overlap] screen.	P.171
Auto Sampler Setting	Displays [Auto Sampler Setting] screen.	P.173
Injection Mode	Displays [AOC Injection Mode] screen. ▶▶ Reference For injection mode, refer to "3.3.3 Injection Mode" in AOC-20i/AOC-20s Instruction Manual.	-

■ [AOC Settings] Screen

Press  (HOME) - [AOC] - [Settings] to display [AOC Settings] screen.

You can set basic parameters for AOC-20 series.



No.	Item	Description
①	Sample Wash	Sets the number of times to rinse the syringe with sample before injection.
		Range 0 to 99
		Default 2
②	Injections per Vial	Sets the number of injections to analyze the sample several times.
		Range 1 to 99
		Default 1
③	Injection Volume	Sets the amount of sample to be injected. Range, increment, and default are different depending on [Syringe Type] on [AOC Advanced Settings] screen.
		Range • 10 μL Syringe: 0.1 to 8.0 μL (0.1 increments) • 50 μL Syringe: 0.5 to 40.0 μL (0.5 increments) • 250 μL Syringe: 2.5 to 200.0 μL (2.5 increments) • 0.5 μL Syringe: 0.01 to 0.5 μL (0.01 increments) • 5 μL Syringe: 0.1 to 4.0 μL (0.5 increments)
		Default • 10 μL Syringe: 1.0 μL • 50 μL Syringe: 5.0 μL • 250 μL Syringe: 25.0 μL • 0.5 μL Syringe: 0.10 μL • 5 μL Syringe: 0.5 μL

No.	Item	Description
④	Pre Solvent Wash	Sets the number of times to rinse the syringe with solvent before injection. ▶▶ Reference For cases where injection mode is not [0] (solvent flush), refer to "3.3.3 Injection Mode" in User's Manual for AOC-20i/AOC-20s.
		Range 0 to 99
		Default 0
⑤	Post Solvent Wash	Sets the number of times to rinse the syringe with solvent after injection.
		Range 0 to 99
		Default 1
⑥	Pumping	Set the number of times to raise and lower the plunger with the needle tip inside the sample to eliminate syringe air bubbles.
		Range 0 to 99
		Default 5
⑦	Viscosity Comp. Time (s)	Sets the wait time for the plunger during rinse with sample and pumping. When aspirating sample before injection, the plunger waits for either the value set here or 4 seconds, whichever is longer. The wait time during rinse with solvent is always 0.2 seconds.
		Range 0.0 to 99.9 seconds
		Default 0.2 seconds
⑧	Post Inj. Dwell Time (s)	Sets the time for the plunger to remain in the syringe after sample injection.
		Range 0.0 to 99.9 seconds
		Default 0.0 seconds
⑨	Plunger Speed (Injection)	Sets the plunger speed during sample injection.
		Items Slow, Mid, Fast
		Default Fast

Submenu

Item	Description	See also
Advanced Settings	Displays [AOC Advanced Settings] screen.	P.169

■ [AOC Advanced Settings] Screen

Press  (HOME) - [AOC] - [Settings] - [Submenu] - [Advanced Settings] to display [AOC Advanced Settings] screen.

You can set advanced parameters for AOC-20 series.



No.	Item	Description
①	Syringe Injection Speed	Sets syringe insertion speed.
		Items Slow, Fast
		Default Fast
②	Number of Solvent Vials	Sets whether to use three solvent vials when the autosampler AOC-20s is not in use. ▶▶ Reference "[Auto Sampler Setting] Screen" P.173
		Items 1, 3
		Default 1
③	Solvent Selection	Selects solvent to be used. This item is available when ② [Number of Solvent Vials] is set at [3] or the autosampler AOC-20s is in use. ▶▶ Reference "[Auto Sampler Setting] Screen" P.173
		Items • All: Uses 3 solvents. • A only: Uses solvent A only. • B only: Uses solvent B only. • C only: Uses solvent C only. ▶▶ Reference For details, refer to Fig. 3.4.1 in "3.4. Autosampler" in User's Manual for AOC-20i/AOC-20s.
		Default All

No.	Item	Description	
④	Add Terminal Air Gap	Sets whether to aspirate 1 µL of air into the syringe after aspirating sample. This type of injection is useful for samples with a wide boiling point range, which may cause compound discrimination.	
		 NOTE When the column initial temperature is high or a PEG-based high-polarity column is used, injection of air may reduce the column life.	
		Items	No, Yes
Default	No		
⑤	Plunger Speed (Suction)	Sets the plunger speed (suction) during sample injection.	
		Items	Slow, Mid, Fast
		Default	Fast
⑥	Plunger Speed (Wash)	Sets the plunger speed during rinse with sample or pumping.	
		Items	Slow, Mid, Fast
		Default	Fast
⑦	Syringe Height (High)	Sets the syringe height when it moves down to a sample vial (moves syringe up from default).	
		Range	0 to 20 mm
		Default	0 mm
⑧	Syringe Height (Low)	Sets the syringe height when it moves down to a sample vial (moves syringe down from default).	
		Range	⑪ [Vial Type] is [1.5 mL] 0 to 2 mm ⑪ [Vial Type] is [4 mL] 0 to 10 mm
		Default	0 mm
⑨	Syringe Injection Position	Sets the syringe height when it moves down for sample injection.	
		Range	0 to 22 mm
		Default	0 mm
⑩	Multi Injection Count	Sets the number of injections for one analysis.	
		Range	1 to 99 times
		Default	1
⑪	Vial Type	Sets the vial type.	
		Items	1.5 mL, 4 mL
		Default	1.5 mL
⑫	Rack Type	Sets the rack type.	
		Items	Short, Long
		Default	Short

No.	Item	Description	
13	Syringe Type	Sets the syringe type.	
		Items	10 µL, 50 µL, 250 µL, 0.5 µL, 5 µL
		Default	10 µL
14	Suction Volume (Wash)	Sets the suction volume during rinse with sample and pumping.	
		Items	80 %, 60 %
		Default	80 %
15	Injector Position	Sets the auto injector AOC-20i position when auto sampler AOC-20s is used. This item is available when [Use AOC-20s] in Auto Sampler Setting] is checked. ▶▶ Reference • "[Auto Sampler Setting] Screen" P.173 • Maintenance Help	
		Range	0 to 2
		Default	1
16	Turret Direction	Sets the turret direction for sub-side AOC if the system employs a dual AOC configuration. When using the long turret by installing the sub-side auto injector with the back side against the other auto injector, select [Reverse]. This item is displayed for a dual AOC configuration with no auto sampler.	
		Items	Normal, Reverse
		Default	Normal

■ [Overlap] Screen

Press  (HOME) - [AOC] - [Submenu] - [Overlap] to display [Overlap] screen.

Overlap is a function to shorten the total time of analysis which requires long time for pre-run by starting pre-run for the next sample during analysis.

Without overlap

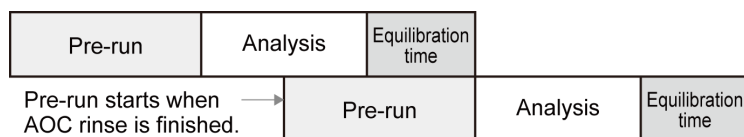
Pre-run	Analysis	Equilibration time	Pre-run	Analysis	Equilibration time

With overlap

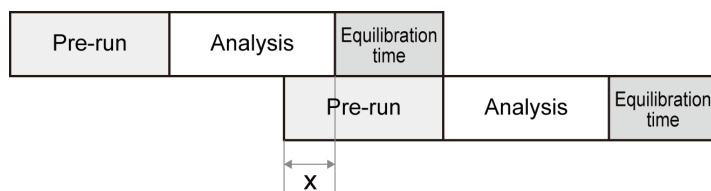
Pre-run	Analysis	Equilibration time			
		Pre-run	Analysis	Equilibration time	
			Pre-run	Analysis	Equilibration time

Overlap can be started at the following 3 timings.

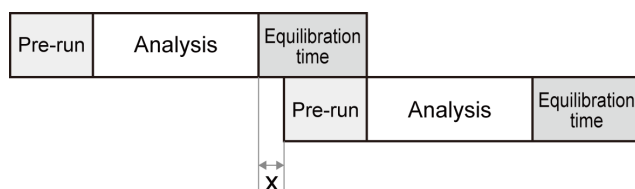
- Post-Injection



- Mid-Analysis (X minutes)

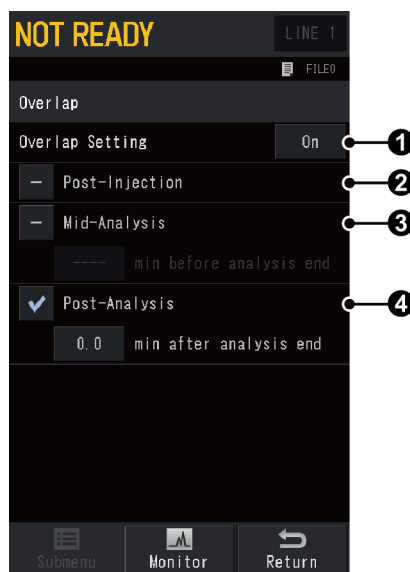


- Post-Analysis (X minutes)



NOTE When overlap function starts and pre-run is completed, AOC injects sample even if the instrument status is not "READY". Set an appropriate time.

On [Overlap] screen, you can set items related to Overlap function.



No.	Item	Description	
❶	Overlap Setting	Select [On] to use overlap function.	
		Items	Off, On
		Default	Off
❷	Post-Injection	Check to start pre-run for the next vial after the current vial is injected.	
❸	Mid-Analysis	Check to start pre-run for the next vial while the current vial being analyzed. Set the time to start the overlap.	
❹	Post-Analysis	Check to start pre-run for the next vial after the current vial is analyzed. Set the time to start the overlap.	

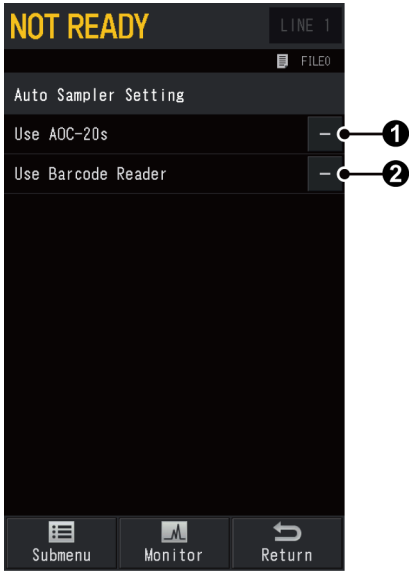
NOTE Select overlap method to be used from ❷ [Post-Injection], ❸ [Mid-Analysis], and ❹ [Post-Analysis].

Press  beside the setting to be used to change it to .

■ [Auto Sampler Setting] Screen

Press  (HOME) - [AOC] - [Submenu] - [Auto Sampler Setting] to display [Auto Sampler Setting] screen.

Set this item when using the autosampler AOC-20s.



No.	Item	Description
❶	Use AOC-20s	When using the autosampler AOC-20s, press  to change it to  .

No.	Item	Description
②	Use Barcode Reader	To manage samples with barcode using a barcode reader, press  to change it to  .

Submenu

Item	Description
Allocation	Displays [Allocation] screen. ▶▶ Reference For details, refer to "3.4 Allocation" in User's Manual for AOC-20 Dual Injection System.

7.3.2 AOC-30 Series

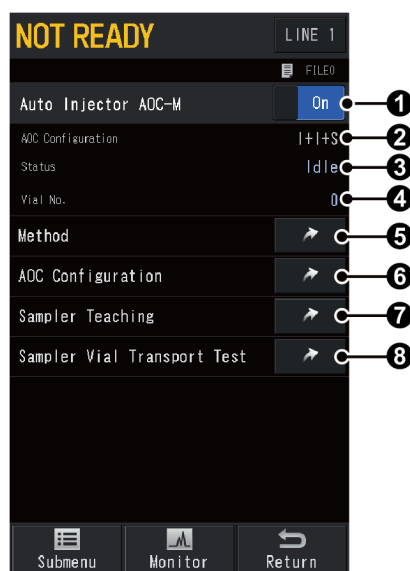
If [AOC-30] is selected on the [Line Configuration] screen, the following screen appears.

▶▶ Reference "7.8.2 [Line Configuration] Screen" P.314

■ [Auto Injector] Screen

To display [Auto Injector AOC-M], press  (HOME) - [AOC] after you install AOC-30 series on the instrument and configure AOC in the analytical line.

On this screen, you can check the status of AOC-30 series and set parameters for them. Install AOC-30 series on the instrument and then configure AOC-M in the analytical line. For dual configuration, configure AOC-S (sub) in the analytical line, and switch lines to set up them.



No.	Item	Description
①	Auto Injector Control	Select [On] to control AOC-30 series with the instrument.
		Items Off, On
		Default Off

No.	Item	Description																																												
②	AOC Configuration	Displays the configuration setting for this equipment.																																												
		<table><tr><th>Screen display</th><th>Configuration</th></tr><tr><td>I</td><td>Single tower</td></tr><tr><td>I+S</td><td>Sampler system</td></tr><tr><td>I+I</td><td>Dual tower</td></tr><tr><td>I+I+S</td><td>Dual sampler system</td></tr></table>	Screen display	Configuration	I	Single tower	I+S	Sampler system	I+I	Dual tower	I+I+S	Dual sampler system																																		
		Screen display	Configuration																																											
		I	Single tower																																											
		I+S	Sampler system																																											
		I+I	Dual tower																																											
I+I+S	Dual sampler system																																													
③	Status	Indicates the status of the auto injector.																																												
		<table><tr><th>Screen display</th><th>Status</th></tr><tr><td>Not Connected</td><td>GC is not connected to the auto injector.</td></tr><tr><td>Connecting</td><td>GC is in the process of connecting to the auto injector.</td></tr><tr><td>Idle</td><td>Operation is stopped.</td></tr><tr><td>Initializing</td><td>Auto injector or auto sampler is in initialization process.</td></tr><tr><td>Waiting GC Ready</td><td>AOC is waiting for the GC to be in READY state in order to start operation.</td></tr><tr><td>Retrieving Vial</td><td>Vial is being transported from the sampler.</td></tr><tr><td>Checking Vial</td><td>AOC is detecting the presence of sample, solvent, and waste vials.</td></tr><tr><td>Pre Solvent Wash</td><td>Pre-injection solvent wash is in progress.</td></tr><tr><td>Drawing Flush Solvent</td><td>Flush solvent is being measured for sandwich injection mode.</td></tr><tr><td>Drawing Standard Sample</td><td>Standard solvent is being measured for sandwich injection mode.</td></tr><tr><td>Sample Wash</td><td>Sample wash is in progress.</td></tr><tr><td>Drawing Derivatization Reagent</td><td>Derivatization reagent is being measured for 2-step injection.</td></tr><tr><td>Drawing Sample</td><td>Sample is being measured.</td></tr><tr><td>Injecting</td><td>Injection</td></tr><tr><td>Post Solvent Wash</td><td>Post-injection solvent wash is in progress.</td></tr><tr><td>Returning Vial</td><td>Vial is being returned to the sampler.</td></tr><tr><td>Dispensing Liquid</td><td>Dispensing accuracy evaluation is in progress.</td></tr><tr><td>Scanning Vials</td><td>Vials are being checked.</td></tr><tr><td>④</td><td>Vial No.</td><td>Displays the sample no. of the sample currently being analyzed.</td></tr><tr><td>⑤</td><td>Method</td><td>Displays [Method] screen. ▶▶ Reference "[AOC Method] Screen" P.176</td></tr></table>	Screen display	Status	Not Connected	GC is not connected to the auto injector.	Connecting	GC is in the process of connecting to the auto injector.	Idle	Operation is stopped.	Initializing	Auto injector or auto sampler is in initialization process.	Waiting GC Ready	AOC is waiting for the GC to be in READY state in order to start operation.	Retrieving Vial	Vial is being transported from the sampler.	Checking Vial	AOC is detecting the presence of sample, solvent, and waste vials.	Pre Solvent Wash	Pre-injection solvent wash is in progress.	Drawing Flush Solvent	Flush solvent is being measured for sandwich injection mode.	Drawing Standard Sample	Standard solvent is being measured for sandwich injection mode.	Sample Wash	Sample wash is in progress.	Drawing Derivatization Reagent	Derivatization reagent is being measured for 2-step injection.	Drawing Sample	Sample is being measured.	Injecting	Injection	Post Solvent Wash	Post-injection solvent wash is in progress.	Returning Vial	Vial is being returned to the sampler.	Dispensing Liquid	Dispensing accuracy evaluation is in progress.	Scanning Vials	Vials are being checked.	④	Vial No.	Displays the sample no. of the sample currently being analyzed.	⑤	Method	Displays [Method] screen. ▶▶ Reference "[AOC Method] Screen" P.176
		Screen display	Status																																											
		Not Connected	GC is not connected to the auto injector.																																											
		Connecting	GC is in the process of connecting to the auto injector.																																											
		Idle	Operation is stopped.																																											
		Initializing	Auto injector or auto sampler is in initialization process.																																											
		Waiting GC Ready	AOC is waiting for the GC to be in READY state in order to start operation.																																											
		Retrieving Vial	Vial is being transported from the sampler.																																											
		Checking Vial	AOC is detecting the presence of sample, solvent, and waste vials.																																											
		Pre Solvent Wash	Pre-injection solvent wash is in progress.																																											
		Drawing Flush Solvent	Flush solvent is being measured for sandwich injection mode.																																											
		Drawing Standard Sample	Standard solvent is being measured for sandwich injection mode.																																											
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Drawing Sample	Sample is being measured.																																													
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⑤	Method	Displays [Method] screen. ▶▶ Reference "[AOC Method] Screen" P.176																																												

No.	Item	Description
⑥	AOC Configuration	Displays [AOC Configuration] screen. ▶▶ Reference "[AOC Configuration] Screen" P.180
⑦	Sampler Teaching	Displays [Sampler Teaching] screen. ▶▶ Reference "[Sampler Teaching] Screen" P.181
⑧	Sampler Vial Transport Test	Displays [Sampler Vial Transport Test] screen. ▶▶ Reference "[Sampler Vial Transport Test] Screen" P.182

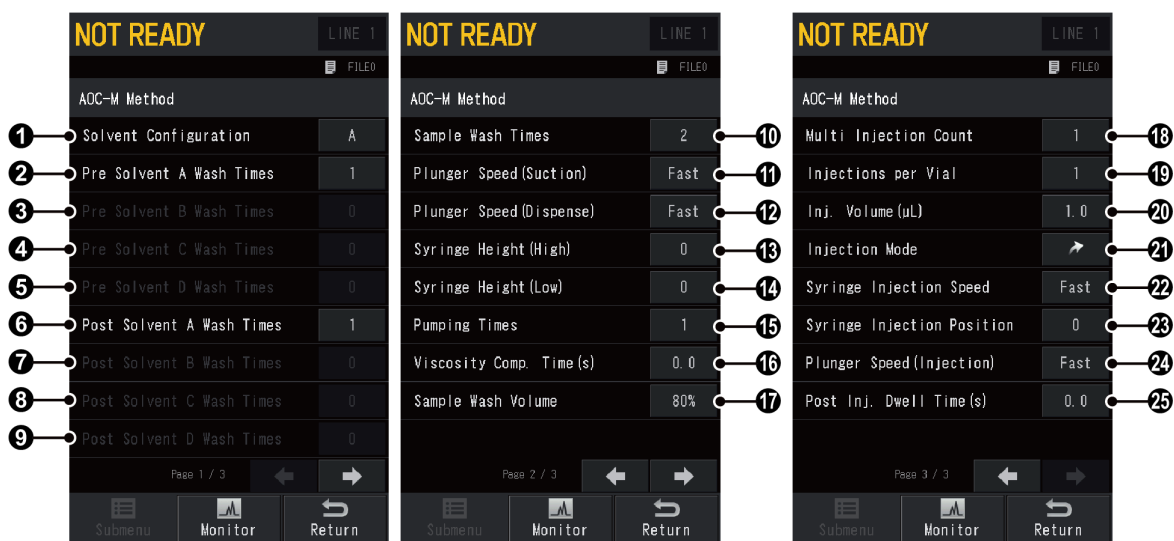
Submenu

Item	Description	See also
Overlap	Displays [Overlap] screen.	P.171
AOC Liquid Dispensing	Displays [AOC Liquid Dispensing] screen.	P.184

■ [AOC Method] Screen

Press  (HOME) - [AOC] - [Method] to display [AOC Method] screen.

You can set basic parameters for AOC-30 series.



No.	Item	Description
①	Solvent Configuration	Select the types of solvents that will be used.
		Items A, A/C, A/B/C/D
		Default A
②	Pre Solvent A Wash Times	Sets the number of times to rinse the syringe with solvent A before injection.
		Range 0 to 99
		Default 1

No.	Item	Description	
3	Pre Solvent B Wash Times	Sets the number of times to rinse the syringe with solvent B before injection.	
		Range	0 to 99
		Default	1
4	Pre Solvent C Wash Times	Sets the number of times to rinse the syringe with solvent C before injection.	
		Range	0 to 99
		Default	1
5	Pre Solvent D Wash Times	Sets the number of times to rinse the syringe with solvent D before injection.	
		Range	0 to 99
		Default	1
6	Post Solvent A Wash Times	Sets the number of times to rinse the syringe with solvent A after injection.	
		Range	0 to 99
		Default	1
7	Post Solvent B Wash Times	Sets the number of times to rinse the syringe with solvent B after injection.	
		Range	0 to 99
		Default	1
8	Post Solvent C Wash Times	Sets the number of times to rinse the syringe with solvent C after injection.	
		Range	0 to 99
		Default	1
9	Post Solvent D Wash Times	Sets the number of times to rinse the syringe with solvent D after injection.	
		Range	0 to 99
		Default	1
10	Sample Wash Times	Sets the number of times to rinse the syringe with sample before injection.	
		Range	0 to 99
		Default	2
11	Plunger Speed (Suction)	Sets the plunger speed (suction) during sample injection.	
		Items	Slow, Mid, Fast
		Default	Fast
12	Plunger Speed (Dispense)	Sets the plunger speed (dispensing) during sample wash or pumping.	
		Items	Slow, Mid, Fast
		Default	Fast

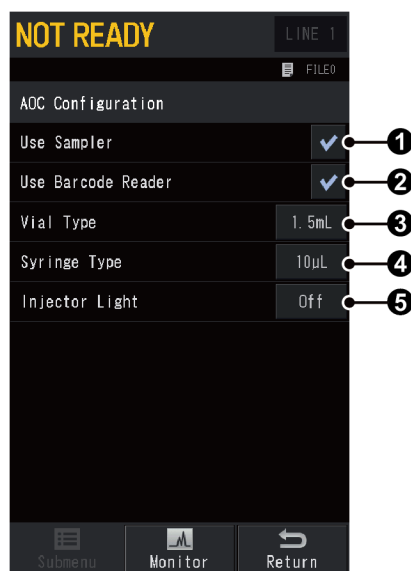
No.	Item	Description	
13	Syringe Height (High)	Sets the syringe height when it moves down to a sample vial (moves syringe up from default).	
		Range	0 to 20 mm
		Default	0 mm
14	Syringe Height (Low)	Sets the syringe height when it moves down to a sample vial (moves syringe down from default).	
		Range	• When [Vial Type] on the [AOC Configuration] screen is [1.5 mL] 0 to 2 mm • When [Vial Type] on the [AOC Configuration] screen is [4 mL] 0 to 10 mm
		Default	0 mm
15	Pumping Times	Set the number of times to raise and lower the plunger with the needle tip inside the sample to eliminate syringe air bubbles.	
		Range	0 to 99
		Default	0
16	Viscosity Comp. Time (s)	Sets the time for the plunger to remain in the syringe after sample injection.	
		Range	0.0 to 99.9 seconds
		Default	0.0 seconds
17	Sample Wash Volume	Sets the suction volume during rinse with sample and pumping.	
		Items	80 %, 60 %
		Default	80 %
18	Multi Injection Count	Sets the number of injections for one analysis.	
		Range	1 to 99 times
		Default	1
19	Injections per Vial	Sets the number of injections to analyze the sample several times.	
		Range	1 to 99
		Default	1

No.	Item	Description	
20	Inj. Volume	Sets the amount of sample to be injected. Range, increment, and default are different depending on [Syringe Type] on [AOC Configuration] screen.	
		Range	• 10 µL Syringe: 0.1 to 8.0 µL (0.1 increments) • 50 µL Syringe: 0.5 to 40.0 µL (0.5 increments) • 250 µL Syringe: 2.5 to 200.0 µL (2.5 increments) • 0.5 µL Syringe: 0.01 to 0.5 µL (0.01 increments) • 5 µL Syringe: 0.1 to 4.0 µL (0.5 increments)
		Default	• 10 µL Syringe: 1.0 µL • 50 µL Syringe: 5.0 µL • 250 µL Syringe: 25.0 µL • 0.5 µL Syringe: 0.10 µL • 5 µL Syringe: 0.5 µL
21	Injection Mode	Displays [AOC Injection Mode] screen. ►► Reference "[AOC Injection Mode] Screen" P.183	
22	Syringe Injection Speed	Sets syringe insertion speed.	
		Items	Slow, Fast
		Default	Fast
23	Syringe Injection Position	Sets the syringe height when it moves down for sample injection.	
		Range	0 to 22 mm
		Default	0 mm
24	Plunger Speed (Injection)	Sets the plunger speed during sample injection.	
		Items	Slow, Mid, Fast
		Default	Fast
25	Post Inj. Dwell Time (s)	Sets the time for the plunger to remain in the syringe after sample injection.	
		Range	0.0 to 99.9 seconds
		Default	0.0 seconds

■ [AOC Configuration] Screen

Press  (HOME) - [AOC] - [AOC Configuration] to display [AOC Configuration] screen.

You can set advanced parameters for AOC-30 series.



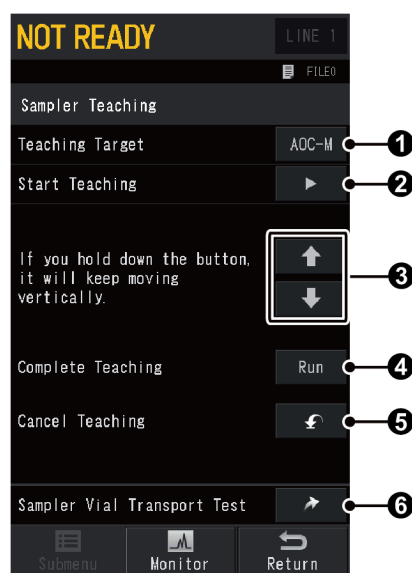
No.	Item	Description
①	Use Sampler	When using the autosampler, press  to change it to  .
②	Use Barcode Reader	To manage samples with barcode using a barcode reader, press  to change it to  .
③	Vial Type	Sets the vial type.
		Items 1.5 mL, 4 mL
		Default 1.5 mL
④	Syringe Type	Sets the syringe type.
		Items 10 µL, 50 µL, 250 µL, 0.5 µL, 5 µL
		Default 10 µL
⑤	Injector Light	Sets the operation of the light inside the auto injector.
		Items Off, On
		Default On

■ [Sampler Teaching] Screen

Press  (HOME) - [AOC] - [Sampler Teaching] to display [Sampler Teaching] screen.

Before using the auto sampler, the position of sample vial handover to the auto injector must be adjusted (sampler teaching). Perform teaching every time you mount the auto sampler.

▶▶ **Reference** For details, refer to the AOC-30 series Instruction Manual.

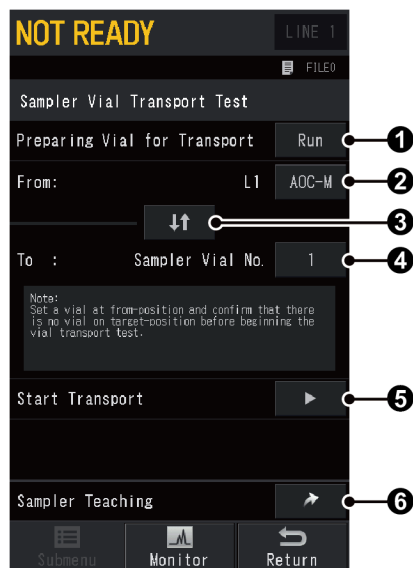


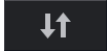
No.	Item	Description
①	Teaching Target	Sets the teaching target.
		Items AOC-M, AOC-S, Barcode
		Default AOC-M
②	Start Teaching	Press this button to start teaching.
③	 , 	Moves the arm in the vertical direction.
④	Complete Teaching	After determining the arm position, press [Run].
⑤	Cancel Teaching	Press this button to stop teaching.
⑥	Sampler Vial Transport Test	Displays [Sampler Vial Transport Test] screen. ▶▶ Reference "[Sampler Vial Transport Test] Screen" P.182

■ [Sampler Vial Transport Test] Screen

Press  (HOME) - [AOC] - [Sampler Vial Transport Test] to display [Sampler Vial Transport Test] screen.

▶▶ **Reference** For details, refer to the AOC-30 series Instruction Manual.

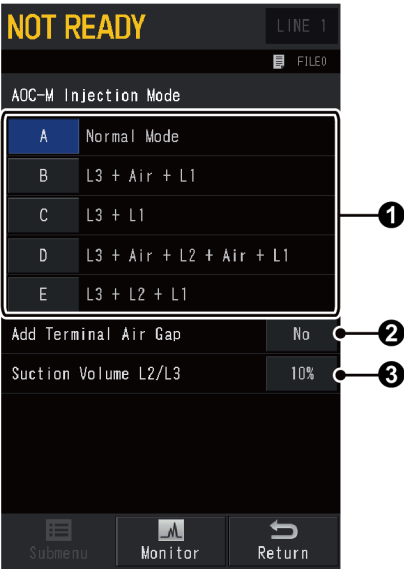


No.	Item	Description
①	Preparing Vial for Transport	Press [Run] to move the auto injector turret to the vial handover position.
②	From	Sets the transport starting point for the vial.
③	 (Switch)	Switches between the vial transport starting point and the vial transport destination.
④	To	Sets the transport destination for the vial.
⑤	Start Transport	Transports the vial specified in [From] to the position specified in [To].
⑥	Sampler Teaching	Displays [Sampler Teaching] screen. ▶▶ Reference "[Sampler Teaching] Screen" P.181

■ [AOC Injection Mode] Screen

Press  (HOME) - [AOC] - [Method] - [Injection Mode] to display [AOC Injection Mode] screen.

▶▶ **Reference** For details, refer to the AOC-30 series Instruction Manual.

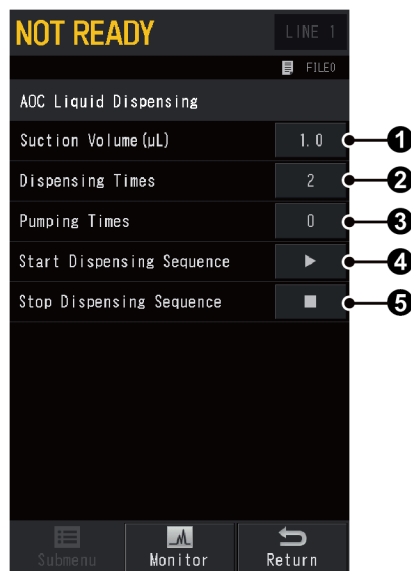


No.	Item	Description	
①	Injection Mode	Select an injection mode. ▶▶ Reference For details, refer to the AOC-30 series Instruction Manual.	
②	Add Terminal Air Gap	Set this item when aspirating 1 µL of air after aspirating the sample. This item is effective when injecting a sample with a wide range of boiling points where discrimination is an issue.	
		Items	Yes, No
		Default	No
③	Suction Volume L2/L3	Set the amount of L2 and L3 to be aspirated.	
		Items	10 %, 5 %
		Default	5 %

■ [AOC Liquid Dispensing] Screen

Press  (HOME) - [AOC] - [Submenu] - [AOC Liquid Dispensing] to display [AOC Liquid Dispensing] screen.

▶▶ **Reference** For details, refer to the AOC-30 series Instruction Manual.



No.	Item	Description	
①	Suction Volume	Set the amount per injection for dispensing.	
		Items	Slow, Fast
		Default	Fast
②	Dispensing Times	Set the number of times of dispensing.	
		Range	1 to 99 times
		Default	2 times
③	Pumping Times	Set the number of times of pumping for the second and subsequent dispensing for repeated dispensing. The first pumping is performed five times (not changeable).	
		Range	1 to 99 times
		Default	1 time
④	Start Dispensing Sequence	Press this button to start dispensing.	
⑤	Stop Dispensing Sequence	Press this button to stop dispensing.	

7.4 Detector

Sets the detector temperature and the detector gas flow, etc.

The detectors which can be used with the instrument are shown below:

- Hydrogen flame ionization detector (FID)
 - ▶▶ Reference • ["7.4.1 \[Detector\] Screen \(FID Tab\)" P.186](#)
 - ["8.5.1 Hydrogen Flame Ionization Detector \(FID\)" P.414](#)
- Thermal conductivity detector (TCD)
 - ▶▶ Reference • ["7.4.2 \[Detector\] Screen \(TCD Tab\)" P.192](#)
 - ["8.5.2 Thermal Conductivity Detector \(TCD, PTCD\)" P.415](#)
- Thermal conductivity detector (PTCD)
 - ▶▶ Reference • ["7.4.3 \[Detector\] Screen \(PTCD Tab\)" P.196](#)
 - ["8.5.2 Thermal Conductivity Detector \(TCD, PTCD\)" P.415](#)
- Flame thermionic detector/Nitrogen phosphorous detector (FTD/NPD)
 - ▶▶ Reference • ["7.4.4 \[Detector\] Screen \(FTD Tab\) " P.200](#)
 - ["8.5.3 Flame Thermionic Detector/Nitrogen Phosphorous Detector \(FTD/NPD\)" P.416](#)
- Flame photometric detector (FPD)
 - ▶▶ Reference • ["7.4.5 \[Detector\] Screen \(FPD Tab\)" P.207](#)
 - ["8.5.4 Flame Photometric Detector \(FPD\)" P.419](#)
- Electron capture detector (ECD)
 - ▶▶ Reference • ["7.4.6 \[Detector\] Screen \(ECD Tab\)" P.212](#)
 - ["8.5.5 Electron Capture Detector \(ECD\)" P.421](#)
- Barrier discharge ionization detector (BID)
 - ▶▶ Reference • ["7.4.7 \[Detector\] Screen \(BID Tab\)" P.217](#)
 - ["8.5.6 Barrier Discharge Ionization Detector \(BID\)" P.425](#)
- Sulfur Chemiluminescence Detector (SCD)
 - ▶▶ Reference • ["7.4.8 \[Detector\] Screen \(SCD Tab\)" P.223](#)
 - ["8.5.7 Sulfur Chemiluminescence Detector \(SCD\)" P.426](#)

Configure detectors to be used in the analytical line before using the instrument.

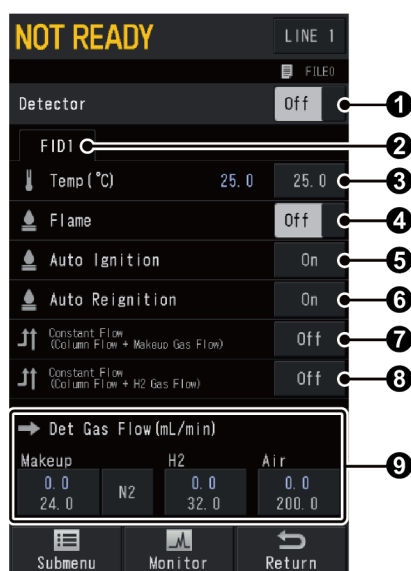
- ▶▶ Reference ["7.8.2 \[Line Configuration\] Screen" P.314](#)

7.4.1 [Detector] Screen (FID Tab)

Press  (HOME) - [Detector] to display [Detector] screen.

[FID] tab is displayed when FID is configured in the analytical line.

When several detectors are configured in the analytical line, press a tab to switch detectors or press [LINE] in the top-right of the screen to switch lines and make settings.



No.	Item	Description
①	Detector Control	Displays the current control status of the detector. Press [Off] or [On] to switch the control status. Select [On] to output detector signal. Only when the detector is configured in the analytical line and ① [Detector Control] is set at [On], the detector can be controlled. For the detector configured in the analytical line, the detector temperature and makeup gas flow can be controlled even when ① [Detector Control] is set at [Off]. When you select [Off] after the GC starts, the instrument stops detector signal output and supply of hydrogen and air to extinguish the flame. Select [On] to restart detector signal output. Select [On] in ④ [Flame] to ignite the flame again.
		Items Off, On
		Default On
②	Tab	Detectors configured in analytical line are displayed. Press the tab to switch detectors.

No.	Item	Description
③	Temp	Sets the detector temperature. Normally, set the detector temperature higher than 150 °C and approximately 30 °C higher than the column oven temperature (the final temperature for programmed analysis) to prevent flame extinguishment and contamination by high boiling point compounds. ▶▶ Reference "[Max Temperature] Screen" P.336
		Range 0.0 to 450.0 °C
		Default 25.0 °C
④	Flame	Displays the ignition status of the flame. Press [Off] or [On] to switch the ignition status. [On] and [Off] is displayed when the flame is ignited and extinguished, respectively. [Running] is displayed during ignition. When you start the GC with ⑤ [Auto Ignition] turned [Off], press [On] after the instrument is ready to ignite the flame.
		Items Off, On
		Default Off
⑤	Auto Ignition	Select [On] to automatically ignite the flame after the detector temperature reaches the set value. 💡 Hint This setting is linked with the setting of [Auto Ignite] on [GC Start Sequence] screen.
		Items Off, On
		Default On
⑥	Auto Reignition	Select [On] to automatically re-ignite the flame when the instrument detects the extinguishment.
		Items Off, On
		Default On
⑦	Constant Flow (Column Flow + Makeup Gas Flow)	Select [On] to control the instrument so that the column flow and the makeup gas flow remains constant. NOTE - When it is set at [On], Makeup Program does not work even if Makeup Program is set. - It is effective when types of carrier gas and makeup gas are the same. When gas types are different, it may cause fluctuation of baseline and sensitivity. - You cannot set it when AFT is configured in the same line and several detectors are configured in the same line. - You cannot set it when ⑧ [Constant Flow (Column Flow + H2 Gas Flow)] is [On].
		Items Off, On
		Default Off

No.	Item	Description		
8	Constant Flow (Column Flow + H2 Gas Flow)	Select [On] to control the instrument so that the column flow and the H2 gas flow remains constant.  NOTE • When it is set at [On], H2 Program does not work even if H2 Program is set. • It is effective when the carrier gas type is H2. When gas types are different, it may cause fluctuation of baseline and sensitivity. • You cannot set it when AFT is configured in the same line and several detectors are configured in the same line. • You cannot set it when 7 [Constant Flow (Column Flow + Makeup Gas Flow)] is [On].		
		<table><tr><td>Items</td><td>Off, On</td></tr></table>	Items	Off, On
		Items	Off, On	
<table><tr><td>Default</td><td>Off</td></tr></table>	Default	Off		
Default	Off			

No.	Item		Description
9	Det Gas Flow		Sets flows of the detector gases. Actual value is displayed in the upper line, and the set value is displayed in the bottom line. NOTE Normally, set the flow of makeup gas, hydrogen and air as follows to maximize the FID sensitivity. Makeup : 24.0 mL/min H2 : About 32.0 mL/min Air : About 200.0 mL/min
	Makeup		Sets makeup gas flow supplied to the detector to optimize its sensitivity. The gas is supplied upon the GC start. When the GC stops, the gas is controlled according to the setting of [Flow Control] on [GC Stop Sequence] screen as same as the carrier gas. NOTE Nitrogen offers higher absolute sensitivity than helium, however, also increases noise level. Therefore, S/N ratio is similar among them.
		Items	He, N2, Ar
		Range	0.0 to 100.0 mL/min
		Default	N2, 24.0 mL/min
	H2		Sets hydrogen gas flow used for the hydrogen flame which burns in the detector. The supply starts right before the ignition.
		Range	0.0 to 100.0 mL/min
		Default	32.0 mL/min
	Air		Sets air flow used for the hydrogen flame which burns in the detector. The supply starts right before the ignition.
		Range	0.0 to 1000.0 mL/min
		Default	200.0 mL/min

Submenu

Item	Description	See also
Signal Settings	Displays [Signal Settings] screen. Sets the detector signal outputted from the instrument.	P.229
Makeup Program	Displays [DET Makeup Program] screen. Sets makeup gas flow programs.	P.227
H2 Program	Displays [DET H2 Program] screen. Sets hydrogen gas flow programs.	P.227
Air Program	Displays [DET Air Program] screen. Sets air flow programs.	P.227
Detector Gas Control	Displays [Detector Gas Control] screen. Turns On/Off detector gases and sets flows.	P.233

Item	Description	See also
Calibration Offset	Press [Run] to perform calibration so that the displayed APC pressure becomes "0 kPa" at atmospheric pressure. Use this function before GC starts or if the displayed pressure is not "0 kPa" while the gas supply stops (exposed to atmospheric pressure).	P.438

FID ignition

There are the following 3 procedures for FID ignition.

- To automatically ignite the FPD after the GC Start
 - 1 Select [On] in [Detector Control] on [Detector] screen.
 ▶▶ Reference "7.4.1 [Detector] Screen (FID Tab)" P.186
 - 2 Select [On] in [Detector] and [Auto Ignition] on [GC Start Sequence] screen.
 ▶▶ Reference "7.1.1 [GC Start Sequence] Screen" P.143
 - 3 Press [GC Start].
 Control of the instrument starts and ignition automatically starts after the parameters reach the set values.
 The increased baseline should indicate whether ignition was successful. The message [Ignition finished] appears, and the ignition is completed.
- To automatically start the detector control when the GC starts and ignite the FPD manually.
 - 1 Select [On] in [Detector Control] on [Detector] screen.
 ▶▶ Reference "7.4.1 [Detector] Screen (FID Tab)" P.186
 - 2 Select [On] in [Detector] and [Off] in [Auto Ignition] on [GC Start Sequence] screen.
 ▶▶ Reference "7.1.1 [GC Start Sequence] Screen" P.143
 - 3 Press [GC Start].
 - 4 Wait until the detector temperature reaches the set value.
 - 5 Select [On] in [Flame] on [Detector] screen.
 The increased baseline should indicate whether ignition was successful. The message [Ignition finished] appears, and the ignition is completed.
- Not to start the detector control when the GC starts
 - 1 Select [Off] in [Detector] and [Auto Ignition] on [GC Start Sequence] screen.
 ▶▶ Reference "7.1.1 [GC Start Sequence] Screen" P.143
 - 2 Press [GC Start].
 - 3 Select [On] in [Detector Control] on [Detector] screen.
 ▶▶ Reference "7.4.1 [Detector] Screen (FID Tab)" P.186

- 4 Wait until the detector temperature reaches the set value.
- 5 Select [On] in [Flame] on [Detector] screen.
The increased baseline should indicate whether ignition was successful. The message [Ignition finished] appears, and the ignition is completed.

- NOTE**
- When the ignition fails, ignition sequence is reattempted up to 5 times.
 - If the ignition is successful in the reattempted sequence, the message [Ignition finished (retried)] appears.
 - If the ignition sequences are failed, the message [DET#n ignition failed] appears.

Ignition troubleshooting

When ignition has failed and the message [Ignition failed.] appears, check the following items.

Cause	Solution
Column is not connected.	Connect the column to the detector to be used, and ensure that carrier gas is flowing.
Gas leaks at the detector side column connection.	Stop the leakage.
Makeup gas is not supplied or the flow is incorrect.	Supply makeup gas and set the flow to a proper value.
Hydrogen gas is not supplied or the flow is incorrect.	Supply hydrogen gas and set the flow to a proper value.
Air is not supplied or the flow is incorrect.	Supply air and set the flow to a proper value.
The control of unused hydrogen flame detector (FID, FPD) is tuned [On].	Turn [Off] the control of unused detectors.
FID jet is clogged.	• Perform maintenance for the FID jet. • Replace the FID jet.
Igniter filament is broken.	Replace the igniter.

FID extinguishment

Shut off the hydrogen supply at the main valve after the extinguishment, if necessary.

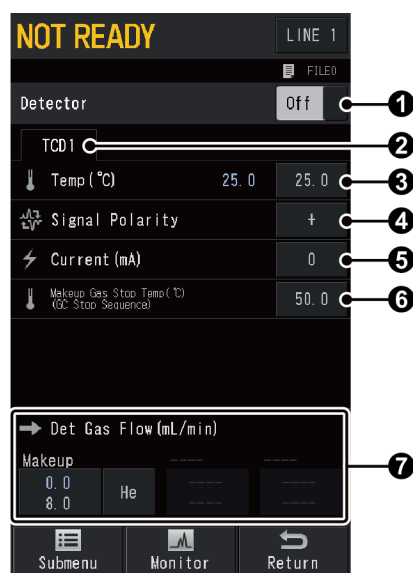
- Auto extinguishment
Press [Stop GC] on [GC Stop Sequence] screen to stop supply of hydrogen and air automatically and extinguish the flame. When a program is running or [Stop Time] is set in [GC Stop Sequence] screen, the detector gas is automatically shut off at the end of the program, extinguishing the FID flame.
- Manual extinguishment
For manual extinguishment, select [Off] in [Flame] on [Detector] screen or turn [Off] the detector control to shut off hydrogen gas and air and extinguish the flame.

7.4.2 [Detector] Screen (TCD Tab)

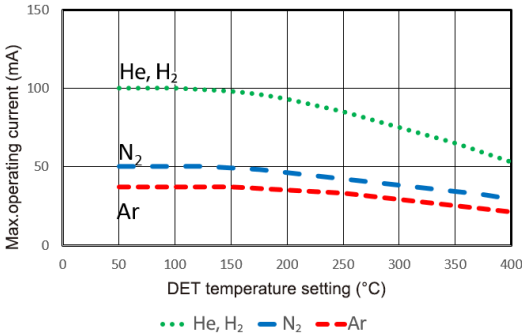
Press  (HOME) - [Detector] to display [Detector] screen.

[TCD] tab is displayed when TCD is configured in the analytical line.

When several detectors are configured in the analytical line, press a tab to switch detectors or press [LINE] in the top-right of the screen to switch lines and make settings.



No.	Item	Description
①	Detector Control	Displays the current control status of the detector. Press [Off] or [On] to switch the control status. Select [On] to send current through TCD filament outputting detector signal. Only when the detector is configured in the analytical line and ① [Detector Control] is set at [On], the detector can be controlled.
		Items Off, On
		Default On
②	Tab	Detectors configured in analytical line are displayed. Press the tab to switch detectors.
③	Temp	Sets the detector temperature. The TCD sensitivity is proportional to the difference in temperature between the detector and the filament. Accordingly, the sensitivity increases as the detector temperature decreases. However, the detector temperature should be normally set approximately 10 °C higher than the column oven temperature (the final temperature for programmed analysis): this prevents contamination in the TCD cell. ▶▶ Reference "[Max Temperature] Screen" P.336
		Range 0.0 to 400.0 °C
		Default 25.0 °C

No.	Item	Description																																				
4	Signal Polarity	Normally, set signal polarity to [+]. Set it to [-] when analyzing compounds with a thermal conductivity higher than the carrier gas because baseline peaks will be inverted (negative) if [+] is selected for these cases.																																				
		Items	-, +																																			
		Default	+																																			
5	Current	The TCD sensitivity is approximately proportional to the cube of the current. If the sensitivity is insufficient, increase the current up to the maximum operating current. The maximum operating current is determined by the detector temperature and the carrier gas type. NOTE - Keeping the current higher than necessary shortens the filaments life and can cause noise and/or baseline drift. - When the GC starts or the detector temperature is changed, the current is turned off and the detector signal is not outputted until the detector temperature reaches the set value. CAUTION ! Instruction Ensure that [Current] is set at "0" before starting the GC. Set [Start Time] on [GC Start Sequence] screen to approximately 10 minutes and then press [GC Start]. Ensure that the gas flows to the detector vent. Filaments may break if the current passes the filaments when the air inside the cell is not replaced with carrier gas or makeup gas. ! Instruction To avoid broken filaments and poor performance, set the current below the values indicated by the curves below. <table><caption>Approximate data from the graph</caption><thead><tr><th>DET temperature setting (°C)</th><th>He, H₂ (mA)</th><th>N₂ (mA)</th><th>Ar (mA)</th></tr></thead><tbody><tr><td>50</td><td>100</td><td>50</td><td>30</td></tr><tr><td>100</td><td>100</td><td>48</td><td>28</td></tr><tr><td>150</td><td>98</td><td>45</td><td>25</td></tr><tr><td>200</td><td>90</td><td>42</td><td>22</td></tr><tr><td>250</td><td>80</td><td>38</td><td>18</td></tr><tr><td>300</td><td>70</td><td>32</td><td>15</td></tr><tr><td>350</td><td>60</td><td>28</td><td>12</td></tr><tr><td>400</td><td>50</td><td>30</td><td>20</td></tr></tbody></table> Range 0 to 100 mA Default 0 mA	DET temperature setting (°C)	He, H ₂ (mA)	N ₂ (mA)	Ar (mA)	50	100	50	30	100	100	48	28	150	98	45	25	200	90	42	22	250	80	38	18	300	70	32	15	350	60	28	12	400	50	30	20
		DET temperature setting (°C)	He, H ₂ (mA)	N ₂ (mA)	Ar (mA)																																	
		50	100	50	30																																	
100	100	48	28																																			
150	98	45	25																																			
200	90	42	22																																			
250	80	38	18																																			
300	70	32	15																																			
350	60	28	12																																			
400	50	30	20																																			

No.	Item	Description		
⑥	Makeup Gas Stop Temp	Sets a temperature at which makeup gas supply stops. The instrument stops makeup gas supply when the detector temperature drops below the set value.		
		NOTE - Set the temperature so that makeup gas stops after detector temperature drops adequately. - When you preset [Flow Off Time] on [GC Stop Sequence] screen, the instrument starts to count the flow off time after the temperature reaches the set value in ⑥ [Make Up Gas Stop Temp]. - If the temperature is set in uncontrollable range, count of flow off time may not start and gas control may not stop.		
		<table><tr><td>Range</td><td>0.0 to 100.0 °C</td></tr><tr><td>Default</td><td>50.0 °C</td></tr></table>	Range	0.0 to 100.0 °C
Range	0.0 to 100.0 °C			
Default	50.0 °C			

No.	Item	Description																											
7	Det Gas Flow	Sets the detector gas flow. Actual value is displayed in the upper line, and the set value is displayed in the bottom line. NOTE - Normally, set the makeup gas flow at 8.0 L/min to maximize the TCD sensitivity. - If the makeup gas flow is set below the optimal rate, absolute sensitivity increases. However, the reference filament can break and peak tailing may occur. The baseline after the solvent peak has eluted may be come elevated. The level is different depending on solvent type, etc.																											
	Makeup	The gas tubing is routed so that the TCD detector gas pass through the reference side and then are supplied as the makeup gas. The gas is supplied upon the GC start. NOTE The TCD sensitivity is proportional to the difference in thermal conductivity between the sample and the carrier gas. The sensitivity increases as the difference in thermal conductivity between the sample and the carrier gas increases. For high sensitivity analysis, use gases with purity of 99.9995 % or more. Thermal conductivity "k" at room temperature and 300 K ($\times 10^{-4} \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$) <table><tr><th colspan="2">Gas</th><th>Thermal conductivity</th></tr><tr><td rowspan="4">Simple substance</td><td>He</td><td>1499</td></tr><tr><td>H₂</td><td>1815</td></tr><tr><td>N₂</td><td>259.8</td></tr><tr><td>Ar</td><td>177.2</td></tr><tr><td rowspan="2">Inorganic compound</td><td>CO₂</td><td>166.2</td></tr><tr><td>H₂O</td><td>181</td></tr><tr><td rowspan="2">Organic compound</td><td>Acetone</td><td>115</td></tr><tr><td>Hexane</td><td>128</td></tr></table> <table><tr><td>Items</td><td>He, N2, H2, Ar</td></tr><tr><td>Range</td><td>0.0 to 20.0 mL/min</td></tr><tr><td>Default</td><td>He, 8.0 mL/min</td></tr></table>	Gas		Thermal conductivity	Simple substance	He	1499	H ₂	1815	N ₂	259.8	Ar	177.2	Inorganic compound	CO ₂	166.2	H ₂ O	181	Organic compound	Acetone	115	Hexane	128	Items	He, N2, H2, Ar	Range	0.0 to 20.0 mL/min	Default
Gas		Thermal conductivity																											
Simple substance	He	1499																											
	H ₂	1815																											
	N ₂	259.8																											
	Ar	177.2																											
Inorganic compound	CO ₂	166.2																											
	H ₂ O	181																											
Organic compound	Acetone	115																											
	Hexane	128																											
Items	He, N2, H2, Ar																												
Range	0.0 to 20.0 mL/min																												
Default	He, 8.0 mL/min																												

Submenu

Item	Description	See also
Signal Settings	Displays [Signal Settings] screen. Sets the detector signal outputted from the instrument.	P.229
Makeup Program	Displays [DET Makeup Program] screen. Sets makeup gas flow programs.	P.227

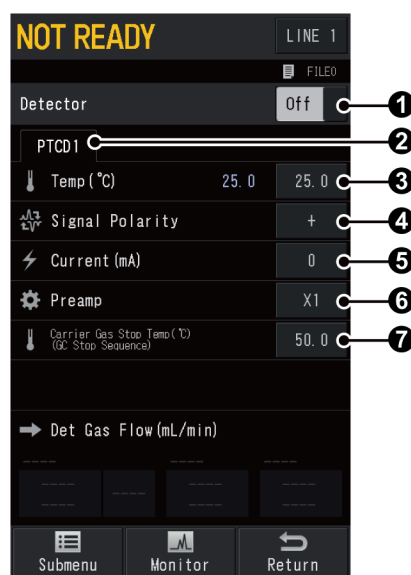
Item	Description	See also
Detector Gas Control	Displays [Detector Gas Control] screen. Turns On/Off detector gases and sets flows.	P.233
Calibration Offset	Press [Run] to perform calibration so that the displayed APC pressure becomes "0 kPa" at atmospheric pressure. Use this function before GC starts or if the displayed pressure is not "0 kPa" while the gas supply stops (exposed to atmospheric pressure).	P.438

7.4.3 [Detector] Screen (PTCD Tab)

Press  (HOME) - [Detector] to display [Detector] screen.

[PTCD] tab is displayed when a packed column is installed on the instrument and TCD is configured in the analytical line.

When several detectors are configured in the analytical line, press a tab to switch detectors or press [LINE] in the top-right of the screen to switch lines and make settings.



No.	Item	Description
①	Detector Control	Displays the current control status of the detector. Press [Off] or [On] to switch the control status. Select [On] to send current through TCD filament outputting detector signal. Only when the detector is configured in the analytical line and ① [Detector Control] is set at [On], the detector can be controlled.
		Items Off, On
		Default On
②	Tab	Detectors configured in analytical line are displayed. Press the tab to switch detectors.

No.	Item	Description
③	Temp	Sets the detector temperature. The TCD sensitivity is proportional to the difference in temperature between the detector and the filament. Accordingly, the sensitivity increases as the detector temperature decreases. However, the detector temperature should be normally set approximately 10 °C higher than the column oven temperature (the final temperature for programmed analysis): this prevents contamination in the TCD cell. ▶▶ Reference "[Max Temperature] Screen" P.336
		Range 0.0 to 350.0 °C
		Default 25.0 °C
④	Signal Polarity	Normally, set signal polarity to [+]. Set it to [-] when analyzing compounds with a thermal conductivity higher than the carrier gas because baseline peaks will be inverted (negative) if [+] is selected for these cases.
		Items -, +
		Default +

No.	Item	Description				
5	Current	The TCD sensitivity is approximately proportional to the cube of the current. If the sensitivity is insufficient, increase the current up to the maximum operating current. The maximum operating current is determined by the detector temperature and the carrier gas type.				
		NOTE - Keeping the current higher than necessary shortens the filaments life and can cause noise and/or baseline drift. - When the GC starts or the detector temperature is changed, the current is turned off and the detector signal is not outputted until the detector temperature reaches the set value.				
		CAUTION ! Instruction Ensure that [Current] is set at "0" before starting the GC. Set [Start Time] on [GC Start Sequence] screen to approximately 10 minutes and then press [GC Start]. Ensure that the gas flows to the detector vent. Filaments may break if the current passes the filaments when the air inside the cell is not replaced with carrier gas or makeup gas. ! Instruction To avoid broken filaments and poor performance, set the current below the values indicated by the curves below. 200 150 100 50 0 He, H₂ N₂ Ar 50 100 150 200 250 300 350 Temperature setting [°C] He, H₂ N₂ Ar				
		<table><tr><td>Range</td><td>0 to 200 mA</td></tr><tr><td>Default</td><td>0 mA</td></tr></table>	Range	0 to 200 mA	Default	0 mA
Range	0 to 200 mA					
Default	0 mA					
6	Preamp	Use it to amplify the detector signal output of TCD.				
		<table><tr><td>Range</td><td>×1, ×10</td></tr><tr><td>Default</td><td>×1</td></tr></table>	Range	×1, ×10	Default	×1
		Range	×1, ×10			
		Default	×1			

No.	Item	Description		
7	Carrier Gas Stop Temp	Sets a temperature at which carrier gas supply stops. The instrument stops carrier gas supply when the detector temperature drops below the set value.		
		 NOTE • Set the temperature so that carrier gas stops after detector temperature drops adequately. • When you preset [Flow Off Time] on [GC Stop Sequence] screen, the instrument starts to count the flow off time after the temperature reaches the set value in 7 [Carrier Gas Stop Temp]. • If the temperature is set in uncontrollable range, count of flow off time may not start and gas control may not stop.		
		<table><tr><td>Rang</td><td>0.0 to 100.0 °C</td></tr><tr><td>Default</td><td>50.0 °C</td></tr></table>	Rang	0.0 to 100.0 °C
Rang	0.0 to 100.0 °C			
Default	50.0 °C			

Submenu

Item	Description	See also
Signal Settings	Displays [Signal Settings] screen. Sets the detector signal outputted from the instrument.	P.229
Calibration Offset	Press [Run] to perform calibration so that the displayed APC pressure becomes "0 kPa" at atmospheric pressure. Use this function before GC starts or if the displayed pressure is not "0 kPa" while the gas supply stops (exposed to atmospheric pressure).	P.438

Thermal conductivity

The TCD sensitivity is proportional to the difference in thermal conductivity between the sample and the carrier gas. The sensitivity increases as the difference in thermal conductivity between the sample and the carrier gas increases. For high sensitivity analysis, use gases with purity of 99.9995 % or more.

Thermal conductivity "k" at room temperature and 300 K ($\times 10^{-4} \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$)

Gas		Thermal conductivity
Simple substance	He	1499
	H ₂	1815
	N ₂	259.8
	Ar	177.2
Inorganic compound	CO ₂	166.2
	H ₂ O	181
Organic compound	Acetone	115
	Hexane	128

7.4.4 [Detector] Screen (FTD Tab)

Press  (HOME) - [Detector] to display [Detector] screen.

[FTD] tab is displayed when FTD is configured in the analytical line.

When several detectors are configured in the analytical line, press a tab to switch detectors or press [LINE] in the top-right of the screen to switch lines and make settings.



No.	Item	Description
①	Detector Control	Displays the current control status of the detector. Press [Off] or [On] to switch the control status. Select [On] to output detector signal. Only when the detector is configured in the analytical line and ① [Detector Control] is set at [On], the detector can be controlled. For the detector configured in an analytical line, the detector temperature can be controlled even when ① [Detector Control] is set at [Off].
		Items Off, On
		Default On
②	Tab	Detectors configured in analytical line are displayed. Press the tab to switch detectors.
③	Temp	Sets the detector temperature. Normally, set the detector temperature approximately 30 °C higher than the column oven temperature (the final temperature for programmed analysis) to prevent contamination by high boiling point compounds. ▶▶ Reference "[Max Temperature] Screen" P.336
		Range 0.0 to 450.0 °C
		Default 25.0 °C

No.	Item	Description				
4	Current	Sets background current. This item is displayed when 5 [Control Mode] is set at [Current]. NOTE - Set it to a small value at first, then gradually increase the value until the desired sensitivity is achieved. - A large value makes the peaks larger, however, baseline noise also increases, which results in the longer time until the instrument stabilizes. The alkaline source life can be shortened. - Background current is adjusted when the current value is changed if 1 [Detector Control] and 6 [Power Controller] is set at [On].				
		<table><tr><td>Range</td><td>0.00 to 10.00 pA</td></tr><tr><td>Default</td><td>1.00 pA</td></tr></table>	Range	0.00 to 10.00 pA	Default	1.00 pA
		Range	0.00 to 10.00 pA			
		Default	1.00 pA			
	Voltage	Sets the voltage applied on the filament. This item is displayed when 5 [Control Mode] is set at [Voltage]. NOTE A large value makes the peaks larger, however, baseline noise also increases, which results in the longer time until the instrument stabilizes. The alkaline source life can be shortened.				
<table><tr><td>Range</td><td>0 to 100 %</td></tr><tr><td>Default</td><td>0 %</td></tr></table>	Range	0 to 100 %	Default	0 %		
Range	0 to 100 %					
Default	0 %					
5	Control Mode	Sets control mode.				
		<table><tr><td>Items</td><td> - Current Adjusts the background current to be the set value. - Voltage Directly sets the voltage applied on the filament. </td></tr><tr><td>Default</td><td>Current</td></tr></table>	Items	- Current Adjusts the background current to be the set value. - Voltage Directly sets the voltage applied on the filament.	Default	Current
		Items	- Current Adjusts the background current to be the set value. - Voltage Directly sets the voltage applied on the filament.			
Default	Current					

No.	Item	Description
⑥	Power controller	Displays the current control status of the power controller. Press [Off] or [On] to switch the control status. Select [On] to control the voltage applied on the filament. NOTE - When ⑤ [Control Mode] is set at [Voltage] and ⑥ [Power Controller] is set at [Off], background current adjustment will not start even if you set ① [Detector Control] to [On]. - When ⑤ [Control Mode] is set at [Current] and ① [Detector Control] is set at [Off], background current adjustment will not start even if you set ⑥ [Power Controller] to [On]. Set ④ [Current] and then set ⑥ [Power Controller] to [On] to adjust background current automatically.
		ItemsOff, On
		DefaultOff
⑦	Adjustment	Press [Start] to adjust the background current again without the current value change. [Complete] is displayed after the set time in ⑧ [Adjustment Time] elapses. The instrument automatically perform adjustment when you change the value in ④ [Current] This item is used when ⑤ [Control Mode] is set at [Current].
⑧	Adjustment Time	Sets adjustment time for background current. This item is used when ⑤ [Control Mode] is set at [Current]. NOTE When Adjustment Time is short, background current may not be adjusted correctly. Set Adjustment Time depending on the condition of alkaline source. It is recommended to set it at a value more 30 min.
		Range0.00 to 9999.99 min
		Default60.00 min
⑨	Power	Displays the percentage (%) of the voltage applied on the filament to full power.

No.	Item	Description
10	Constant Flow (Column Flow + Makeup Gas Flow)	Select [On] to control the instrument so that the column flow and the makeup gas flow remains constant. NOTE - When it is set at [On], Makeup Program does not work even if Makeup Program is set. - It is effective when types of carrier gas and makeup gas are the same. When gas types are different, it may cause fluctuation of baseline and sensitivity. - You cannot set it when AFT is configured in the same line and several detectors are configured in the same line. - You cannot set it when 11 [Constant Flow (Column Flow + H2 Gas Flow)] is [On].
		Items Off, On
		Default Off
11	Constant Flow (Column Flow + H2 Gas Flow)	Select [On] to control the instrument so that the column flow and the H2 gas flow remains constant. NOTE - When it is set at [On], H2 Program does not work even if H2 Program is set. - It is effective when the carrier gas type is H2. When gas types are different, it may cause fluctuation of baseline and sensitivity. - You cannot set it when AFT is configured in the same line and several detectors are configured in the same line. - You cannot set it when 10 [Constant Flow (Column Flow + Makeup Gas Flow)] is [On].
		Items Off, On
		Default Off

No.	Item	Description
12	Det Gas Flow	Sets flows of the detector gases. Actual value is displayed in the upper line, and the set value is displayed in the bottom line.
		NOTE The optimal flows for various target components are shown below. - Organic nitrogen compounds - Makeup : about 10.0 to 30.0 mL/min (Helium) - H2 : about 1.0 to 2.0 mL/min - Air : about 140.0 to 150.0 mL/min - Phosphorus compound - Makeup : about 10.0 to 30.0 mL/min (Helium) - H2 : about 3.0 to 6.0 mL/min - Air : about 140.0 to 150.0 mL/min
	Makeup H2 Air	Sets makeup gas flow supplied to the detector to optimize its sensitivity. The gas is supplied upon the GC start.
		Items He, N2, Ar
		Range 0.0 to 100.0 mL/min
		Default He, 27.5 mL/min
		Used to generate rubidium radicals from alkaline source.
		Range 0.0 to 30.0 mL/min
		Default 1.5 mL/min
		Used to generate rubidium radicals from alkaline source.
		Range 0.0 to 1000.0 mL/min
		Default 145.0 mL/min

Submenu

Item	Description	See also
Signal Settings	Displays [Signal Settings] screen. Sets the detector signal outputted from the instrument.	P.229
Makeup Program	Displays [DET Makeup Program] screen. Sets makeup gas flow programs.	P.227
H2 Program	Displays [DET H2 Program] screen. Sets hydrogen gas flow programs.	P.227
Air Program	Displays [DET Air Program] screen. Sets air flow programs.	P.227
Detector Gas Control	Displays [Detector Gas Control] screen. Turns On/Off detector gases and sets flows.	P.233

Item	Description	See also
Calibration Offset	Press [Run] to perform calibration so that the displayed APC pressure becomes "0 kPa" at atmospheric pressure. Use this function before GC starts or if the displayed pressure is not "0 kPa" while the gas supply stops (exposed to atmospheric pressure).	P.438

Setting of background current

▶▶ Reference "About background current" P.418

Background current (alkaline source temperature) should be same under the same analytical conditions (when background adjustment is performed) to perform analysis at the same sensitivity with FTD detector.

The change of the sensitivity of FTD detector is among the highest in GC detectors. Therefore, background current is changing due to consumption and contamination of the alkaline source after adjustment. You need to check the sensitivity periodically during continuous analysis. When the daily deviation is above 20 % at the middle concentration of the calibration curve, adjust the background current again. Generally, the temperature of alkaline source and the sensitivity increases with use, however, it promotes consumption of alkaline source.

Check the sensitivity before a series of analysis as possible. If the sensitivity changes, adjust the background current again.

When the sensitivity is different after the readjustment, you need to create calibration curve again.

• How to set background current

- ▼ **NOTE** Check the following items before background current setting.
- Whether the detector temperature is set at the value for analysis.
 - Whether the column oven temperature is below 40 °C.
 - When you perform analysis at the same sensitivity as the previous time, whether the temperatures and flows are set at the same values as the previous background adjustment.
 - Whether the flows of carrier gas and makeup gas are stable (Flows during analysis).
 - Whether the flows of hydrogen gas and air are stable (Flows during analysis).

- 1 Display [Detector] screen.
- 2 Set [Control Mode] to [Current].
- 3 Enter the background current in [Current].

- ▼ **NOTE**
- Set the current to a small value at first, then gradually increase the value until the desired sensitivity is achieved.
 - A large current value makes the peaks larger, however, baseline noise also increases, which results in the longer time until the instrument stabilizes. The alkaline source life can be shortened.

- 4 Enter adjustment time for background current in [Adjustment Time].
If [Power Controller] is set at [On], the instrument enters into adjustment mode automatically to set background current.
The detector keeps READY status for the time set in [Adjustment Time] or more after the background current setting is set. Then the adjustment is completed.

 **NOTE** When the current value is set at small values such as "1.00 pA", alkaline source may be not red hot and the background current may increase, which prevents adjustment. In this case, change the current value to a little higher value. When you adjust background current at the same value as the previous time, for example, when you turn [Off] power controller immediately after use and then turn [On] it soon, you may not be able to perform adjustment because the background current increases. In this case, set the current value at a little higher value, check that the background current decreases, and then set the current value at the value for analysis again.

- To forcefully terminate the adjustment mode
If the baseline becomes stable adequately before the time set in [Adjustment Time] elapses while the instrument adjusts background current, you can terminate the adjustment to start analysis by pressing [End]. In this case, the filament current is determined as you press [End]. Pay attention to sensitivity fluctuating.
- How to readjust background current
The sensitivity is changing with consumption of alkaline source during continuous analysis. When the sensitivity fluctuates considerably during continuous analysis, readjust background current.

- 1 Set [Column Temp] at "40.0 °C".
- 2 Press [Start] in [Adjustment] on [Detector] screen.

 **NOTE**

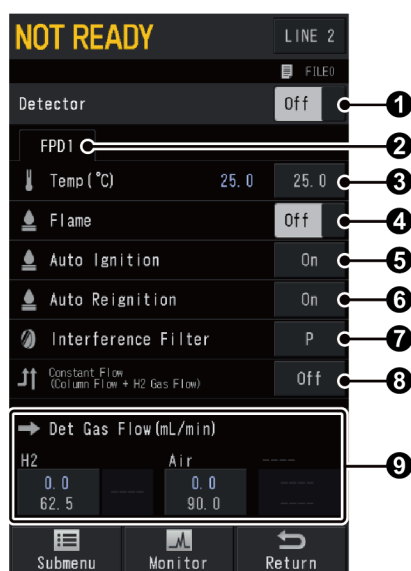
- Set the temperatures and flows at the same values as the previous background adjustment, and then press [Start]. If the conditions are different, background current is not adjusted to the same level.
- The instrument does not start background adjustment even after you set [Current] at the same value again. Be sure to press [Start] in [Adjustment]. When you input the current value for readjustment, enter a different value and then enter the current value to be used for analysis.

7.4.5 [Detector] Screen (FPD Tab)

Press  (HOME) - [Detector] to display [Detector] screen.

[FPD] tab is displayed when FPD is configured in the analytical line.

When several detectors are configured in the analytical line, press a tab to switch detectors or press [LINE] in the top-right of the screen to switch lines and make settings.



No.	Item	Description
①	Detector Control	Displays the current control status of the detector. Press [Off] or [On] to switch the control status. Select [On] to output detector signal. Only when the detector is configured in the analytical line and ① [Detector Control] is set at [On], the detector can be controlled. For the detector configured in an analytical line, the detector temperature can be controlled even when ① [Detector Control] is set at [Off]. When you select [Off] after the GC starts, the instrument stops detector signal output and supply of hydrogen and air to extinguish the flame. Select [On] to restart detector signal output. Select [On] in ④ [Flame] to ignite the flame again.
		Items Off, On
		Default On
②	Tab	Detectors configured in analytical line are displayed. Press the tab to switch detectors.

No.	Item	Description		
③	Temp	Sets the detector temperature. Normally, set the detector temperature higher than 200 °C and approximately 30 °C higher than the column oven temperature (the final temperature for programmed analysis) to prevent flame extinguishment and contamination by high boiling point compounds. ▶▶ Reference "[Max Temperature] Screen" P.336		
		 NOTE Set the detector temperature between 200 °C and 350 °C during analysis. • Using the detector under 200 °C may cause condensation inside the detector resulting in decreased sensitivity due to corrosion. • Using the detector over 350 °C may shorten the filter life.		
		<table><tr><td>Range</td><td>0.0 to 450.0 °C</td></tr></table>	Range	0.0 to 450.0 °C
		Range	0.0 to 450.0 °C	
<table><tr><td>Default</td><td>25.0 °C</td></tr></table>	Default	25.0 °C		
Default	25.0 °C			
④	Flame	Displays the ignition status of the flame. Press [Off] or [On] to switch the ignition status. [On] and [Off] is displayed when the flame is ignited and extinguished, respectively. [Running] is displayed during ignition. When you start the GC with ⑤ [Auto Ignition] turned [Off], press [On] after the instrument is ready to ignite the flame.		
		<table><tr><td>Items</td><td>Off, On</td></tr></table>	Items	Off, On
		Items	Off, On	
<table><tr><td>Default</td><td>Off</td></tr></table>	Default	Off		
Default	Off			
⑤	Auto Ignition	Select [On] to ignite the FPD automatically while the GC starts.  Hint This setting is linked with the setting of [Auto Ignite] on [GC Start Sequence] screen.		
		<table><tr><td>Items</td><td>Off, On</td></tr></table>	Items	Off, On
		Items	Off, On	
<table><tr><td>Default</td><td>On</td></tr></table>	Default	On		
Default	On			
⑥	Auto Reignition	Select [On] to automatically re-ignite the flame when the instrument detects the extinguishment.		
		<table><tr><td>Items</td><td>Off, On</td></tr></table>	Items	Off, On
		Items	Off, On	
<table><tr><td>Default</td><td>On</td></tr></table>	Default	On		
Default	On			
⑦	Interference Filter	Select a filter suitable for the target element. Select the same filter as one attached to the instrument.		
		<table><tr><td>Items</td><td> • P: For phosphorus • S: For sulfur • Sn: For tin </td></tr></table>	Items	• P: For phosphorus • S: For sulfur • Sn: For tin
		Items	• P: For phosphorus • S: For sulfur • Sn: For tin	
<table><tr><td>Default</td><td>P</td></tr></table>	Default	P		
Default	P			

No.	Item	Description				
8	Constant Flow (Column Flow + H2 Gas Flow)	Select [On] to control the instrument so that the column flow and the H2 gas flow remains constant. NOTE - When it is set at [On], H2 Program does not work even if H2 Program is set. - It is effective when the carrier gas type is H2. When gas types are different, it may cause fluctuation of baseline and sensitivity. - You cannot set it when AFT is configured in the same line and several detectors are configured in the same line.				
		<table><tr><td>Items</td><td>Off, On</td></tr></table>	Items	Off, On		
		Items	Off, On			
<table><tr><td>Default</td><td>Off</td></tr></table>	Default	Off				
Default	Off					
9	Det Gas Flow	Sets flows of the detector gases. Actual value is displayed in the upper line, and the set value is displayed in the bottom line. NOTE The optimal flows for various target components are shown below. - For phosphorous component (P) H2 : About 62.5 mL/min Air : About 90.0 mL/min - For sulfur component (S) H2 : About 40.0 mL/min Air : About 60.0 mL/min - For tin component (Sn) H2 : About 75.0 mL/min Air : About 65.0 mL/min				
	H2	Sets hydrogen gas flow used for the hydrogen flame which burns in the detector. The supply starts right before the ignition. <table><tr><td>Range</td><td>0.0 to 250.0 mL/min</td></tr><tr><td>Default</td><td>80.0 mL/min</td></tr></table>	Range	0.0 to 250.0 mL/min	Default	80.0 mL/min
		Range	0.0 to 250.0 mL/min			
	Default	80.0 mL/min				
	Air	Sets air flow used for the hydrogen flame which burns in the detector. The supply starts right before the ignition. <table><tr><td>Range</td><td>0.0 to 1000.0 mL/min</td></tr><tr><td>Default</td><td>120.0 mL/min</td></tr></table>	Range	0.0 to 1000.0 mL/min	Default	120.0 mL/min
		Range	0.0 to 1000.0 mL/min			
Default	120.0 mL/min					

Submenu

Item	Description	See also
Signal Settings	Displays [Signal Settings] screen. Sets the detector signal outputted from the instrument.	P.229
H2 Program	Displays [DET H2 Program] screen. Sets hydrogen gas flow programs.	P.227

Item	Description	See also
Air Program	Displays [DET Air Program] screen. Sets air flow programs.	P.227
Detector Gas Control	Displays [Detector Gas Control] screen. Turns On/Off detector gases and sets flows.	P.233
Calibration Offset	Press [Run] to perform calibration so that the displayed APC pressure becomes "0 kPa" at atmospheric pressure. Use this function before GC starts or if the displayed pressure is not "0 kPa" while the gas supply stops (exposed to atmospheric pressure).	P.438

FPD ignition

There are the following 3 procedures for FPD ignition.

- To automatically ignite the FPD after the GC Start
 - 1 Select [On] in [Detector Control] on [Detector] screen.
 ▶▶ Reference ["7.4.5 \[Detector\] Screen \(FPD Tab\)" P.207](#)
 - 2 Select [On] in [Detector] and [Auto Ignition] on [GC Start Sequence] screen.
 ▶▶ Reference ["7.1.1 \[GC Start Sequence\] Screen" P.143](#)
 - 3 Press [GC Start].
 Control of the instrument starts and ignition automatically starts after the parameters reach the set values.
 The increased baseline should indicate whether ignition was successful. The message [Ignition finished] appears, and the ignition is completed.
- To automatically start the detector control when the GC starts and ignite the FPD manually.
 - 1 Select [On] in [Detector Control] on [Detector] screen.
 ▶▶ Reference ["7.4.5 \[Detector\] Screen \(FPD Tab\)" P.207](#)
 - 2 Select [On] in [Detector] and [Off] in [Auto Ignition] on [GC Start Sequence] screen.
 ▶▶ Reference ["7.1.1 \[GC Start Sequence\] Screen" P.143](#)
 - 3 Press [GC Start].
 - 4 Wait until the detector temperature reaches the set value.
 - 5 Select [On] in [Flame] on [Detector] screen.
 The increased baseline should indicate whether ignition was successful. The message [Ignition finished] appears, and the ignition is completed.
- Not to start the detector control when the GC starts
 - 1 Select [Off] in [Detector] and [Auto Ignition] on [GC Start Sequence] screen.
 ▶▶ Reference ["7.1.1 \[GC Start Sequence\] Screen" P.143](#)

- 2 Press [GC Start].
- 3 Select [On] in [Detector Control] on [Detector] screen.
 ▶▶ Reference "7.4.5 [Detector] Screen (FPD Tab)" P.207
- 4 Wait until the detector temperature reaches the set value.
- 5 Select [On] in [Flame] on [Detector] screen.
 The increased baseline should indicate whether ignition was successful. The message [Ignition finished] appears, and the ignition is completed.

- **NOTE**
- When the ignition fails, ignition sequence is reattempted up to 5 times.
 - If the ignition is successful in the reattempted sequence, the message [Ignition finished (retried)] appears.
 - If the ignition sequences are failed, the message [DET#n ignition failed] appears.

Ignition troubleshooting

When ignition has failed and the message [Ignition failed.] appears, check the following items.

Cause	Solution
Column is not connected.	Connect the column to the detector to be used, and ensure that carrier gas is flowing.
Gas leaks at the detector side column connection.	Stop the leakage.
Hydrogen gas is not supplied or the flow is incorrect.	Supply hydrogen gas and set the flow to a proper value.
Air is not supplied or the flow is incorrect.	Supply air and set the flow to a proper value.
The control of unused hydrogen flame detector (FID, FPD) is tuned [On].	Turn [Off] the control of unused detectors.
Igniter filament is broken.	Replace the igniter.

FPD extinguishment

Shut off the hydrogen supply at the main valve after the extinguishment, if necessary.

- Auto extinguishment
 Press [Stop GC] on [GC Stop Sequence] screen to stop supply of hydrogen and air automatically and extinguish the flame. When a program is running or [Stop Time] is set in [GC Stop Sequence] screen, the detector gas is automatically shut off at the end of the program, extinguishing the FID flame.
- Manual extinguishment
 For manual extinguishment, select [Off] in [Flame] on [Detector] screen or turn [Off] the detector control to shut off hydrogen gas and air and extinguish the flame.

FPD photomul purge kit

▶▶ **Reference** Refer to Maintenance Help for the replacement/installation procedure of the FPD photomul purge kit.

Photomultiplier tube maintains a vacuum. Therefore, contamination by a gas with a small molecular weight such as helium may shorten the life of the photomultiplier.

FPD photomul purge kit provides the following measures and reduces the possibility that helium, etc. contaminates the inside of the photomultiplier.

- It can keep the pressure in the photomultiplier case a little higher than atmospheric pressure.
- It can circulate nitrogen gas in the atmosphere around the photomultiplier.

Cautions when using FPD photomul purge kit

- Use nitrogen gas (recommended) or an air cylinder.
About 6 mL/min of the gas is consumed at the maximum.
- Always keep nitrogen or air flow even when using the detector other than FPD or not using the GC.
- Normally, you do not need to use the adjustment knob.

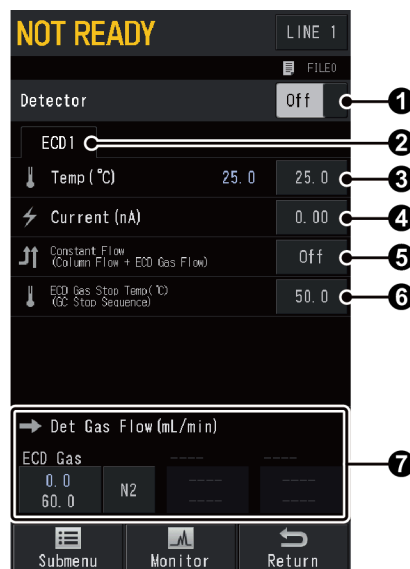
NOTE Normally, you do not need to turn the adjustment knob on the top surface of the flow controller because it is set at an optimal value when the instrument is shipped or installed. During replacement, do not turn the adjustment knob. If you turn the adjustment knob by mistake, adjust it by checking the actual value at the connecting part.

7.4.6 [Detector] Screen (ECD Tab)

Press  (HOME) - [Detector] to display [Detector] screen.

[ECD] tab is displayed when ECD is configured in the analytical line.

When several detectors are configured in the analytical line, press a tab to switch detectors or press [LINE] in the top-right of the screen to switch lines and make settings.



No.	Item	Description
❶	Detector Control	Displays the current control status of the detector. Press [Off] or [On] to switch the control status. Select [On] to output detector signal. Only when the detector is configured in the analytical line and ❶ [Detector Control] is set at [On], the detector can be controlled. For the detector configured in an analytical line, the detector temperature and ECD gas can be controlled even when ❶ [Detector Control] is set at [Off].
		Items Off, On
		Default On
❷	Tab	Detectors configured in analytical line are displayed. Press the tab to switch detectors.
❸	Temp	Sets the detector temperature. Normally, set the detector temperature approximately 30 °C higher than the column oven temperature (the final temperature for programmed analysis) to prevent contamination by high boiling point compounds. ▶▶ Reference "[Max Temperature] Screen" P.336
		Range 0.0 to 350.0 °C
		Default 25.0 °C
❹	Current	Sets the current value. The signal output increases as the current value increases. Sets the value within the range in which the instrument can perform Auto Zero.
		Range 0.0 to 3.50 nA
		Default 1.00 nA
❺	Constant Flow (Column Flow + ECD Gas Flow)	Select [On] to control the instrument so that the column flow and the ECD gas flow remains constant. NOTE - When it is set at [On], ECD Gas Program does not work even if ECD Gas Program is set. - It is effective when types of carrier gas and ECD gas are the same. When gas types are different, it may cause fluctuation of baseline and sensitivity. - You cannot set it when AFT is configured in the same line and several detectors are configured in the same line.
		Items Off, On
		Default Off
❻	ECD Gas Stop Temp	Sets a temperature at which ECD gas supply stops. The instrument stops ECD gas supply when the detector temperature drops below the set value. NOTE Set the temperature so that ECD gas stops after detector temperature drops adequately.
		Range 0.0 to 100.0 °C
		Default 50.0 °C

No.	Item	Description					
7	Det Gas Flow	Sets the detector gas flow. Actual value is displayed in the upper line, and the set value is displayed in the bottom line. NOTE - To ensure that your ECD performs at its best for as long as possible, set the flow to 15.0 mL/min (flow path A) or 30.0 mL/min (flow path B)*¹. For flow path A only, if the carrier gas flow is set above 15.0 mL/min, set the ECD gas flow to the same setting as the carrier gas. - The ECD sensitivity depends on the sample (including ECD gas and carrier gas) concentration in the detector. The sensitivity increases as ECD gas flow decreases if it does not affect the peak width. When types of carrier gas and ECD gas are the same (N₂), ⑤ [Constant Flow (Column Flow + ECD Gas Flow)] can reduce fluctuation of sensitivity. - Continue to supply ECD gas to the cell even when not using ECD to keep the cell and flow line clean. It shorten the time until the baseline stabilizes after restart compared to a case where you stop ECD gas supply.					
		▶▶ Reference "ECD sweep gas" P.216					
	ECD Gas	Sets ECD gas flow supplied to the detector to optimize its sensitivity. The gas is supplied upon the GC start. <table><tr><td>Items</td><td>N2, Ar</td></tr><tr><td>Range</td><td>0.0 to 200.0 mL/min</td></tr><tr><td>Default</td><td>N2, 15.0 mL/min (flow path A) or 30.0 mL/min (flow path B)*¹</td></tr></table>	Items	N2, Ar	Range	0.0 to 200.0 mL/min	Default
Items	N2, Ar						
Range	0.0 to 200.0 mL/min						
Default	N2, 15.0 mL/min (flow path A) or 30.0 mL/min (flow path B)* ¹						

*1 The standard flow for ECD varies depending on the ECD detector configuration. See "2.2.8 How to Differentiate ECD-2010 Exceed Flow Paths" P.20.

Submenu

Item	Description	See also
Signal Settings	Displays [Signal Settings] screen. Sets the detector signal outputted from the instrument.	P.229
ECD Gas Program	Displays [DET ECDGas Program] screen. Sets ECD gas flow programs.	P.227
Detector Gas Control	Displays [Detector Gas Control] screen. Turns On/Off detector gases and sets flows.	P.233
Calibration Offset	Press [Run] to perform calibration so that the displayed APC pressure becomes "0 kPa" at atmospheric pressure. Use this function before GC starts or if the displayed pressure is not "0 kPa" while the gas supply stops (exposed to atmospheric pressure).	P.438

To keep ECD cell clean

Follow the instructions below to keep ECD cell clean.

- Use columns with high heat resistance
ECD cell is often contaminated by vapors from the liquid phase of the column. Columns with high heat resistance are recommended. Use the instrument at temperatures more than 20 °C lower than maximum operating temperature of the column to reduce contamination of ECD cell.
 - Use columns with less liquid phase vapors
To prevent vapors from the liquid phase of the column contacting ECD cell, we recommend to use columns with less liquid phase vapors. Extra care should be exercised when using packed column.
 - Use columns which is conditioned adequately
To prevent contamination of ECD cell, condition the column adequately before connection. You can reduce contamination of ECD cell by not connecting the column to ECD during conditioning.
 - Condition the injection port adequately
In like manner with the column, check contamination of the injection port (glass insert) and condition it adequately.
 - Reduce impurities included in carrier gas and ECD gas
Use high-purity gases. Use clean flow line parts (tubing parts, flow controller, etc.). Be sure to use gas filter and oxygen trap which are effective to remove impurities.
 - Condition ECD cell periodically
Condition ECD cell periodically at temperatures near the maximum operating temperature 350 °C (for example, 340 °C).
Condition the ECD cell immediately after a sequence of the analysis is completed to reduce ECD cell contamination.
 - Set detector temperature higher than column oven temperature
If detector temperature is higher than column oven temperature, less amount of vapors from the liquid phase of the column will contact ECD cell. Set detector temperature 20 °C to 50 °C higher than column oven temperature. Remember that the maximum operating temperature of ECD is 350 °C.
- ▶▶ Reference "7.4.6 [Detector] Screen (ECD Tab)" P.212
- Set the temperature at lower values during continuous operation (waiting for analysis)
For analysis with ECD, continuous operation should be performed to shorten the time for stabilization. In this case, ECD cell may be more contaminated if column oven temperature is set at higher values, especially when using packed column. It is recommended that temperatures of column oven and injection port are set at lower values when the instrument is preparing for analysis during continuous operation. Do NOT stop carrier gas and ECD gas.

ECD comes equipped with bypass kit as standard, which continues to supply a small amount of sweep gas even while the power is turned off. When you remove the column after GC stops, seal the column connection side of ECD using graphite ferrule with wire.

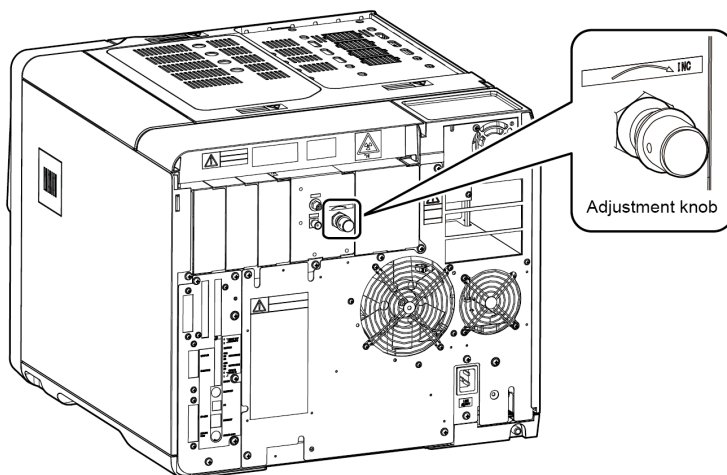
ECD sweep gas

The instrument need to supply sweep gas flowing at 5 to 10 mL/min to ECD even while the instrument is turned off or the GC is not energized to stabilize the detector and shorten the time for stabilization after restart.

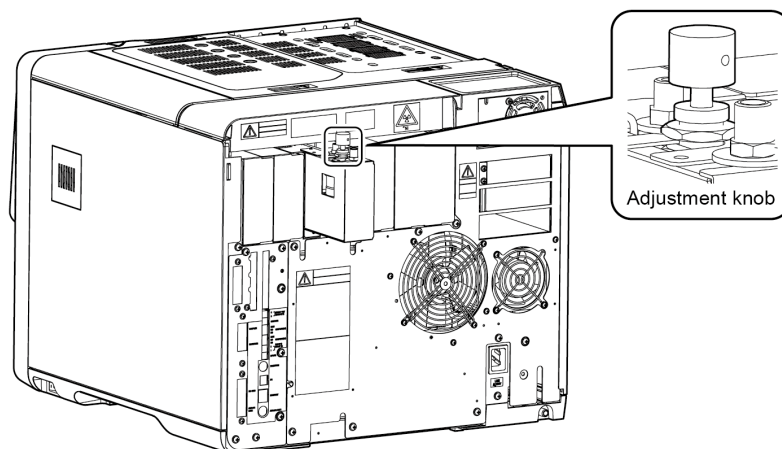
APC for ECD comes equipped with bypass unit as standard equipment, which can supply sweep gas even while the GC is turned off.

Change or adjust sweep gas flow according to the following procedures.

- 1 Stop GC when the GC operates.
▶▶ Reference "7.1.2 [GC Stop Sequence] Screen" P.146
 - 2 Press  (HOME) - [Detector] - [Submenu] - [Detector Gas Control].
[Detector Gas Control] screen appears.
 - 3 Set [ECD Gas] at [Off].
 - 4 Remove the column connected to ECD and cap the fitting.
 - 5 Open main valve of ECD gas cylinder to supply gas.
 - 6 Adjust flow by turning the knob of the bypass unit while checking ECD gas flow on [Detector Gas Control] screen.
Set flow at a value sufficiently smaller than ECD gas flow during analysis (5 to 10 mL/min).
- When the P/N of APC is S221-77570-81



- When the P/N of APC is S221-85791-41



- NOTE**
- APC error will occur if you set flow at a value larger than ECD gas flow controlled by APC.
 - Stop sweep gas supply before APC calibration. Remove the column, shut off the main valve of the cylinder or turn the knob of the bypass unit to stop sweep gas, and then, perform calibration.
 - To stop sweep gas supply, shut off the main valve of the cylinder or attach a stop valve to the supply line from the cylinder and close the valve. To restart sweep gas supply after shutoff, flow sweep gas or ECD gas to replace the air (oxygen) in the detector adequately before using the detector.

7 Set [ECD Gas] at [On] on [Detector Gas Control] screen.

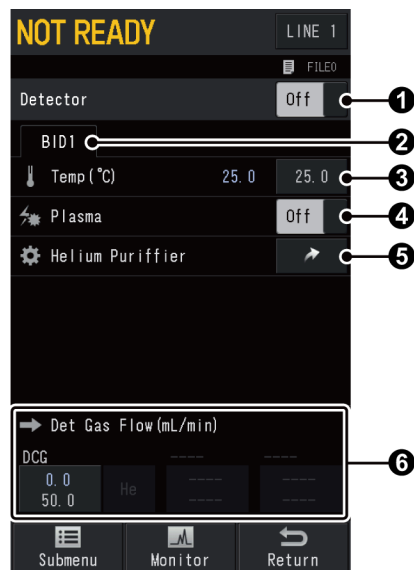
- NOTE** If [ECD Gas] is not set at [On], ECD gas flow does not reach the set flow on the next startup.

7.4.7 [Detector] Screen (BID Tab)

Press  (HOME) - [Detector] to display [Detector] screen.

[BID] tab is displayed when BID is configured in the analytical line.

When several detectors are configured in the analytical line, press a tab to switch detectors or press [LINE] in the top-right of the screen to switch lines and make settings.



No.	Item	Description
①	Detector Control	Displays the current control status of the detector. Press [Off] or [On] to switch the control status. Select [On] to output detector signal. Only when the detector is configured in the analytical line and ① [Detector Control] is set at [On], the detector can be controlled. For the detector configured in the analytical line, the detector temperature and DCG can be controlled even when ① [Detector Control] is set at [Off]. When you select [Off] after the GC starts, the instrument stops detector signal output and turns on the plasma. Select [On] to restart detector signal output. Select [On] in ④ [Plasma] to turn on the plasma again.
		Items Off, On
		Default On
②	Tab	Detectors configured in analytical line are displayed. Press the tab to switch detectors.

No.	Item	Description				
③	Temp	Sets the detector temperature. Normally, set the detector temperature approximately 30 °C higher than the column oven temperature (the final temperature for programmed analysis) to prevent contamination by high boiling point compounds. ▶▶ Reference " [Max Temperature] Screen " P.336				
		NOTE • Set the detector temperature between 150 °C and 300 °C during analysis. Using the detector below 150 °C may cause unstable baseline. Using the detector over 300 °C for a long time may shorten the detector life. • Set it at about 160 °C when you analyze samples including much oxygen. Using the detector at a high temperature may shorten the detector life. • Set it below 300 °C when you use a capillary column whose outer cover is made of polyimide. Using the detector over 300 °C may cause carbonization of polyimide on the surface of the column inserted into the detector, resulting in peak tailing. You can remove the peak tailing by cutting a part of the capillary column inserted into the detector, however, it is recommended to decrease the detector temperature.				
		<table><tr><td>Range</td><td>0.0 to 350.0 °C</td></tr><tr><td>Default</td><td>25.0 °C</td></tr></table>	Range	0.0 to 350.0 °C	Default	25.0 °C
Range	0.0 to 350.0 °C					
Default	25.0 °C					
④	Plasma	Displays the illumination status of the plasma. Press [Off] or [On] to switch the illumination status. [On] and [Off] is displayed when the plasma is turn on and off, respectively. [Running] is displayed while the instrument is illuminating the plasma.				
		<table><tr><td>Items</td><td>Off, On</td></tr><tr><td>Default</td><td>Off</td></tr></table>	Items	Off, On	Default	Off
		Items	Off, On			
Default	Off					
⑤	Helium Purifier	Displays [Helium Purifier] screen. ▶▶ Reference " 7.7.6 [Helium Purifier] Screen " P.305				

No.	Item	Description								
6	Detector Gas	Sets the detector gas flow. Actual value is displayed in the upper line, and the set value is displayed in the bottom line.  NOTE - Set the detector gas flow at the following recommended values depending on the column flow to maximize the BID sensitivity. <table><thead><tr><th>Column Flow</th><th>Detector Gas Flow (Recommended)</th></tr></thead><tbody><tr><td>Less than 10.00 mL/min</td><td>50.0 mL/min</td></tr><tr><td>10.00 to 15.00 mL/min</td><td>70.0 mL/min</td></tr><tr><td>More than 15.00 mL/min</td><td>100.0 mL/min</td></tr></tbody></table> - If you set flow at a higher value than recommended, the sensitivity will decrease. If you set flow at a lower value than recommended, the sensitivity will increase, however, the following problems may occur. - Abnormal peak shape occurred because the dynamic range varies and the instrument cannot analyze high concentration of sample. - Unstable operation such as baseline fluctuation and decreased sensitivity due to remaining/adsorbed solvent or high-boiling component in the detector.	Column Flow	Detector Gas Flow (Recommended)	Less than 10.00 mL/min	50.0 mL/min	10.00 to 15.00 mL/min	70.0 mL/min	More than 15.00 mL/min	100.0 mL/min
	Column Flow	Detector Gas Flow (Recommended)								
Less than 10.00 mL/min	50.0 mL/min									
10.00 to 15.00 mL/min	70.0 mL/min									
More than 15.00 mL/min	100.0 mL/min									
DCG	Sets DCG flow supplied to the detector to optimize its sensitivity. The gas is supplied upon the GC start.  NOTE The instrument continuously consumes sweep gas (helium gas flowing at 5 to 10 mL/min) even while the instrument is turned off or the GC is not energized to protect helium purifier, stabilize the detector, and shorten the time for stabilization after restart. Shut off the main valve of the cylinder when you need to stop sweep gas supply, for example, when you do not use BID for a long time. Ensure that the control is turned [Off] on [Helium Purifier] screen more than one hour before the stop of sweep gas supply.  Reference "BID sweep gas" P.221 "7.7.6 [Helium Purifier] Screen" P.305 <table><tr><td>Range</td><td>0.0 to 100.0 mL/min</td></tr><tr><td>Default</td><td>50.0 mL/min</td></tr></table>	Range	0.0 to 100.0 mL/min	Default	50.0 mL/min					
Range	0.0 to 100.0 mL/min									
Default	50.0 mL/min									

Submenu

Item	Description	See also
Signal Settings	Displays [Signal Settings] screen. Sets the detector signal outputted from the instrument.	P.229
DCG Program	Displays [DET DCG Program] screen. Sets DCG flow programs.	P.227
Detector Gas Control	Displays [Detector Gas Control] screen. Turns On/Off detector gases and sets flows.	P.233
Calibration Offset	Press [Run] to perform calibration so that the displayed APC pressure becomes "0 kPa" at atmospheric pressure. Use this function before GC starts or if the displayed pressure is not "0 kPa" while the gas supply stops (exposed to atmospheric pressure).	P.438

BID sweep gas

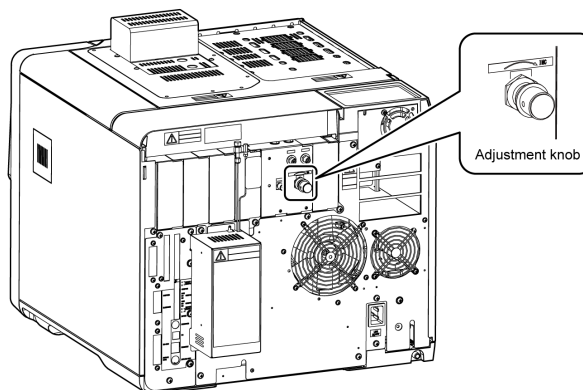
The instrument need to supply sweep gas flowing at 5 to 10 mL/min to BID even while the instrument is turned off or the GC is not energized to protect helium purifier, stabilize the detector, and shorten the time for stabilization after restart.

APC for BID-2030 comes equipped with bypass unit as standard equipment, which can supply sweep gas even while the GC is turned off.

Change or adjust sweep gas flow according to the following procedures.

- 1 Stop GC when the GC operates.
▶▶ Reference ["7.1.2 \[GC Stop Sequence\] Screen" P.146](#)
- 2 Press  (HOME) - [Detector] - [Submenu] - [Detector Gas Control].
[Detector Gas Control] screen appears.
- 3 Set [DCG] at [Off].
- 4 Remove the column connected to BID and cap the fitting.
- 5 Open main valve of helium gas cylinder to supply gas.

- 6 Set flow with the adjustment knob of helium purifier at the rear of the instrument while checking DCG flow on [Detector Gas Control] screen.
Set flow at a value (5 to 10 mL/min) sufficiently smaller than DCG gas flow during analysis (recommended value for capillary analysis: 50 mL/min).



- NOTE**
- APC error will occur if you set flow at a value larger than DCG gas flow controlled by APC.
 - Stop sweep gas supply before APC calibration. Remove the column, shut off the main valve of the cylinder or turn the adjustment knob of helium purifier to stop sweep gas, and then, perform calibration.

- 7 Set [DCG] at [On] on [Detector Gas Control] screen.

- NOTE** If [DCG] is not set at [On], DCG gas flow does not reach the set flow on the next startup.

Stop sweep gas supply according to the following procedures.

! CAUTION



Instruction

Ensure that the control is turned [Off] on [Helium Purifier] screen more than one hour before the stop of sweep gas supply.

Do NOT stop helium gas supply within one hour after helium purifier control is turned off (while purifier temperature remains high).

If the air etc. gets into flow line from the vent while purifier temperature is high, the time for stabilization may become longer at the next startup and various problems including decreased sensitivity may occur. In addition, the capacity of helium purifier to remove impurities decreases rapidly, and you may need to replace it.

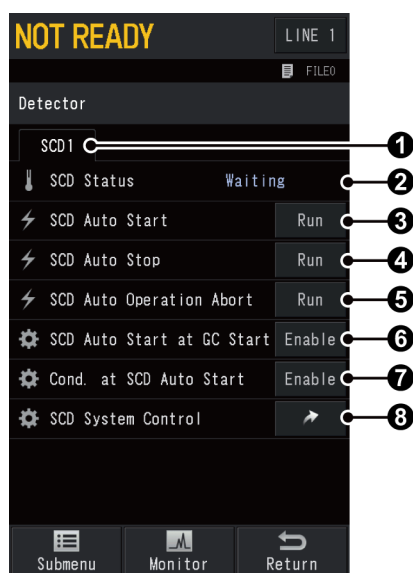
- 1 Press  (HOME) - [Peripherals] - [Helium Purifier].
[Helium Purifier] screen appears.
- 2 Turn [Off] the control.
- 3 Stop gas supply after one hour.

7.4.8 [Detector] Screen (SCD Tab)

Press  (HOME) - [Detector] to display [Detector] screen.

[SCD] tab is displayed when SCD is configured in the analytical line.

When several detectors are configured in the analytical line, press a tab to switch detectors or press [LINE] in the top-right of the screen to switch lines and make settings.



No.	Item	Description
①	Tab	Detectors configured in analytical line are displayed. Press the tab to switch detectors.

No.	Item	Description															
②	SCD Status	Displays the control status of the SCD.															
		Screen display	Status	Waiting	Control of the SCD is not started or only the main switch of the SCD is turned ON.	Safety Circuit Check	Operation of the safety circuit of the SCD is checked.	Vacuum Pump On	The vacuum pump is turned ON.	Gas Control	Flow control of any gas is turned ON.	Temp Control	Controlling temperatures of the furnace and SCD interface.	Conditioning	Controlling the furnace at the conditioning temperature for the conditioning time.	Startup Complete	The temperature control of the furnace, all gases, and the ozone generator are turned ON.
		Screen display	Status														
		Waiting	Control of the SCD is not started or only the main switch of the SCD is turned ON.														
		Safety Circuit Check	Operation of the safety circuit of the SCD is checked.														
		Vacuum Pump On	The vacuum pump is turned ON.														
		Gas Control	Flow control of any gas is turned ON.														
		Temp Control	Controlling temperatures of the furnace and SCD interface.														
		Conditioning	Controlling the furnace at the conditioning temperature for the conditioning time.														
		Startup Complete	The temperature control of the furnace, all gases, and the ozone generator are turned ON.														
 Hint If an error related to control of the SCD occurs, the SCD is automatically stopped for safety. When the error is solved and you press [Reset] on the error screen, the SCD is automatically restored to the state before the error. In this case, [Auto Restoration] is indicated in each control state.																	

No.	Item	Description
③	SCD Auto Start	When [Run] is pressed, the SCD automatically starts up as follows: [Running] is displayed during SCD Auto Start. 1. The main switch, vacuum pump and PMT are turned ON. 2. When the detector absolute pressure falls below 2.67 kPa, makeup nitrogen/oxygen for oxidization/oxygen for the ozone generator are turned ON. Temperature control for the furnace starts. 3. When 1 minute has elapsed after oxygen for the ozone generator is turned ON, the ozone generator is turned ON. 4. When conditioning at SCD Auto Start is set at [Enable], the furnace is controlled at the conditioning temperature for the conditioning time. 5. After the furnace temperature reaches the set value, hydrogen for reduction is turned ON. NOTE • It can be performed only when the GC is activated. • An error message appears if [Run] of SCD Auto Start is pressed when the value set for the furnace temperature is lower than 750 °C. For safety, hydrogen for reduction is controlled so that it flows only when the furnace temperature is high. When the error occurs, set the furnace temperature at 750 °C or higher. • An error message appears if [Run] of SCD Auto Start is pressed when the value set for flow of oxygen for the ozone generator is lower than 16 mL/min. This is because the ozone generator may be damaged if the ozone generator is running under low oxygen flow. When the error occurs, set flow of oxygen for the ozone generator at 16 mL/min or higher.
④	SCD Auto Stop	When [Run] is pressed, the SCD automatically stops as follows: [Running] is displayed during SCD Auto Stop. 1. Hydrogen for reduction, the ozone generator, oxygen for oxidization, and temperature control for the furnace are turned OFF. 2. When 1 minute has elapsed after the ozone generator is turned OFF, oxygen for the ozone generator is turned OFF. 3. When the furnace temperature and SCD interface temperature become lower than makeup nitrogen stop temperature, makeup nitrogen is turned OFF. 4. The vacuum pump and main switch are turned OFF. 5. Makeup nitrogen is flown until the furnace and detector pressure return to atmospheric pressure.
⑤	SCD Auto Operation Abort	Press [Run] during SCD Auto Start, SCD Auto Stop, or SCD Auto Restoration to abort the process. Each system of the SCD maintains the control status at the time of termination of automatic process.

No.	Item	Description	
⑥	SCD Auto Start at GC Start	Set it at [Enable] to start SCD Auto Start when [Start GC] is pressed on the [GC Start Sequence] screen.	
		Items	Enable, Disable
		Default	Enable
⑦	Cond. at SCD Auto Start	Set it at [Enable] to perform conditioning during SCD Auto Start.	
		Items	Enable, Disable
		Default	Enable
⑧	SCD System Control	Displays [SCD System Control] screen. ▶▶ Reference "7.4.12 [SCD System Control] Screen" P.235	

Submenu

Item	Description	See also
Signal Settings	Displays [Signal Settings] screen. Sets the detector signal outputted from the instrument.	P.229
SCD Conditioning Mode	Displays [SCD Conditioning Mode] screen. You can perform conditioning of the SCD manually.	P.240
SCD Leak Check	Displays [SCD Leak Check] screen. You can check the SCD system for leakage.	P.242
SCD Vacuum Log	Displays [SCD Vacuum Log] screen. Displays logs of furnace pressure and detector pressure when [SCD Status] is [Activated].	P.244
SCD Parts Counter	Displays [SCD Parts Counter] screen. You can check usage time of SCD consumables.	P.245
Calibration Offset	Press [Run] to perform calibration so that the displayed flow controller pressure becomes "0 kPa" at atmospheric pressure. Use this function before GC starts or if the displayed pressure is not "0 kPa" while the gas supply stops (exposed to atmospheric pressure).	P.438

7.4.9 Settings for Detector Gas Program

Press  (HOME) - [Detector] - [Submenu] to select and set the detect gas flow program.

The items displayed in Submenu are different depending on the detector type, however, the setting methods are same for all.

This section describes FID Makeup Program screen as an example.

▶▶ Reference See "7.5.8 [Column Flow Program] Screen" P.271 for creating a program.

List of programs available for each detector

- NOTE**
- If [Constant Flow (Column Flow + Makeup Gas Flow)] is set at [On] when using FID or FTD as the detector, Makeup Program does not work.
 - If [Constant Flow (Column Flow + ECD Gas Flow)] is set at [On] when using ECD as the detector, ECD Gas Program does not work.
 - When the detector is the SCD, programming function for the detector gas is not available.

FID	TCD	FTD	FPD	ECD	BID
Makeup Program	Makeup Program	Makeup Program	H2 Program	ECD Gas Program	DCG Program
H2 Program	-	H2 Program	Air Program	-	-
Air Program	-	Air Program	-	-	-



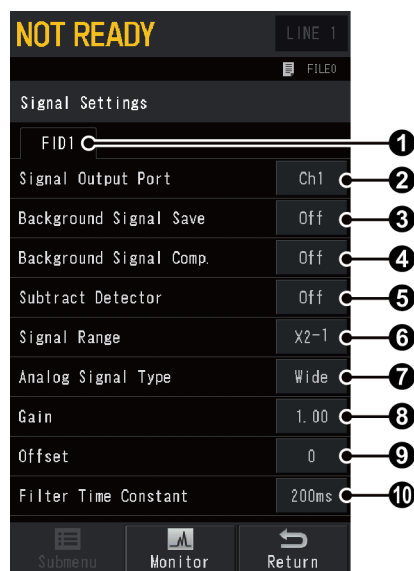
No.	Item	Description
①	Detector	Displays active detector.
②	Flow Monitor	Displays the current flow.
③	 (Graph)	You can see the set program in graph form. ▶▶ Reference "Graph window" P.25

No.	Item		Description
④	Creating a program		You can create a detector gas program (1 to 7 steps).
		Step	Displays the number of steps currently set. Press [Init] or the number to insert or delete the step. Inserted step includes the same content as the step of [Init] or specified number.
		Rate	Sets the program rate. Press [Add] under the last step to insert a step including the same content as the last step. When you set it at "0", [Add] appears and the program will end at the previous step.  NOTE Range and defaults are different depending on the program.
		Flow	Sets the initial flow and the final flow of each step.  NOTE Range and defaults are different depending on the program.
		Time	Sets the hold time for the initial flow and the final flow of each step.  NOTE Range and defaults are different depending on the program.
⑤	Total Time		Displays the total time of the program.

7.4.10 [Signal Settings] Screen

Press  (HOME) - [Detector] - [Submenu] - [Signal Settings] to display [Signal Settings] screen.

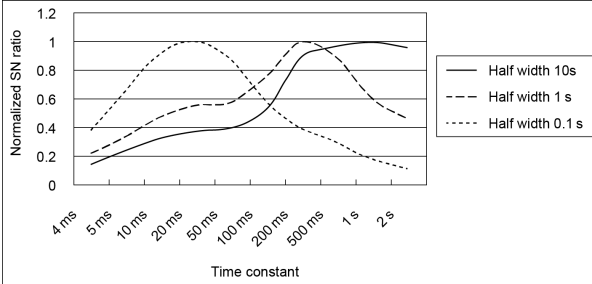
Sets the detector signal outputted from the instrument.



No.	Item	Description	
①	Tab	Displays the name of detector currently set. When several detectors are installed in the instrument, press a tab to switch detectors.	
②	Signal Output Port	Sets the channel for detector signal outputted from the instrument. The instrument can output digital and analogue signal and has 4 channels in total. The instrument can output both (digital and analogue) signals simultaneously from one channel. And it can also output signals from several channels at the same time. For analogue signal, only Ch1 and Ch2 are available. For detector signal transmission, select and use USB or Ethernet for PC (digital signal), and use CHROMATOPAC signal cable for CHROMATOPAC (analogue signal).	
		Items	Off, Ch1, Ch2, Ch3, Ch4
		Default	Ch1
③	Background Signal Save	Baseline signals obtained from blank run (not using sample) can be saved as background baseline in the waveform storage memory of the instrument. Use this function if the baseline fluctuates considerably during programmed analysis. ▶▶ Reference "Background signal save/comp." P.232	
		Items	Off, Buff1, Buff2
		Default	Off

No.	Item	Description
④	Background Signal Comp.	Subtracts the saved background signal baseline from the actual background signal. This compensation produces a stable baseline despite considerable baseline fluctuations. Use this function if the baseline fluctuates considerably during programmed analysis. ▶▶ Reference "Background signal save/comp." P.232
		Items Off, Buff1, Buff2
		Default Off
⑤	Subtract Detector	Subtracts the detector signal of one detector from the signal of another detector. This function is used for a dual column flow line to subtract the data acquired without an injection from the data acquired with an injection. ■ NOTE When high sensitivity analysis or high temperature programmed analysis is performed, large amount of stationary liquid vapor released from the column enters into the detector, causing baseline drift or increased noises. When this occurs, set up dual flow lines (dual column flow lines) with injection ports, two columns of the same type and detectors. One flow line is used as a reference and the other flow line receives the sample injection. The instrument acquires signals from each detector at the same time and calculates the difference between them to provide stable baselines.
		Items Off, DET#1, DET#2, DET#3, DET#4
		Default Off
⑥	Signal Range	Multiplies the analog signal by the coefficient "10 ^{-x} " when ⑦ [Analog Signal Type] is [Linear]. If the signal intensity of a peak is beyond the input range of the data processing unit, for example, change the setting from $\times 1 \rightarrow \times 10^{-1}$ or from $\times 10^{-2} \rightarrow \times 10^{-3}$ to decrease the intensity. If the peak is too small and the instrument cannot detect weak peaks, for example, change the setting from $\times 10^{-1} \rightarrow \times 1$ or from $\times 10^{-3} \rightarrow \times 10^{-2}$ to increase the intensity. Multiplies the analog signal by the coefficient "2 ^{-x} " when ⑦ [Analog Signal Type] is [Wide]. If the signal intensity of a peak is beyond the input range of the data processing unit, for example, change the setting from $\times 1 \rightarrow \times 2^{-1}$ and from $\times 2^{-2} \rightarrow \times 2^{-3}$ to decrease the intensity. If the peak is too small and the instrument cannot detect weak peaks, for example, change the setting from $\times 2^{-1} \rightarrow \times 1$ or from $\times 2^{-3} \rightarrow \times 2^{-2}$ to increase the intensity. In case of the digital signal, the signal is always outputted with $\times 1$.
		Items • When ⑦ [Analog Signal Type] is [Linear] $\times 1, \times 10^{-1}, \times 10^{-2}, \times 10^{-3}, \times 10^{-4}$ • When ⑦ [Analog Signal Type] is [Wide] $\times 1, \times 2^{-1}, \times 2^{-2}, \times 2^{-3}, \times 2^{-4}$
		Default $\times 2^{-1}$

No.	Item	Description	
7	Analog Signal Type	Set this item when the instrument is connected to an external device in analog format.	
		Items	• Linear Select it when connecting analogue signal cable for wide (P/N : S221-47251-41) to any device other than C-R8A/C-R7A/C-R7A plus, or any external device other than Chromatopac. To use Linear setting when connecting the cable to C-R8A/C-R7A/C-R7A plus, you need to analogue signal cable for linear (P/N: S221-47251-42). • Wide Select it when connecting analogue signal cable for wide (P/N : S221-47251-41) to C-R8A/C-R7A/C-R7A plus. The instrument outputs compressed signal; then, the signal received by Chromatopac is decompressed. When connecting the instrument to C-R8A/C-R7A/C-R7A plus for the first time, or replacing Chromatopac, set ② [Signal Output Port] at [Off] and perform calibration (Z.Calib) by Chromatopac. ▶▶ Reference "8.9.2 Connecting to CHROMATOPAC" P.458
		Default	Wide
8	Gain	Sets the detector signal gain.	
		Range	0.00 to 1000.00
		Default	1.00
9	Offset	Sets the detector signal offset.	
		Range	-999999 to 999999
		Default	0

No.	Item	Description		
10	Filter Time Constant	Sets parameter for the processing of the detector signal. As the time constant increases, noise are reduced, however, the peak become broad and the peak height are reduced. Select the optimum value for the filter time constant in accordance with the peak half width.		
		NOTE Normally, use the default value (200 ms) for the filter time constant. However, in some cases the S/N ratio is improved by changing the time constant. For example, if the half width of a peak is "0.1 sec", the S/N ratio is maximized when the time constant is set at [20 ms]. Example for relationship between FID time constant and S/N ratio 		
		<table><tr><td>Items</td><td>2 ms, 4 ms, 10 ms, 20 ms, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s</td></tr><tr><td>Default</td><td>200 ms</td></tr></table>	Items	2 ms, 4 ms, 10 ms, 20 ms, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s
Items	2 ms, 4 ms, 10 ms, 20 ms, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s			
Default	200 ms			

Background signal save/comp.

If the baseline fluctuates considerably during programmed analysis, the instrument can save baseline signals obtained from blank run (not using sample) as background baseline in the waveform storage memory of the instrument, and then subtract the saved background signal baseline from the actual background signal (background compensation).

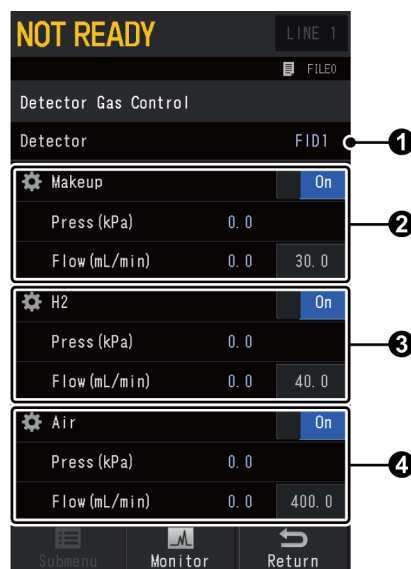
Procedures of background signal save/comp are described below.

- 1 Set [Signal Output Port] in [Signal Settings] to a desired channel.
Signal Output Channel is selected. ("Ch3" and "Ch4" for analog signal are optional)
- 2 Set [Background Signal Save] at [Buff 1] or [Buff 2].
- 3 Press  (START) without sample injection.
The instrument starts analysis and the background baseline is saved.
- 4 Set [Background Signal Comp.] at [Buff 1] or [Buff 2], the same selection in [Background Signal Save] (procedure 2).
- 5 Inject a sample and press  (START).
The instrument starts analysis and then outputs the signal after background signal compensation.

7.4.11 [Detector Gas Control] Screen

Press  (HOME) - [Detector] - [Submenu] - [Detector Gas Control] to display [Detector Gas Control] screen.

Turns On/Off detector gases and sets flows.



No.	Item		Description
①	Detector		Displays active detector.
②	Makeup		 NOTE [ECD Gas] is displayed when the detector is ECD. And [DCG] is displayed when the detector is BID.
		Makeup control	Displays the status of makeup gas supply. Select [Off] to stop the gas supply.
			ItemsOff, On
			DefaultOn
		Press	Displays the current pressure of makeup gas.
		Flow	Sets the makeup gas flow.
			Range - FID, FTD, BID: 0.0 to 100.0 mL/min - ECD: 0.0 to 200.0 mL/min - TCD: 0.0 to 20.0 mL/min
Default - FID: 24.0 mL/min - FTD: 27.5 mL/min - BID: 50.0 mL/min - ECD: 15.0 mL/min (flow path A)*¹ - ECD: 30.0 mL/min (flow path B)*¹ - TCD: 8.0 mL/min			

No.	Item		Description
③	H2		
	Hydrogen control		Displays the status of hydrogen gas supply. Select [Off] to stop the gas supply.
		Items	Off, On
		Default	On
	Press		Displays the current pressure of hydrogen gas.
	Flow		Sets the hydrogen gas flow.
		Range	• FTD: 0.0 to 30.0 mL/min • FPD: 0.0 to 250.0 mL/min • Others: 0.0 to 100.0 mL/min
		Default	• FTD: 1.5 mL/min • FPD: 80.0 mL/min • Others: 40.0 mL/min
④	Air		
	Air control		Displays the status of air gas supply. Select [Off] to stop the gas supply.
		Items	Off, On
		Default	On
	Press		Displays the current pressure of air gas.
	Flow		Sets the air gas flow.
		Range	0.0 to 1000.0 mL/min
		Default	• FTD: 145.0 mL/min • FPD: 120.0 mL/min • Others: 40.0 mL/min

*1 The default ECD flow varies depending on the ECD detector configuration. See "[2.2.8 How to Differentiate ECD-2010 Exceed Flow Paths](#)" P.20.

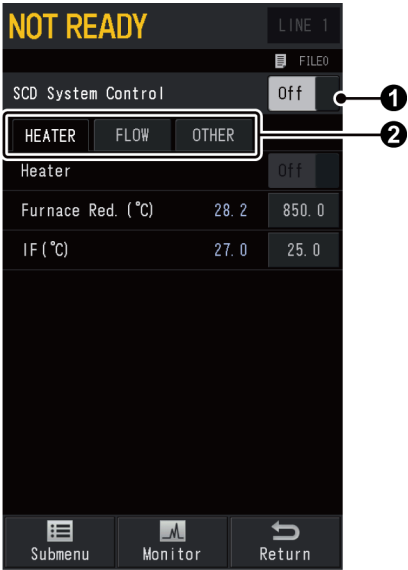
7.4.12 [SCD System Control] Screen

Press  (HOME) - [Detector] - [SCD System Control] to display [SCD System Control] screen.

You can check set values and on/off status of the SCD system.

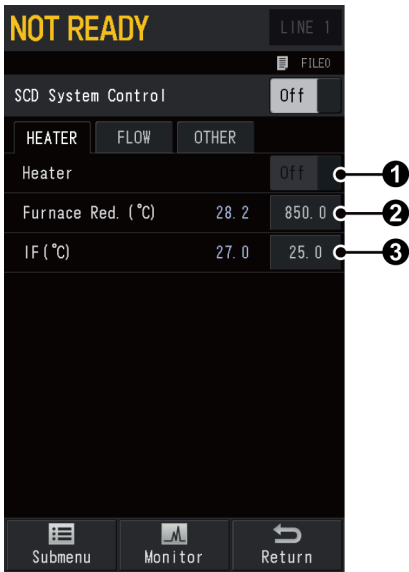
 **NOTE** Each item can be turned on/off under specific conditions. For details, see "[On/Off conditions for SCD system control](#)" P.239.

Common items



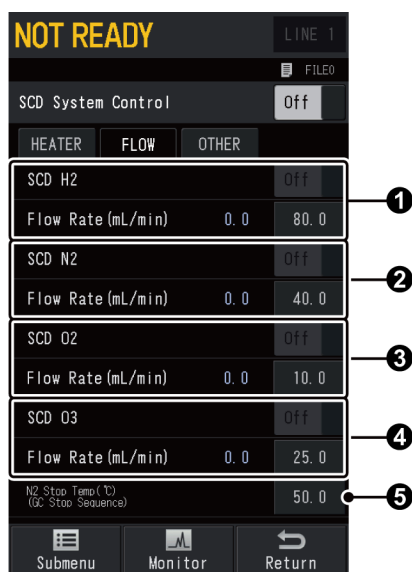
No.	Item	Description
①	SCD Main Switch	Displays the current control status of the SCD main switch. Press [Off] or [On] to switch the control status. Select [On] to start control of the SCD system. Select [Off] to stop control of the SCD system.
②	Tab switching	Press the tab to switch the target of control.

[HEATER] tab



No.	Item	Description
①	Heater	Displays the current control status of the furnace heater and SCD interface heater. Press [Off] or [On] to switch the control status. Select [On] to control temperatures of the furnace and SCD interface.
②	Furnace Red.	Sets the furnace temperature.
		Range0.0 to 900.0 °C
		Default850.0 °C
③	IF	Sets temperature of the SCD interface.
		Range0.0 to 300.0 °C
		Default200.0 °C

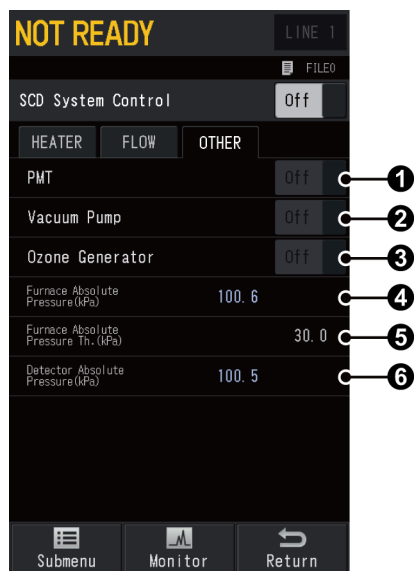
[FLOW] tab



No.	Item		Description
①	SCD H2		
	Control of hydrogen for reduction		Sets the supply status of hydrogen for reduction. Select [Off] to stop gas supply.
		Items	Off, On
		Default	Off
	Flow Rate		Sets flow of hydrogen for reduction.
		Range	0.0 to 170.0 mL/min
		Default	80.0 mL/min
②	SCD N2		
	Makeup nitrogen control		Sets the supply status of makeup nitrogen. Select [Off] to stop gas supply.
		Items	Off, On
		Default	Off
	Flow Rate		Sets flow of makeup nitrogen.
		Range	5.0 to 100.0 mL/min
		Default	40.0 mL/min
③	SCD O2		
	Control of oxygen for oxidization		Sets the supply status of oxygen for oxidization. Select [Off] to stop gas supply.
		Items	Off, On
		Default	Off
	Flow Rate		Sets flow of oxygen for oxidization.
		Range	5.0 to 15.0 mL/min
		Default	10.0 mL/min

No.	Item		Description
④	SCD O3		
	Control of oxygen for the ozone generator		Sets the supply status of oxygen for the ozone generator. Select [Off] to stop gas supply.
		Items	Off, On
		Default	Off
	Flow Rate		Sets flow of oxygen for the ozone generator.
		Range	0.0 to 50.0 mL/min
		Default	25.0 mL/min
⑤	N2 Stop Temp		Sets a temperature at which makeup gas supply stops. The instrument stops makeup gas supply when the detector temperature drops below the set value.
			NOTE - Set the temperature so that makeup gas stops after detector temperature drops adequately. - When you preset [Flow Off Time] on [GC Stop Sequence] screen, the instrument starts to count the flow off time after the temperature reaches the set value in ⑤ [N2 Stop Temp].
			Range 50.0 to 100.0 °C
			Default 50.0 °C

[OTHER] tab



No.	Item	Description	
①	PMT	Sets the control status of the photomultiplier at GC start.	
		Items	Off, On
		Default	Off

No.	Item	Description
②	Vacuum Pump	Displays the current control status of the vacuum pump. Press [Off] or [On] to switch the control status. Select [On] to activate the vacuum pump and decrease the furnace pressure and detector pressure.
		Items Off, On
		Default Off
③	Ozone Generator	Displays the current control status of the ozone generator. Press [Off] or [On] to switch the control status. Select [On] to activate the ozone generator.
		Items Off, On
		Default Off
④	Furnace Absolute Pressure	Displays the current pressure of the furnace.  Hint The pressure after replacing the pyro tube is usually 22 to 30 kPa (Short), 25 to 33 kPa (Long).
⑤	Furnace Absolute Pressure Th.	It is the threshold value to judge whether the SCD system can operate correctly when all gases are turned [On]. When exceeding the threshold of the furnace pressure, a warning occurs.  Hint If it exceeds 38 kPa, an error will occur and the SCD auto stop.
⑥	Detector Absolute Pressure	Displays the current pressure of the detector.  Hint The pressure after replacing the pyro tube is usually 4 kPa or less.

Submenu

Item	Description
Calib. Furnace Prs. Sensor	Press [Run] to calibrate the furnace pressure sensor. Use this function when the displayed value of the furnace pressure and the atmospheric pressure are significantly different, even when sufficient time has elapsed after the vacuum pump is turned Off.  NOTE Perform this operation after sufficient time has elapsed after the vacuum pump is turned Off.
Calib. Detector Prs. Sensor	Press [Run] to calibrate the detector pressure sensor. Use it if displayed values of the furnace pressure and detector pressure are different before the GC starts or when the vacuum pump is turned Off.

On/Off conditions for SCD system control

Item	On conditions	Off conditions
SCD Main Switch	When starting the GC	[Vacuum Pump] is turned [Off]
Heater	[SCD N2] is turned [On]	None

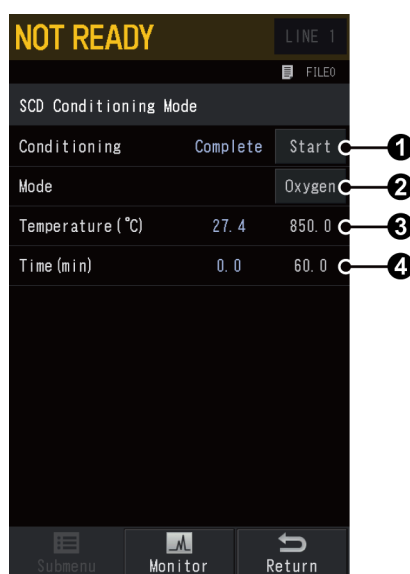
Item	On conditions	Off conditions
SCD H2	- The actual measured value of [Furnance Reduction] is 750.0 °C or higher [SCD O2] is turned [On]	None
SCD N2	[Detector Pressure] is less than 2.67 kPa	- The actual measured values of [Furnance Reduction] and [IF] are lower than [N2 Stop Temp] [SCD O2] is turned [Off]
SCD O2	[SCD N2] is turned [On]	[SCD H2] is turned [Off]
SCD O3	[Detector Pressure] is less than 2.67 kPa	[Ozone generator] is turned [Off]
PMT	None	None
Vacuum Pump	SCD main switch is turned On	- All gases are turned Off - One minute or more has elapsed after the [Ozone generator] is turned [Off]
Ozone generator	The actual measured value of [SCD O3] is 15.0 mL/min or higher	None

7.4.13 [SCD Conditioning Mode] Screen

Press  (HOME) - [Detector] - [Submenu] - [SCD Conditioning Mode] to display [SCD Conditioning Mode] screen.

When SCD conditioning starts, supply of hydrogen for reduction stops and conditioning of the SCD system is performed in desired mode. Switch [Mode] as needed.

▶▶ Reference "7.4.8 [Detector] Screen (SCD Tab)" P.223



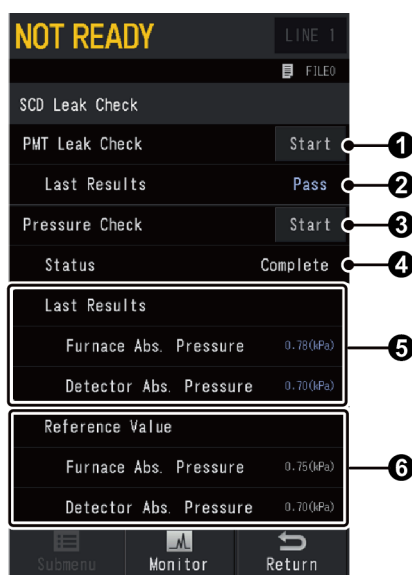
No.	Item	Description				
①	Conditioning	Press [Start] to start SCD conditioning. When the conditioning time has elapsed after reaching the conditioning temperature, [Complete] is displayed and conditioning is completed. After conditioning, the temperature is controlled at the temperature set in [Furnance Reduction] on the [SCD System Control] screen.  NOTE Conditioning can be started only when [Heater], [SCD N2], [SCD O2], and [SCD O3] on the [SCD System Control] screen are turned [On]. ▶▶ Reference "7.4.12 [SCD System Control] Screen" P.235				
②	Mode	Sets conditioning mode. <table><tr><td>Items</td><td> • Pyrotube Controls temperature of the furnace at 850 °C for conditioning temperature and for 180 minutes for conditioning time. Use it when replacing the inner or outer pyrotube. • Oxygen Controls temperature of the furnace at 850 °C for conditioning temperature and for 60 minutes for conditioning time. Use it when performing oxygen cleaning. • Drying Controls temperature of the furnace at 100 °C for conditioning temperature and for 60 minutes for conditioning time. Use it to perform degassing of heat insulating materials when not using the SCD for a long time. • Custom Controls temperature of the furnace at desired conditioning temperature and for desired conditioning time. </td></tr></table>	Items	• Pyrotube Controls temperature of the furnace at 850 °C for conditioning temperature and for 180 minutes for conditioning time. Use it when replacing the inner or outer pyrotube. • Oxygen Controls temperature of the furnace at 850 °C for conditioning temperature and for 60 minutes for conditioning time. Use it when performing oxygen cleaning. • Drying Controls temperature of the furnace at 100 °C for conditioning temperature and for 60 minutes for conditioning time. Use it to perform degassing of heat insulating materials when not using the SCD for a long time. • Custom Controls temperature of the furnace at desired conditioning temperature and for desired conditioning time.		
Items	• Pyrotube Controls temperature of the furnace at 850 °C for conditioning temperature and for 180 minutes for conditioning time. Use it when replacing the inner or outer pyrotube. • Oxygen Controls temperature of the furnace at 850 °C for conditioning temperature and for 60 minutes for conditioning time. Use it when performing oxygen cleaning. • Drying Controls temperature of the furnace at 100 °C for conditioning temperature and for 60 minutes for conditioning time. Use it to perform degassing of heat insulating materials when not using the SCD for a long time. • Custom Controls temperature of the furnace at desired conditioning temperature and for desired conditioning time.					
③	Temperature	Temperature of the furnace is controlled at this temperature when conditioning is performed. It can be set only when ② [Mode] is set at [Custom]. <table><tr><td>Range</td><td>50.0 to 900.0 °C</td></tr><tr><td>Default</td><td>700.0 °C</td></tr></table>	Range	50.0 to 900.0 °C	Default	700.0 °C
Range	50.0 to 900.0 °C					
Default	700.0 °C					
④	Time	Temperature of the furnace is controlled for this time when conditioning is performed. It can be set only when ② [Mode] is set at [Custom]. <table><tr><td>Range</td><td>0.0 to 9999.0 min</td></tr><tr><td>Default</td><td>60.0 min</td></tr></table>	Range	0.0 to 9999.0 min	Default	60.0 min
Range	0.0 to 9999.0 min					
Default	60.0 min					

7.4.14 [SCD Leak Check] Screen

Press  (HOME) - [Detector] - [Submenu] - [SCD Leak Check] to display [SCD Leak Check] screen.

You can check the SCD system for leakage.

- NOTE**
- Before performing pressure check, remove the column from the SCD and seal the connection.
 - PMT leak check and pressure check cannot be performed while the GC is turned on. It is because when [SCD Auto Start at GC Start] is set to [Enable], the SCD control is started upon the GC startup. Before check, stop the GC and ensure that gas and temperature control is terminated.
 - When the result of PMT leak check or pressure check is "Fail", control of the SCD cannot be started even after the GC is turned on. Determine the cause of leak and resolve the problem. Then perform leak check again.
- ▶▶ Reference "5.10.2 Furnace and Detector Pressure Do Not Decrease (SCD)" P.80



No.	Item	Description
①	PMT Leak Check	Press [Start] to start light leakage check for the photomultiplier.
②	Last Results	Displays the latest result of light leakage check for the photomultiplier. There is a light leakage when [Fail] is displayed.
③	Pressure Check	Press [Start] to start pressure leakage check for the furnace and detector.
④	Status	After pressure leakage check for the furnace and detector starts, the progress is displayed.
⑤	Last Results	Displays the latest result of pressure leakage check for the furnace and detector. There is a pressure leakage when [Fail] is displayed.

No.	Item	Description
⑥	Reference Value	Displays the diagnosis results of the leakage check for the furnace and detector at the time of shipment and when the sensor is replaced.

 **Hint** If the last pressure check results differ significantly from the reference value, it is possible that there is a pressure leakage in the furnace or the detector. In this case, check that the pressure inside the instrument has returned to atmospheric pressure. Then turn off the main power of the instrument and inspect the locations where maintenance was just performed.

About pressure check

- The fan of the SCD and vacuum pump is turned on during pressure check. Gas and temperature control of the SCD is not performed.
- Verify whether all the parts are attached at the pressure value 5 minutes after the vacuum pump is turned on.
- For [Furnace Abs. Pressure], the following diagnosis result is indicated based on the diagnosis pressure value.
When the result is more than 3.73 kPa: "Fail"

 **NOTE** A Pass determination is not performed.

- For [Detector Abs. Pressure], diagnosis is performed with the diagnosis pressure value determined by the following equation.
Diagnosis Pressure Value = Furnace Absolute Pressure - Detector Absolute Pressure
The following diagnosis result is indicated based on the diagnosis pressure value.
When the result is more than 1.17 kPa: "Fail"

 **NOTE** A Pass determination is not performed.

7.4.15 [SCD Vacuum Log] Screen

Press  (HOME) - [Detector] - [Submenu] - [SCD Vacuum Log] to display [SCD Vacuum Log] screen.

Records and displays logs of furnace pressure and detector pressure every day when [SCD Status] on the [Detector] screen (SCD tab) is [Activated]. The maximum number of logs is 30. Press [Clear Log] to delete the log.

NOT READY			LINE 1
			FILE0
SCD Vacuum Log			
Time	Furnace Absolute Pressure(kPa)	Detector Absolute Pressure(kPa)	
2019/01/30 16:34	23.64	2.58	
2019/01/29 16:34	23.66	2.55	
2019/01/28 16:34	23.59	2.53	
2019/01/27 16:34	23.64	2.54	
2019/01/26 16:34	23.59	2.53	
2019/01/25 16:34	16.52	2.33	
2019/01/24 16:34	16.51	2.34	
2019/01/23 16:34	16.76	2.34	
2019/01/22 16:34	16.14	2.30	
2019/01/21 16:34	16.83	2.33	
2019/01/20 16:34	16.82	2.33	
2019/01/19 16:34	16.86	2.34	
2019/01/18 16:34	16.86	2.34	
Clear Log	Page 2 / 3	←	→
Submenu	Monitor	Return	

7.4.16 [SCD Parts Counter] Screen

Press  (HOME) - [Detector] - [Submenu] - [SCD Parts Counter] to display [SCD Parts Counter] screen.

You can check usage time of SCD consumables.



No.	Item	Description
1	Inner Pyrotube	Sets usage time of the inner pyrotube.
	Usage Counter	Select [Yes] to display a message in the message display when usage time of the inner pyrotube exceeds the threshold.
		Items No, Yes
		Default Yes
	Usage Time	Displays usage time of the inner pyrotube. Press [Reset] to reset usage time. When [Usage Counter] is set at [Yes] and usage time exceeds the threshold, the displayed color turns red.
	Threshold	Sets usage time when you should replace the inner pyrotube.
		Range 0 to 20000
		Default 1000

No.	Item		Description	
2	Outer Pyrotube		Sets usage time of the outer pyrotube.	
	Usage Counter	Select [Yes] to display a message in the message display when usage time of the outer pyrotube exceeds the threshold.		
		Items	No, Yes	
		Default	Yes	
	Usage Time	Displays usage time of the outer pyrotube. Press [Reset] to reset usage time. When [Usage Counter] is set at [Yes] and usage time exceeds the threshold, the displayed color turns red.		
	Threshold	Sets usage time when you should replace the outer pyrotube.		
		Range	0 to 20000	
		Default	1000	
3	SCD Ozone Scrubber		Sets usage time of the SCD ozone scrubber.	
	Usage Counter	Select [Yes] to display a message in the message display when usage time of the SCD ozone scrubber exceeds the threshold.		
		Items	No, Yes	
		Default	Yes	
	Usage Time	Displays usage time of the SCD ozone scrubber. Press [Reset] to reset usage time. When [Usage Counter] is set at [Yes] and usage time exceeds the threshold, the displayed color turns red.		
	Threshold	Sets usage time when you should replace the SCD ozone scrubber.		
		Range	0 to 20000	
		Default	8760	
4	Vacuum Pump		Sets usage time of the vacuum pump.	
	Usage Counter	Select [Yes] to display a message in the message display when usage time of the vacuum pump exceeds the threshold.		
		Items	No, Yes	
		Default	Yes	
	Usage Time	Displays usage time of the vacuum pump. Press [Reset] to reset usage time. When [Usage Counter] is set at [Yes] and usage time exceeds the threshold, the displayed color turns red.		
	Threshold	Sets usage time when you should replace the vacuum pump.		
		Range	0 to 20000	
		Default	8760	

7.5 Injection Port

Sets temperature and flow rate, etc. of the injection port.

The injection units which can be used with the instrument are shown below:

- Split/Splitless injection unit (SPL)
 ▶▶ Reference "7.5.1 [INJ/FLOW] Screen (SPL)" P.247
- Direct injection unit (WBI)
 ▶▶ Reference "7.5.2 [INJ/FLOW] Screen (WBI)" P.252
- On-column injection unit (OCI)
 ▶▶ Reference "7.5.3 [INJ/FLOW] Screen (OCI)" P.256
- Programmed Temperature Vaporizer (PTV)
 ▶▶ Reference "7.5.4 [INJ/FLOW] Screen (PTV)" P.260
- Single packed injection unit (SINJ)
 ▶▶ Reference "7.5.5 [INJ/FLOW] Screen (SINJ)" P.264

For details of sample injection, see "8.4 Sample Injection System" P.404.

Configure injection units in analytical line before using the instrument.

▶▶ Reference "7.8.2 [Line Configuration] Screen" P.314

7.5.1 [INJ/FLOW] Screen (SPL)

Press  (HOME) - [Injection Port] to display [INJ/FLOW] screen.

The screen is different depending on the injection units configured in the analytical line. When several injection units are installed on the instrument and are configured in several analytical lines, press [LINE] in the top-right of the screen to switch lines and make settings.

This section describes the screen for SPL.



No.	Item	Description		
①	Control of Flow Controller	Displays the current control status of the flow controller. Press [Off] or [On] to switch the control status. Set at [On] to control the flow controller in the injection port. When you press [Start GC] on [GC Start Sequence] screen, the instrument starts to control the injection port which is configured in the analytical line and whose ① [Control of Flow Controller] is set at [On]. For the injection port configured in the analytical line, ② [Inj Temp] can be controlled even when ① [Control of Flow Controller] is set at [Off].		
		 NOTE If this function is turned [Off] while the instrument performs analysis or column temperature is high, it stops supply of the carrier gas and may result in column degradation due to oxidization of the liquid phase.		
		<table><tr><td>Items</td><td>Off, On</td></tr><tr><td>Default</td><td>On</td></tr></table>	Items	Off, On
Items	Off, On			
Default	On			
②	Inj Temp	Sets the injection port temperature. Select a temperature suitable for each sample to instantly vaporize the sample in the injection port.		
		 NOTE • The use at high temperature may reduce the service life of the temperature sensor. Do not increase the temperature higher than necessary. • Due to vapor pressure of the sample elements, the sample also vaporizes at temperatures lower than the boiling point of sample elements.		
		<table><tr><td>Range</td><td>0.0 to 450.0 °C</td></tr><tr><td>Default</td><td>25.0 °C</td></tr></table>	Range	0.0 to 450.0 °C
Range	0.0 to 450.0 °C			
Default	25.0 °C			

No.	Item	Description
③	Inlet Press	Sets the inlet pressure of the column. Set initial pressure when you use Column Inlet Press Program.
		Range 0.0 to 970.0 kPa
		Default 100.0 kPa
④	Col Flow	Sets column flow. The instrument calculates the column inlet pressure based on inner diameter, length, and film thickness of the column, which are set on [Column Information] screen to achieve the set column flow at the initial temperature in the column oven temperature program.
		Range - When ⑪ [Carrier Gas Type] is He, N2, or Ar 0.00 to 1300.00 mL/min - When ⑪ [Carrier Gas Type] is H2 0.00 to 50.00 mL/min
		Default 1.00 mL/min
⑤	Linear Vel	Sets the average linear velocity of the carrier gas flowing in the capillary column. The instrument calculates the column inlet pressure based on inner diameter, length, and film thickness of the column, which are set on [Column Information] screen so that the gas flows in the column at the set velocity at the initial temperature in the column oven temperature program.
		Range 0.0 to 99999.9 cm/s
		Default 40.0 cm/s
⑥	Split Ratio	The split ratio is "split flow / column flow". When you set a split ratio, the instrument sets the total flow so that the desired split ratio occurs at the column oven temperature. Set the split ratio to [-1.0] to fix the total flow regardless of the column oven temperature.
		Range -1.0, 0.0 to 9999.9
		Default -1.0
⑦	Total Flow	Sets the total flow, which is the sum total of column flow, split flow, and septum purge flow. ▶▶ Reference "8.6.7 AFC and APC Control Ranges" P.434
		Range 0.0 to 1300.0 mL/min
		Default 50.0 mL/min
⑧	Injection Mode	Sets injection mode.
		Items - Split Controls the column inlet pressure and the total flow so that the column inlet pressure and split ratio occur as specified. - Splitless Closes the split flow line during the sampling time and controls the Total Flow Controller (TFC) so that the column inlet pressure remains the set value. Opens the split flow line after the sampling time elapses and controls the Electronic Split Controller (ESC) so that the column inlet pressure remains the set value.
		Default Split

No.	Item	Description
⑨	Sampling time	Sets the sampling time for splitless analysis The sampling time indicates the period of time after analysis starts until the split flow line is opened. This item is displayed when ⑧ [Injection Mode] is set at [Splitless]. NOTE For the correct functioning of the sampling time, ensure that the sampling time is shorter than the hold time of the column initial temperature.
		Range0.00 to 9999.99 min
		Default1.00 min
⑩	Flow Control Mode	Sets flow control mode.
		Items • Press Controls the instrument so that the inlet pressure remains constant during analysis. • Velocity Controls the instrument so that the velocity remains constant during analysis. • Col Flow Controls the instrument so that the column flow remains constant during analysis.
		DefaultVelocity
⑪	Carrier Gas Type	Specify the carrier gas type supplied to the AFC. This parameter is used for the calculation of pressure, column flow, and velocity. NOTE If this parameter is not set correctly, the calculations may not be performed correctly. For example, if this parameter is set at "N2" when "He" is actually used, the displayed pressure, column flow, velocity, and total flow are not correct.
		ItemsHe, N2, H2, Ar
		DefaultHe
⑫	Primary Press	A rough pressure level (primary pressure) of the carrier gas supplied to the AFC is displayed. NOTE It is normal differences among equipment that primary pressures displayed on the screen for each injection port have approximately 10 kPa variation when two or more injection ports are mounted.

No.	Item	Description	
13	Purge Flow	Sets septum purge flow. This is the initial flow in the purge flow program.	
		Range	0.0 to 1300.0 mL/min NOTE Control range is different depending on the column inlet pressure. ▶▶ Reference "8.6.7 AFC and APC Control Ranges" P.434
		Default	3.0 mL/min
14	Press Program	Displays [Column Inlet Press Program] screen. This item is displayed when 10 [Flow Control Mode] is set at [Press]. ▶▶ Reference "7.5.6 [Column Inlet Press Program] Screen" P.267	
	Linear Vel Program	Displays [Linear Velocity Program] screen. This item is displayed when 10 [Flow Control Mode] is set at [Velocity]. ▶▶ Reference "7.5.7 [Linear Velocity Program] Screen" P.269	
	Col Flow Program	Displays [Column Flow Program] screen. This item is displayed when 10 [Flow Control Mode] is set at [Col Flow]. ▶▶ Reference "7.5.8 [Column Flow Program] Screen" P.271	
15	Back Flush Setting	Displays [Back Flush Settings] screen. This item is displayed when AFT and the injection port are configured in the same analytical line. ▶▶ Reference "7.5.10 [Back Flush Settings] Screen" P.275	

Submenu

Item	Description	See also
Column Information	Displays [Column Information] screen.	P.292
Carrier Gas Saver	Displays [Carrier Gas Saver] screen. The carrier gas saver saves carrier gas by reducing the split flow.	P.276
Split Ratio Program	Displays [Split Ratio Program] screen. Split ratio can be changed during analysis.	P.277
Purge Flow Program	Displays [Purge Flow Program] screen. Sets septum purge program.	P.279
High Press Setting	Displays [High Pressure Injection] screen. The instrument keeps the column inlet pressure at high value for a certain period of time during the injection.	P.281
Splitter Hold	Displays [Splitter Hold] screen. The instrument fixes the split flow line and keep the split ratio constant.	P.283
Calibration Offset	Press [Run] to perform calibration so that the displayed AFC pressure becomes "0 kPa" at atmospheric pressure. Use this function before GC starts or if the displayed pressure is not "0 kPa" while the gas supply stops (exposed to atmospheric pressure).	P.438

7.5.2 [INJ/FLOW] Screen (WBI)

Press  (HOME) - [Injection Port] to display [INJ/FLOW] screen.

The screen is different depending on the injection units configured in the analytical line. When several injection units are installed on the instrument and are configured in several analytical lines, press [LINE] in the top-right of the screen to switch lines and make settings.

This section describes the screen for WBI.



No.	Item	Description	
①	Control of Flow Controller	Displays the current control status of the flow controller. Press [Off] or [On] to switch the control status. Set at [On] to control the flow controller in the injection port. When you press [Start GC] on [GC Start Sequence] screen, the instrument starts to control the injection port which is configured in the analytical line and whose ① [Control of Flow Controller] is set at [On]. For the injection port configured in the analytical line, ② [Inj Temp] can be controlled even when ① [Control of Flow Controller] is set at [Off].  NOTE If this function is turned [Off] while the instrument performs analysis or column temperature is high, it stops supply of the carrier gas and may result in column degradation due to oxidization of the liquid phase.	
		Items	Off, On
		Default	On

No.	Item	Description				
②	Inj Temp	Sets the injection port temperature. Select a temperature suitable for each sample to instantly vaporize the sample in the injection port.				
		NOTE • The use at high temperature may reduce the service life of the temperature sensor. Do not increase the temperature higher than necessary. • Due to vapor pressure of the sample elements, the sample also vaporizes at temperatures lower than the boiling point of sample elements.				
		<table><tr><td>Range</td><td>0.0 to 450.0 °C</td></tr><tr><td>Default</td><td>25.0 °C</td></tr></table>	Range	0.0 to 450.0 °C	Default	25.0 °C
Range	0.0 to 450.0 °C					
Default	25.0 °C					
③	Inlet Press	Sets the inlet pressure of the column. Set initial pressure when you use Pressure Program. When ⑦ [Flow Control Mode] is set at [Col Flow], the actual value is displayed but you cannot set the value.				
		<table><tr><td>Range</td><td>0.0 to 970.0 kPa</td></tr><tr><td>Default</td><td>100.0 kPa</td></tr></table>	Range	0.0 to 970.0 kPa	Default	100.0 kPa
		Range	0.0 to 970.0 kPa			
Default	100.0 kPa					
④	Col Flow	Sets column flow. This can be set only when ⑦ [Flow Control Mode] is [Col Flow].				
		NOTE When the ⑦ [Flow Control Mode] is set to [Press] or [Velocity], the set value calculated from the inlet pressure and the column dimensions is displayed. If the configured column dimension settings and the actual column dimensions are different, both the actual flow value and the disparity will be displayed. If you want to match the set value and the actual flow value, change the column dimension settings as necessary.				
		<table><tr><td>Range</td><td> • When ⑧ [Carrier Gas Type] is He, N2, or Ar 0.00 to 1300.00 mL/min • When ⑧ [Carrier Gas Type] is H2 0.00 to 50.00 mL/min </td></tr><tr><td>Default</td><td>1.00 mL/min</td></tr></table>	Range	• When ⑧ [Carrier Gas Type] is He, N2, or Ar 0.00 to 1300.00 mL/min • When ⑧ [Carrier Gas Type] is H2 0.00 to 50.00 mL/min	Default	1.00 mL/min
Range	• When ⑧ [Carrier Gas Type] is He, N2, or Ar 0.00 to 1300.00 mL/min • When ⑧ [Carrier Gas Type] is H2 0.00 to 50.00 mL/min					
Default	1.00 mL/min					
⑤	Linear Vel	Sets the average linear velocity of the carrier gas flowing in the capillary column. The instrument calculates the column inlet pressure based on inner diameter, length, and film thickness of the column, which are set on [Column Information] screen so that the gas flows in the column at the set velocity at the initial temperature in the column oven temperature program. This item is displayed when ⑦ [Flow Control Mode] is set at [Press] or [Velocity].				
		<table><tr><td>Range</td><td>0.0 to 99999.9 cm/s</td></tr><tr><td>Default</td><td>40.0 cm/s</td></tr></table>	Range	0.0 to 99999.9 cm/s	Default	40.0 cm/s
		Range	0.0 to 99999.9 cm/s			
Default	40.0 cm/s					
⑥	Total Flow	Displays the total flow, which is the sum total of column flow and septum purge flow.				
		▶▶ Reference "8.6.7 AFC and APC Control Ranges" P.434				

No.	Item	Description	
7	Flow Control Mode	Sets flow control mode.	
		Items	• Press Controls the instrument so that the inlet pressure remains constant during analysis. • Velocity Controls the instrument so that the velocity remains constant during analysis. • Col Flow Controls the instrument so that the column flow remains constant during analysis.
		Default	Velocity
8	Carrier Gas Type	Specify the carrier gas type supplied to the AFC. This parameter is used for the calculation of pressure, column flow, and velocity.	
		 NOTE If this parameter is not set correctly, the calculations may not be performed correctly. For example, if this parameter is set at "N2" when "He" is actually used, the displayed pressure, column flow, velocity, and total flow are not correct.	
		Items	He, N2, H2, Ar
		Default	He
9	Primary Press	A rough pressure level (primary pressure) of the carrier gas supplied to the AFC is displayed.	
		 NOTE It is normal differences among equipment that primary pressures displayed on the screen for each injection port have approximately 10 kPa variation when two or more injection ports are mounted.	
10	Purge Flow	Sets septum purge flow. This is the initial flow in the purge flow program.	
		Range	0.0 to 1300.0 mL/min  NOTE Control range is different depending on the column inlet pressure. ▶▶ Reference "8.6.7 AFC and APC Control Ranges" P.434
		Default	3.0 mL/min

No.	Item	Description
11	Press Program	Displays [Column Inlet Press Program] screen. This item is displayed when 7 [Flow Control Mode] is set at [Press]. ▶▶ Reference "7.5.6 [Column Inlet Press Program] Screen" P.267
	Linear Vel Program	Displays [Linear Velocity Program] screen. This item is displayed when 7 [Flow Control Mode] is set at [Velocity]. ▶▶ Reference "7.5.7 [Linear Velocity Program] Screen" P.269
	Col Flow Program	Displays [Column Flow Program] screen. This item is displayed when 7 [Flow Control Mode] is set at [Col Flow]. ▶▶ Reference "7.5.8 [Column Flow Program] Screen" P.271

Submenu

Item	Description	See also
Column Information	Displays [Column Information] screen.	P.292
Purge Flow Program	Displays [Purge Flow Program] screen. Sets septum purge program.	P.279
Calibration Offset	Press [Run] to perform calibration so that the displayed AFC pressure becomes "0 kPa" at atmospheric pressure. Use this function before GC starts or if the displayed pressure is not "0 kPa" while the gas supply stops (exposed to atmospheric pressure).	P.438

7.5.3 [INJ/FLOW] Screen (OCI)

Press  (HOME) - [Injection Port] to display [INJ/FLOW] screen.

The screen is different depending on the injection units configured in the analytical line. When several injection units are installed on the instrument and are configured in several analytical lines, press [LINE] in the top-right of the screen to switch lines and make settings.

This section describes the screen for OCI.



No.	Item	Description	
①	Control of Flow Controller	Displays the current control status of the flow controller. Press [Off] or [On] to switch the control status. Set at [On] to control the flow controller in the injection port. When you press [Start GC] on [GC Start Sequence] screen, the instrument starts to control the injection port which is configured in the analytical line and whose ① [Control of Flow Controller] is set at [On]. For the injection port configured in the analytical line, ② [Inj Temp] can be controlled even when ① [Control of Flow Controller] is set at [Off].  NOTE If this function is turned [Off] while the instrument performs analysis or column temperature is high, it stops supply of the carrier gas and may result in column degradation due to oxidization of the liquid phase.	
		Items	Off, On
		Default	On

No.	Item	Description				
②	Inj Temp	Sets the initial temperature of the injection port. Set it at a temperature where sample components are not decomposed by heat or sample composition does not change due to distillation. Heating after sample injection can be set in ⑬ [Inj Temp Program]. Select a temperature suitable for each sample to instantly vaporize the sample in the injection port.				
		NOTE Set the initial temperature at a value lower than the boiling point of sample solvent.				
		<table><tr><td>Range</td><td>0.0 to 450.0 °C</td></tr><tr><td>Default</td><td>25.0 °C</td></tr></table>	Range	0.0 to 450.0 °C	Default	25.0 °C
Range	0.0 to 450.0 °C					
Default	25.0 °C					
③	Inlet Press	Sets the inlet pressure of the column. Set initial pressure when you use Pressure Program. When ⑦ [Flow Control Mode] is set at [Col Flow], the actual value is displayed but you cannot set the value.				
		<table><tr><td>Range</td><td>0.0 to 970.0 kPa</td></tr><tr><td>Default</td><td>100.0 kPa</td></tr></table>	Range	0.0 to 970.0 kPa	Default	100.0 kPa
		Range	0.0 to 970.0 kPa			
Default	100.0 kPa					
④	Col Flow	Sets column flow. This can be set only when ⑦ [Flow Control Mode] is [Col Flow].				
		NOTE When the ⑦ [Flow Control Mode] is set to [Press] or [Velocity], the set value calculated from the inlet pressure and the column dimensions is displayed. If the configured column dimension settings and the actual column dimensions are different, both the actual flow value and the disparity will be displayed. If you want to match the set value and the actual flow value, change the column dimension settings as necessary.				
		<table><tr><td>Range</td><td> - When ⑧ [Carrier Gas Type] is He, N2, or Ar 0.00 to 1300.00 mL/min - When ⑧ [Carrier Gas Type] is H2 0.00 to 50.00 mL/min </td></tr><tr><td>Default</td><td>1.00 mL/min</td></tr></table>	Range	- When ⑧ [Carrier Gas Type] is He, N2, or Ar 0.00 to 1300.00 mL/min - When ⑧ [Carrier Gas Type] is H2 0.00 to 50.00 mL/min	Default	1.00 mL/min
Range	- When ⑧ [Carrier Gas Type] is He, N2, or Ar 0.00 to 1300.00 mL/min - When ⑧ [Carrier Gas Type] is H2 0.00 to 50.00 mL/min					
Default	1.00 mL/min					
⑤	Linear Vel	Sets the average linear velocity of the carrier gas flowing in the capillary column. The instrument calculates the column inlet pressure based on inner diameter, length, and film thickness of the column, which are set on [Column Information] screen so that the gas flows in the column at the set velocity at the initial temperature in the column oven temperature program. This item is displayed when ⑦ [Flow Control Mode] is set at [Press] or [Velocity].				
		<table><tr><td>Range</td><td>0.0 to 99999.9 cm/s</td></tr><tr><td>Default</td><td>40.0 cm/s</td></tr></table>	Range	0.0 to 99999.9 cm/s	Default	40.0 cm/s
		Range	0.0 to 99999.9 cm/s			
Default	40.0 cm/s					
⑥	Total Flow	Displays the total flow, which is the sum total of column flow and septum purge flow.				
▶▶ Reference "8.6.7 AFC and APC Control Ranges" P.434						

No.	Item	Description	
7	Flow Control Mode	Sets flow control mode.	
		Items	• Press Controls the instrument so that the inlet pressure remains constant during analysis. • Velocity Controls the instrument so that the velocity remains constant during analysis. • Col Flow Controls the instrument so that the column flow remains constant during analysis.
		Default	Velocity
8	Carrier Gas Type	Specify the carrier gas type supplied to the AFC. This parameter is used for the calculation of pressure, column flow, and velocity.	
		 NOTE If this parameter is not set correctly, the calculations may not be performed correctly. For example, if this parameter is set at "N2" when "He" is actually used, the displayed pressure, column flow, velocity, and total flow are not correct.	
		Items	He, N2, H2, Ar
		Default	He
9	Primary Press	A rough pressure level (primary pressure) of the carrier gas supplied to the AFC is displayed.	
		 NOTE It is normal differences among equipment that primary pressures displayed on the screen for each injection port have approximately 10 kPa variation when two or more injection ports are mounted.	
10	Purge Flow	Sets septum purge flow. This is the initial flow in the purge flow program.	
		Range	0.0 to 1300.0 mL/min
		 NOTE Control range is different depending on the column inlet pressure.  Reference "8.6.7 AFC and APC Control Ranges" P.434	
		Default	3.0 mL/min

No.	Item	Description
11	Press Program	Displays [Column Inlet Press Program] screen. This item is displayed when 7 [Flow Control Mode] is set at [Press]. ▶▶ Reference "7.5.6 [Column Inlet Press Program] Screen" P.267
	Linear Vel Program	Displays [Linear Velocity Program] screen. This item is displayed when 7 [Flow Control Mode] is set at [Velocity]. ▶▶ Reference "7.5.7 [Linear Velocity Program] Screen" P.269
	Col Flow Program	Displays [Column Flow Program] screen. This item is displayed when 7 [Flow Control Mode] is set at [Col Flow]. ▶▶ Reference "7.5.8 [Column Flow Program] Screen" P.271
12	Fan Off Temp	Sets the upper limit when controlling the temperature using the fan.
		Range 0.0 to 100.0 °C
		Default 50.0 °C
13	Inj Temp Program	Displays [INJ Temp Program] screen. ▶▶ Reference "7.5.9 [INJ Temp Program] Screen" P.273

Submenu

Item	Description	See also
Column Information	Displays [Column Information] screen.	P.292
Purge Flow Program	Displays [Purge Flow Program] screen. Sets septum purge program.	P.279
Calibration Offset	Press [Run] to perform calibration so that the displayed AFC pressure becomes "0 kPa" at atmospheric pressure. Use this function before GC starts or if the displayed pressure is not "0 kPa" while the gas supply stops (exposed to atmospheric pressure).	P.438

7.5.4 [INJ/FLOW] Screen (PTV)

Press  (HOME) - [Injection Port] to display [INJ/FLOW] screen.

The screen is different depending on the injection units configured in the analytical line. When several injection units are installed on the instrument and are configured in several analytical lines, press [LINE] in the top-right of the screen to switch lines and make settings.

This section describes the screen for PTV.



No.	Item	Description	
①	Control of Flow Controller	Displays the current control status of the flow controller. Press [Off] or [On] to switch the control status. Set at [On] to control the flow controller in the injection port. When you press [Start GC] on [GC Start Sequence] screen, the instrument starts to control the injection port which is configured in the analytical line and whose ① [Control of Flow Controller] is set at [On]. For the injection port configured in the analytical line, ② [Inj Temp] can be controlled even when ① [Control of Flow Controller] is set at [Off].  NOTE If this function is turned [Off] while the instrument performs analysis or column temperature is high, it stops supply of the carrier gas and may result in column degradation due to oxidization of the liquid phase.	
		Items	Off, On
		Default	On

No.	Item	Description				
②	Inj Temp	Sets the initial temperature of the injection port. Set it at a temperature where sample components are not decomposed by heat or sample composition does not change due to distillation. Heating after sample injection can be set in ⑩ [Inj Temp Program]. Select a temperature suitable for each sample to instantly vaporize the sample in the injection port.				
		 NOTE Set the initial temperature at a value lower than the boiling point of sample solvent.				
		<table><tr><td>Range</td><td>0.0 to 450.0 °C</td></tr><tr><td>Default</td><td>25.0 °C</td></tr></table>	Range	0.0 to 450.0 °C	Default	25.0 °C
Range	0.0 to 450.0 °C					
Default	25.0 °C					
③	Inlet Press	Sets the inlet pressure of the column. Set initial pressure when you use Pressure Program.				
		<table><tr><td>Range</td><td>0.0 to 970.0 kPa</td></tr><tr><td>Default</td><td>100.0 kPa</td></tr></table>	Range	0.0 to 970.0 kPa	Default	100.0 kPa
		Range	0.0 to 970.0 kPa			
Default	100.0 kPa					
④	Col Flow	Sets column flow. The instrument calculates the column inlet pressure based on inner diameter, length, and film thickness of the column, which are set on [Column Information] screen to achieve the set column flow at the initial temperature in the column oven temperature program.				
		<table><tr><td>Range</td><td> - When ⑪ [Carrier Gas Type] is He, N2, or Ar 0.00 to 1300.00 mL/min - When ⑪ [Carrier Gas Type] is H2 0.00 to 50.00 mL/min </td></tr><tr><td>Default</td><td>1.00 mL/min</td></tr></table>	Range	- When ⑪ [Carrier Gas Type] is He, N2, or Ar 0.00 to 1300.00 mL/min - When ⑪ [Carrier Gas Type] is H2 0.00 to 50.00 mL/min	Default	1.00 mL/min
		Range	- When ⑪ [Carrier Gas Type] is He, N2, or Ar 0.00 to 1300.00 mL/min - When ⑪ [Carrier Gas Type] is H2 0.00 to 50.00 mL/min			
Default	1.00 mL/min					
⑤	Linear Vel	Sets the average linear velocity of the carrier gas flowing in the capillary column. The instrument calculates the column inlet pressure based on inner diameter, length, and film thickness of the column, which are set on [Column Information] screen so that the gas flows in the column at the set velocity at the initial temperature in the column oven temperature program.				
		<table><tr><td>Range</td><td>0.0 to 99999.9 cm/s</td></tr><tr><td>Default</td><td>40.0 cm/s</td></tr></table>	Range	0.0 to 99999.9 cm/s	Default	40.0 cm/s
		Range	0.0 to 99999.9 cm/s			
Default	40.0 cm/s					
⑥	Split Ratio	The split ratio is "split flow / column flow". When you set a split ratio, the instrument sets the total flow so that the desired split ratio occurs at the column oven temperature. Set the split ratio to [-1.0] to fix the total flow regardless of the column oven temperature.				
		<table><tr><td>Range</td><td>-1.0, 0.0 to 9999.9</td></tr><tr><td>Default</td><td>-1.0</td></tr></table>	Range	-1.0, 0.0 to 9999.9	Default	-1.0
		Range	-1.0, 0.0 to 9999.9			
Default	-1.0					
⑦	Total Flow	Sets the total flow, which is the sum total of column flow, split flow, and septum purge flow.				
		 Reference "8.6.7 AFC and APC Control Ranges" P.434				
		<table><tr><td>Range</td><td>0.0 to 1300.0 mL/min</td></tr><tr><td>Default</td><td>50.0 mL/min</td></tr></table>	Range	0.0 to 1300.0 mL/min	Default	50.0 mL/min
Range	0.0 to 1300.0 mL/min					
Default	50.0 mL/min					

No.	Item	Description	
⑧	Injection Mode	Sets injection mode.	
		Items	• Split Controls the column inlet pressure and the total flow so that the column inlet pressure and split ratio occur as specified. • Splitless Closes the split flow line during the sampling time and controls the Total Flow Controller (TFC) so that the column inlet pressure remains the set value. Opens the split flow line after the sampling time elapses and controls the Electronic Split Controller (ESC) so that the column inlet pressure remains the set value.
		Default	Split
⑨	Sampling time	Sets the sampling time for splitless analysis. The sampling time indicates the period of time after analysis starts until the split flow line is opened. This item is displayed when ⑧ [Injection Mode] is set at [Splitless].	
		 NOTE For the correct functioning of the sampling time, ensure that the sampling time is shorter than the hold time of the column initial temperature.	
		Range	0.00 to 9999.99 min
		Default	1.00 min
⑩	Flow Control Mode	Sets flow control mode.	
		Items	• Press Controls the instrument so that the inlet pressure remains constant during analysis. • Velocity Controls the instrument so that the velocity remains constant during analysis. • Col Flow Controls the instrument so that the column flow remains constant during analysis.
		Default	Velocity
⑪	Carrier Gas Type	Specify the carrier gas type supplied to the AFC. This parameter is used for the calculation of pressure, column flow, and velocity.	
		 NOTE If this parameter is not set correctly, the calculations may not be performed correctly. For example, if this parameter is set at "N2" when "He" is actually used, the displayed pressure, column flow, velocity, and total flow are not correct.	
		Items	He, N2, H2, Ar
		Default	He

No.	Item	Description		
12	Primary Press	A rough pressure level (primary pressure) of the carrier gas supplied to the AFC is displayed.  NOTE It is normal differences among equipment that primary pressures displayed on the screen for each injection port have approximately 10 kPa variation when two or more injection ports are mounted.		
13	Purge Flow	Sets septum purge flow. This is the initial flow in the purge flow program.		
		<table><tr><td>Range</td><td>0.0 to 1300.0 mL/min</td></tr></table>  NOTE Control range is different depending on the column inlet pressure.  Reference "8.6.7 AFC and APC Control Ranges" P.434	Range	0.0 to 1300.0 mL/min
		Range	0.0 to 1300.0 mL/min	
<table><tr><td>Default</td><td>3.0 mL/min</td></tr></table>	Default	3.0 mL/min		
Default	3.0 mL/min			
14	Press Program	Displays [Column Inlet Press Program] screen. This item is displayed when 10 [Flow Control Mode] is set at [Press].  Reference "7.5.6 [Column Inlet Press Program] Screen" P.267		
	Linear Vel Program	Displays [Linear Velocity Program] screen. This item is displayed when 10 [Flow Control Mode] is set at [Velocity].  Reference "7.5.7 [Linear Velocity Program] Screen" P.269		
	Col Flow Program	Displays [Column Flow Program] screen. This item is displayed when 10 [Flow Control Mode] is set at [Col Flow].  Reference "7.5.8 [Column Flow Program] Screen" P.271		
15	Fan Off Temp	Sets the upper limit when controlling the temperature using the fan.		
		<table><tr><td>Range</td><td>0.0 to 100.0 °C</td></tr></table>	Range	0.0 to 100.0 °C
		Range	0.0 to 100.0 °C	
<table><tr><td>Default</td><td>50.0 °C</td></tr></table>	Default	50.0 °C		
Default	50.0 °C			
16	Inj Temp Program	Displays [INJ Temp Program] screen.  Reference "7.5.9 [INJ Temp Program] Screen" P.273		
17	Back Flush Setting	Displays [Back Flush Settings] screen. This item is displayed when AFT and the injection port are configured in the same analytical line.  Reference "7.5.10 [Back Flush Settings] Screen" P.275		

Submenu

Item	Description	See also
Column Information	Displays [Column Information] screen.	P.292
Carrier Gas Saver	Displays [Carrier Gas Saver] screen. The carrier gas saver saves carrier gas by reducing the split flow.	P.276
Split Ratio Program	Displays [Split Ratio Program] screen. Split ratio can be changed during analysis.	P.277

Item	Description	See also
Purge Flow Program	Displays [Purge Flow Program] screen. Sets septum purge program.	P.279
High Press Setting	Displays [High Pressure Injection] screen. The instrument keeps the column inlet pressure at high value for a certain period of time during the injection.	P.281
Splitter Hold	Displays [Splitter Hold] screen. The instrument fixes the split flow line and keep the split ratio constant.	P.283
Calibration Offset	Press [Run] to perform calibration so that the displayed AFC pressure becomes "0 kPa" at atmospheric pressure. Use this function before GC starts or if the displayed pressure is not "0 kPa" while the gas supply stops (exposed to atmospheric pressure).	P.438

7.5.5 [INJ/FLOW] Screen (SINJ)

Press  (HOME) - [Injection Port] to display [INJ/FLOW] screen.

The screen is different depending on the injection units configured in the analytical line. When several injection units are installed on the instrument and are configured in several analytical lines, press [LINE] in the top-right of the screen to switch lines and make settings.

This section describes the screen for SINJ.



No.	Item	Description				
❶	Control of Flow Controller	Displays the current control status of the flow controller. Press [Off] or [On] to switch the control status. Set at [On] to control the flow controller in the injection port. When you press [Start GC] on [GC Start Sequence] screen, the instrument starts to control the injection port which is configured in the analytical line and whose ❶ [Control of Flow Controller] is set at [On]. For the injection port configured in the analytical line, ❷ [Inj Temp] can be controlled even when ❶ [Control of Flow Controller] is set at [Off].				
		NOTE If this function is turned [Off] while the instrument performs analysis or column temperature is high, it stops supply of the carrier gas and may result in column degradation due to oxidization of the liquid phase.				
		<table><tr><td>Items</td><td>Off, On</td></tr><tr><td>Default</td><td>On</td></tr></table>	Items	Off, On	Default	On
Items	Off, On					
Default	On					
❷	Inj Temp	Sets the injection port temperature. Select a temperature suitable for each sample to instantly vaporize the sample in the injection port.				
		NOTE • The use at high temperature may reduce the service life of the temperature sensor. Do not increase the temperature higher than necessary. • Due to vapor pressure of the sample elements, the sample also vaporizes at temperatures lower than the boiling point of sample elements.				
		<table><tr><td>Range</td><td>0.0 to 450.0 °C</td></tr><tr><td>Default</td><td>25.0 °C</td></tr></table>	Range	0.0 to 450.0 °C	Default	25.0 °C
Range	0.0 to 450.0 °C					
Default	25.0 °C					
❸	Inlet Prs	Inlet Prs of the carrier gas supplied to the DAFC is displayed.				
❹	Ref Inlet Prs	Inlet Prs of the carrier gas supplied to the DAFC on the reference side is displayed. This item is displayed when ❶❷ [DAFC Control Mode] is set at [Dual].				
❺	Col Flow	Sets column flow.				
		<table><tr><td>Range</td><td>0.0 to 100.0 mL/min</td></tr><tr><td>Default</td><td>50.0 mL/min</td></tr></table>	Range	0.0 to 100.0 mL/min	Default	50.0 mL/min
		Range	0.0 to 100.0 mL/min			
Default	50.0 mL/min					
❻	Ref Flow	Sets the column flow on the reference side. This item is displayed when ❶❷ [DAFC Control Mode] is set at [Dual].				
		<table><tr><td>Range</td><td>0.0 to 100.0 mL/min</td></tr><tr><td>Default</td><td>50.0 mL/min</td></tr></table>	Range	0.0 to 100.0 mL/min	Default	50.0 mL/min
		Range	0.0 to 100.0 mL/min			
Default	50.0 mL/min					

No.	Item	Description	
⑦	Carrier Gas Type	Specify the carrier gas type supplied to the DAFC. This setting is used for flow measurement control, etc.  NOTE If this parameter is not set correctly, the calculations may not be performed correctly. Ensure that the setting is correct.	
		Items	He, N2, H2, Ar
		Default	He
⑧	Ref Gas Type	Sets the carrier gas type on the reference side. This item is displayed when ⑫ [DAFC Control Mode] is set at [Dual].	
		Items	He, N2, H2, Ar
		Default	He
⑨	Col Flow Program	Displays [Column Flow Program] screen. ▶▶ Reference "7.5.8 [Column Flow Program] Screen" P.271	
⑩	Ref Flow Program	Displays [Ref Flow Program] screen. The setting procedure is the same as ⑨ [Col Flow Program]. This item is displayed when ⑫ [DAFC Control Mode] is set at [Dual].	
⑪	Copy Flow Program	Press [Run] to copy the setting in ⑨ [Col Flow Program] to ⑩ [Ref Flow Program].	
⑫	DAFC Control Mode	Sets the control mode of the dual AFC. When it is set to [Single], the gas is controlled only for the main side. Gas control for the reference side is turned off.	
		Items	Dual, Single
		Default	Dual

Submenu

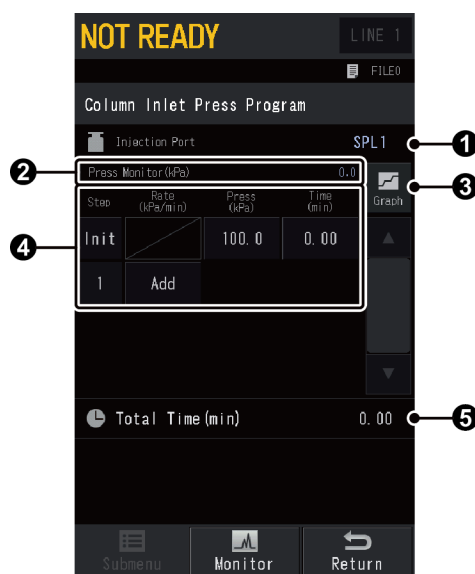
Item	Description	See also
Column Information	Displays [Column Information] screen.	P.292
Calibration Offset	Press [Run] to perform calibration so that the displayed AFC pressure becomes "0 kPa" at atmospheric pressure. Use this function before GC starts or if the displayed pressure is not "0 kPa" while the gas supply stops (exposed to atmospheric pressure).	P.438

7.5.6 [Column Inlet Press Program] Screen

Press  (HOME) - [Injection Port] - [Press Program] to display [Column Inlet Press Program] screen.

Set pressure program for the column inlet pressure (1 to 7 steps) before analysis to change the column inlet pressure during analysis.

Programs that change the column inlet pressure enable to elute high-boiling point contaminants after the target compounds within a short time, or to improve the separation.

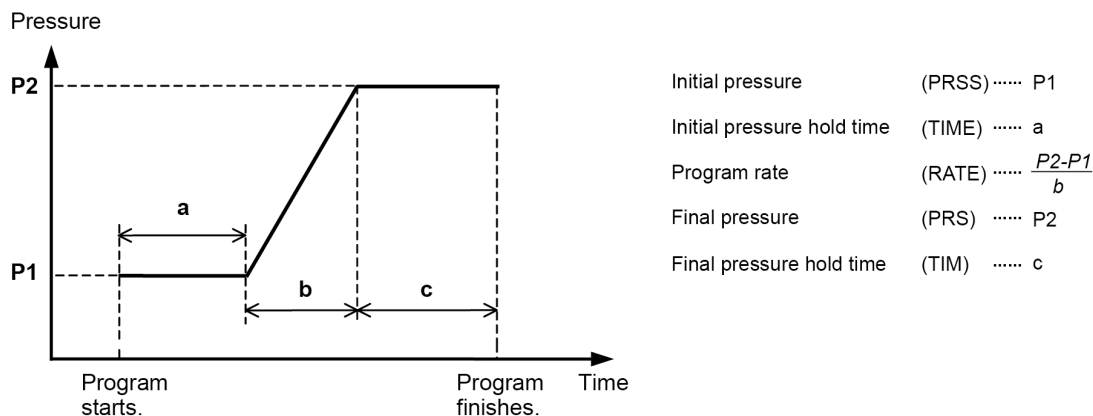


No.	Item	Description
①	Injection Port	Displays active injection port.
②	Press Monitor	Displays the current pressure.
③	 (Graph)	You can see the set pressure program in graph form. ▶▶ Reference "Graph window" P.25

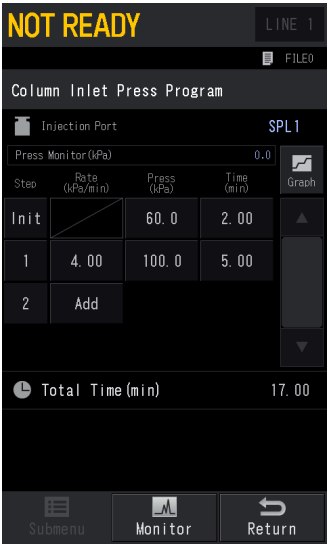
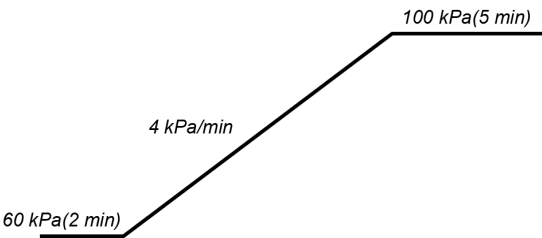
No.	Item		Description
④	Creating a program		You can create a pressure program (1 to 7 steps).
	Step	Step	Displays the number of steps currently set. Press [Init] or the number to insert or delete the step. Inserted step includes the same content as the step of [Init] or specified number.
		Rate	Sets the program rate. Press [Add] under the last step to insert a step including the same content as the last step. When you set it at "0", [Add] appears and the program will end at the previous step.
			Range -400.00 to 400.00 kPa/min
			NOTE Control range is different depending on the set value and the column.
			Default -
	Press	Sets the initial pressure and the final pressure of each step.	
		Range	0.0 to 970.0 kPa ▶▶ Reference "8.6.7 AFC and APC Control Ranges" P.434
		Default	100 kPa
	Time	Sets the hold time for the initial pressure and the final pressure of each step.	
		Range	0.00 to 9999.99 min
		Default	0.00 min
⑤	Total Time		Displays the total time of the program.

Creating a column inlet press program

- Screen terminology (1-ramp pressure program)



- Example for 1-ramp pressure program

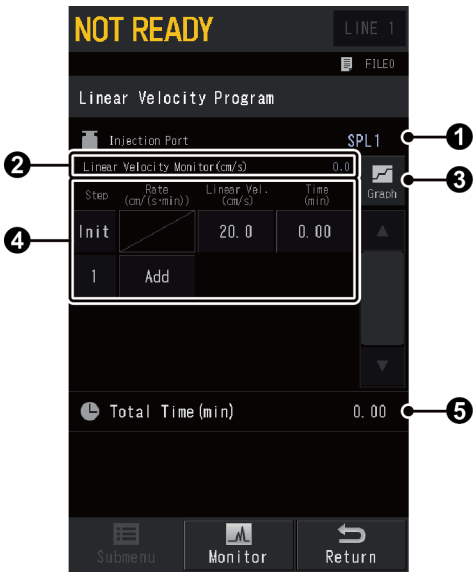


7.5.7 [Linear Velocity Program] Screen

Press (HOME) - [Injection Port] - [Linear Vel Program] to display [Linear Velocity Program] screen.

Set linear velocity program (1 to 7 steps) before analysis to change the velocity during analysis.

Programs that change the velocity enable to elute high-boiling point contaminants after the target compounds within a short time, or to improve the separation.

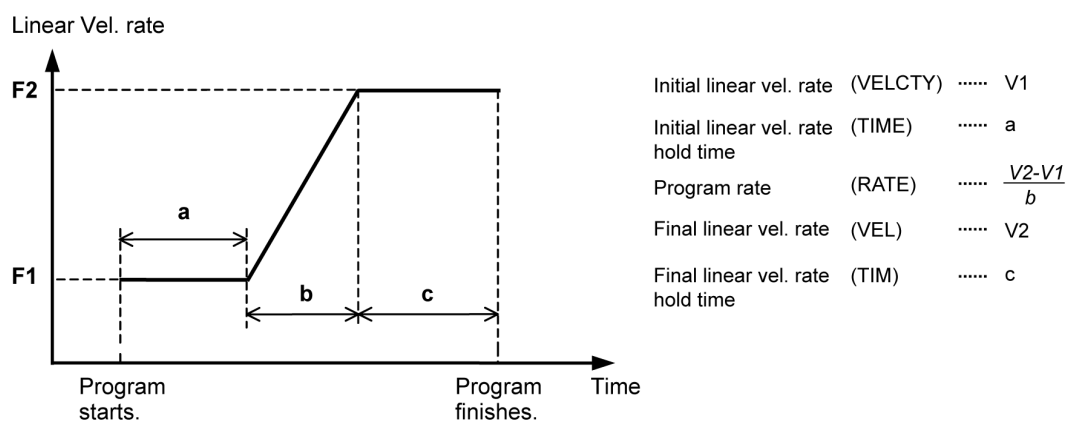


No.	Item	Description
①	Injection Port	Displays active injection port.
②	Linear Velocity Monitor	Displays the current velocity.

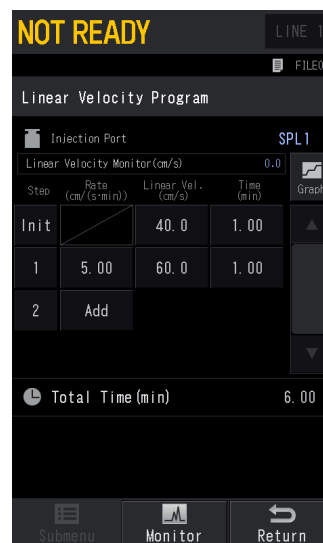
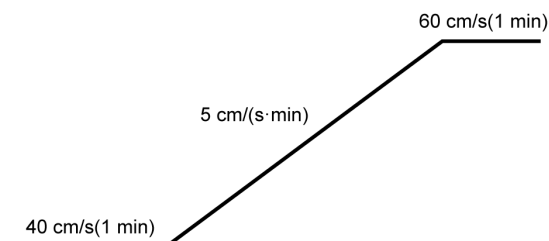
No.	Item	Description	
3	 (Graph)	You can see set linear velocity program in graph form. ▶▶ Reference "Graph window" P.25	
4	Creating a program		
	Step	You can create a linear velocity program (1 to 7 steps).	
	Rate	Displays the number of steps currently set. Press [Init] or the number to insert or delete the step. Inserted step includes the same content as the step of [Init] or specified number.	
		Sets the program rate. Press [Add] under the last step to insert a step including the same content as the last step. When you set it at "0", [Add] appears and the program will end at the previous step.	
	Range	-400.00 to 400.00 cm/(s · min) NOTE Control range is different depending on the set value and the column.	
	Default	-	
	Linear Vel.	Sets the initial velocity and the final velocity of each step.	
		Range	0.0 to 99999.9 cm/s ▶▶ Reference "8.6.7 AFC and APC Control Ranges" P.434
		Default	30.0 cm/s
Time	Sets the hold time for the initial velocity and the final velocity of each step.		
	Range	0.00 to 9999.99 min	
	Default	0.00 min	
5	Total Time	Displays the total time of the program.	

Creating a linear velocity program

- Screen terminology (1-ramp velocity program)



- Example for 1-ramp velocity program

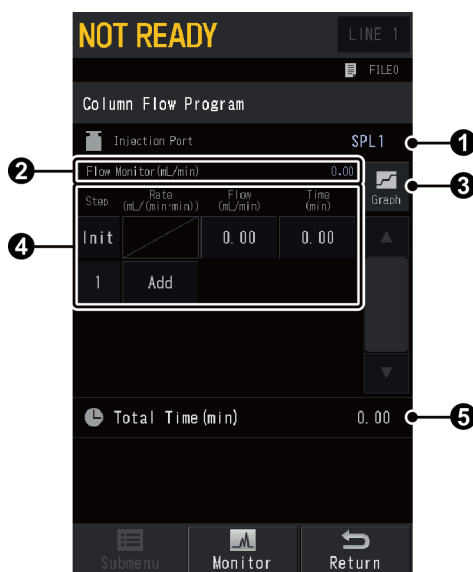


7.5.8 [Column Flow Program] Screen

Press (HOME) - [Injection Port] - [Col Flow Program] to display [Column Flow Program] screen.

Set column flow program (1 to 7 steps) before analysis to change the column flow during analysis.

Programs that change the column flow enable to elute high-boiling point contaminants after the target compounds within a short time, or to improve the separation.

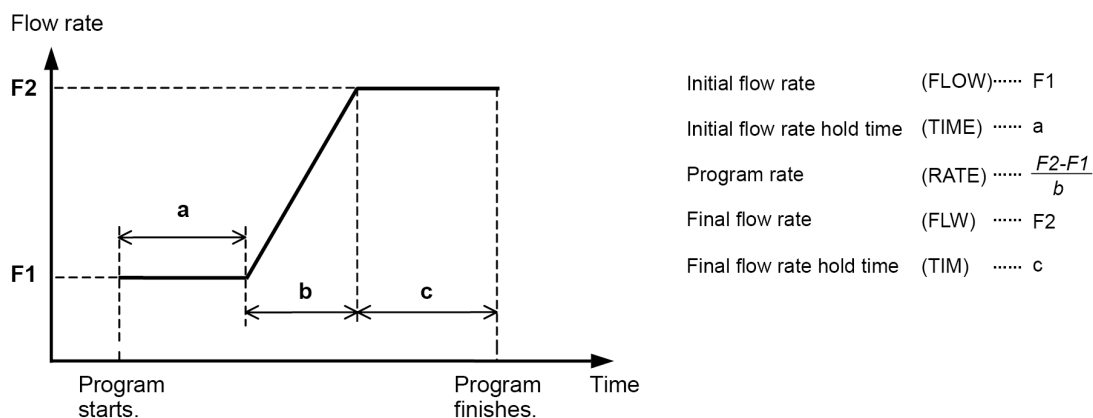


No.	Item	Description
①	Injection Port	Displays active injection port.
②	Flow Monitor	Displays the current column flow.

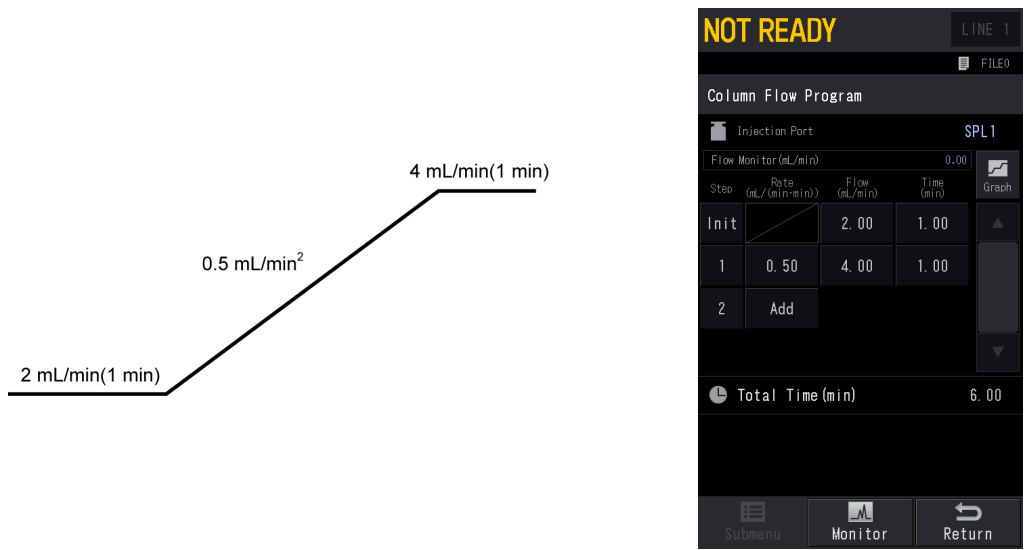
No.	Item	Description
③	 (Graph)	You can see the set flow program in graph form. ▶▶ Reference "Graph window" P.25
④	Creating a program	You can create a flow program (1 to 7 steps).
	Step	Displays the number of steps currently set. Press [Init] or the number to insert or delete the step. Inserted step includes the same content as the step of [Init] or specified number.
	Rate	Sets the program rate. Press [Add] under the last step to insert a step including the same content as the last step. When you set it at "0", [Add] appears and the program will end at the previous step.
		Range -100.00 to 100.00 mL/min ²  NOTE Control range is different depending on the set value and the column.
		Default -
	Flow	Sets the initial flow and the final flow of each step.
		Range • When [Carrier Gas Type] is He, N2, or Ar 0.00 to 1300.00 mL/min • When [Carrier Gas Type] is H2 0.00 to 50.00 mL/min ▶▶ Reference "8.6.7 AFC and APC Control Ranges" P.434
		Default 1.00 mL/min
	Time	Sets the hold time for the initial flow and the final flow of each step.
		Range 0.00 to 9999.99 min
		Default 0.00 min
⑤	Total Time	Displays the total time of the program.

Creating a column flow program

- Screen terminology (1-ramp flow program)



- Example for 1-ramp flow program

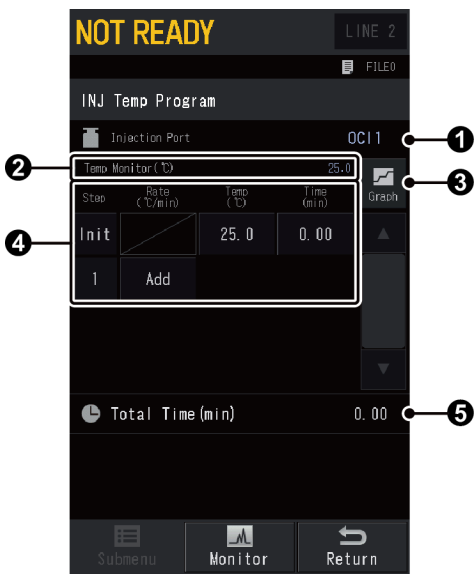


7.5.9 [INJ Temp Program] Screen

For OCI or PTV, press (HOME) - [Injection Port] - [Inj Temp Program] to display [INJ Temp Program] screen.

Set Inj Temp Program (1 to 7 steps) before analysis to change the temperature in the injection port during analysis.

In Inj Temp Program, the instrument can inject the sample at low temperature and then increase the injection port temperature to vaporize the sample element for analysis. It is useful for analysis of easily decomposable materials or reducing composition change of samples containing components over a wide boiling point range.



No.	Item	Description
①	Injection Port	Displays active injection port.

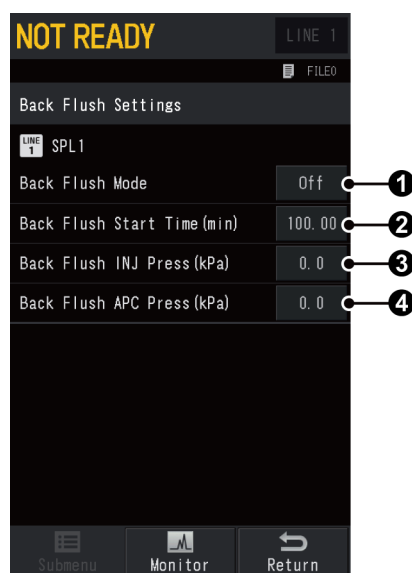
No.	Item	Description
②	Temp Monitor	Displays the current temperature.
③	 (Graph)	You can see the set temperature program in graph form. ▶▶ Reference "Graph window" P.25
④	Creating a program	You can create a temperature program (1 to 7 steps).
		Step
		Displays the number of steps currently set. Press [Init] or the number to insert or delete the step. Inserted step includes the same content as the step of [Init] or specified number.
		Rate
		Sets the program rate. Press [Add] under the last step to insert a step including the same content as the last step. When you set it at "0", [Add] appears and the program will end at the previous step.
		Range
		-400.00 to 400.00 °C/min
		Default
		-
		Temp
		Sets the initial temperature and the final temperature of each step.
		Range
		0.0 to 450.0 °C
		Default
		25.0 °C
		Time
		Sets the hold time for the initial temperature and the final temperature of each step.
		Range
		0.00 to 9999.99 min
		Default
		0.00 min
⑤	Total Time	Displays the total time of the program.

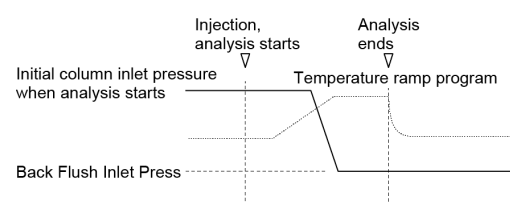
7.5.10 [Back Flush Settings] Screen

[Back Flush Settings] screen is displayed when you configure AFT and the injection port in the same analytical line and press  (HOME) - [Injection Port] - [Back Flush Setting].

For using the Back Flush, an optional back flush element (P/N: S221-72484-92) is required.

▶▶ Reference "8.8.1 Back Flush System" P.449



No.	Item	Description	
①	Back Flush Mode	Sets this item when using back flush function for analysis.	
		Items	• Off Disables back flush. • On Enables back flush. The instrument maintains the set value in ③ [Back Flush INJ Press] and ④ [Back Flush APC Press] and continues to blow the carrier gas back toward the column inlet even after analysis. 
		Default	Off
②	Back Flush Start Time	Sets the time to start back flush.	
		Range	0.00 to 9999.99 min
		Default	100.00 min

No.	Item	Description	
③	Back Flush INJ Press	Sets the column inlet pressure during back flush mode.	
		Range	0.0 to 970.0 kPa
		Default	0.0 kPa
④	Back Flush APC Press	Sets the APC pressure during back flush mode.	
		Range	0.0 to 970.0 kPa
		Default	0.0 kPa

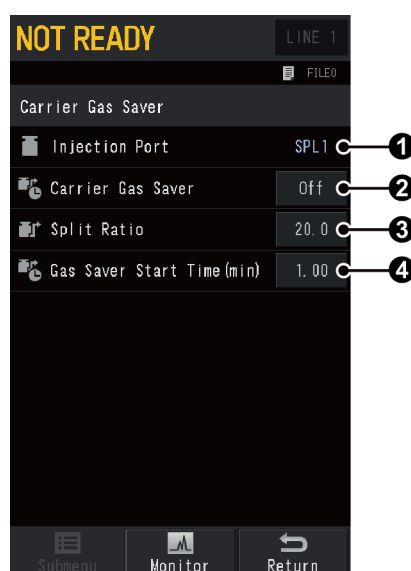
- NOTE**
- The set value in ④ [Back Flush APC Press] should be higher than that in ③ [Back Flush INJ Press].
 - Press  (PREP RUN) on the control panel to return the pressure from back flush mode to the set value for normal mode.
- ▶▶ Reference "7.9.10 [PREP RUN] Screen" P.381

7.5.11 [Carrier Gas Saver] Screen

Press  (HOME) - [Injection Port] - [Submenu] - [Carrier Gas Saver] to display [Carrier Gas Saver] screen.

This function can be used for split/splitless sample injection.

The carrier gas saver saves carrier gas by reducing the amount of carrier gas flowing through the split flow line.



No.	Item	Description
①	Injection Port	Displays active injection port.

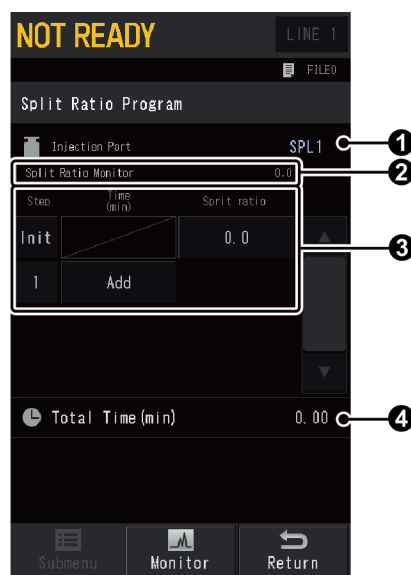
No.	Item	Description	
❷	Carrier Gas Saver	Select [On] to use settings to save carrier gas consumption (Carrier Gas Saver).	
		Items	Off, On
		Default	Off
❸	Split Ratio	Sets split ratio when using the carrier gas saver.	
		Range	0.0 to 9999.9
		Default	20.0
❹	Gas Saver Start Time	Sets the period of time after analysis starts until carrier gas saver starts. This period of time should be longer than the time required for the sample to move from the injection port to the column. If carrier gas saver starts before the sample moves to the column, repeatability of analysis may be impaired.	
		Range	0.00 to 9999.99 min
		Default	1.00 min

7.5.12 [Split Ratio Program] Screen

Press  (HOME) - [Injection Port] - [Submenu] - [Split Ratio Program] to display [Split Ratio Program] screen.

Set split ratio program (1 to 7 steps) before analysis to change the split ratio during analysis or after the sampling time in splitless analysis.

It is useful in cases where you need to increase the total flow when using pressure, velocity, or flow program.

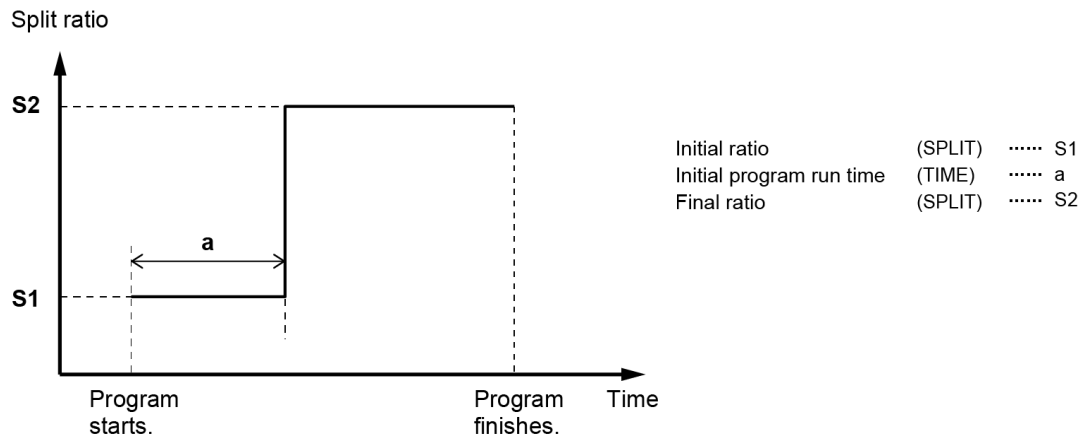


No.	Item	Description
❶	Injection Port	Displays active injection port.
❷	Split Ratio Monitor	Displays the current split ratio.

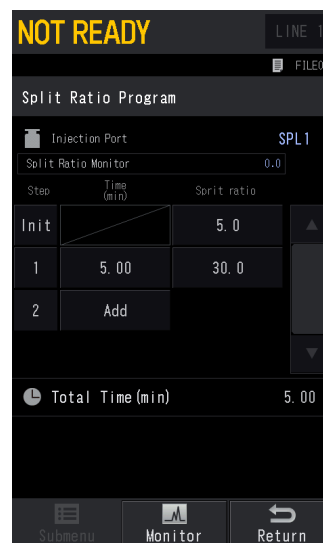
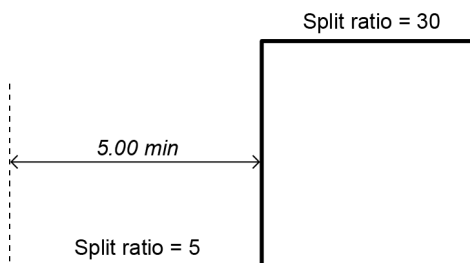
No.	Item		Description
③	Creating a program		You can create a split ratio program (1 to 7 steps).
		Step	Displays the number of steps currently set. Press [Init] or the number to insert or delete the step. Inserted step includes the same content as the step of [Init] or specified number.
		Time	Sets the period of time after analysis starts until split ratio control starts. Press [Add] under the last step to insert a step including the same content as the last step. When you set it at "0", [Add] appears and the program will end at the previous step.
			Range 0.00 to 9999.99 min
			Default 0.00 min
		Split Ratio	Sets the split ratio. Set the split ratio to "-1.0" to fix the total flow.
			Range -1.0, 0.0 to 9999.9
④	Total Time		Default -1.0
			Displays the total time of the program.

Creating a split ratio program

- Screen terminology (1-ramp)



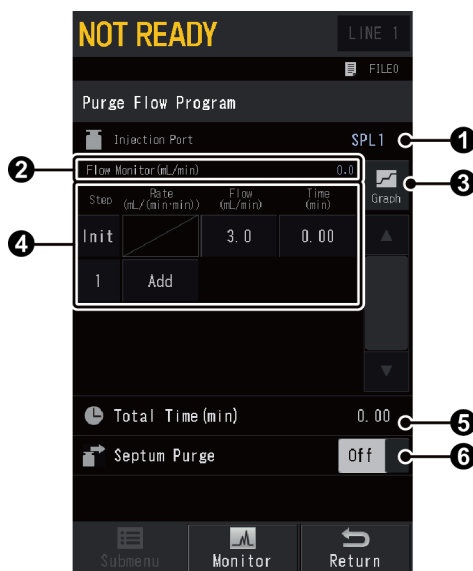
- Example for 1-ramp split ratio program



7.5.13 [Purge Flow Program] Screen

Press (HOME) - [Injection Port] - [Submenu] - [Purge Flow Program] to display [Purge Flow Program] screen.

Set purge flow program (1 to 7 steps) before analysis to change the septum purge flow during analysis.



No.	Item	Description
①	Injection Port	Displays active injection port.
②	Flow Monitor	Displays the current flow.
③	(Graph)	You can see the set flow program in graph form. ▶▶ Reference "Graph window" P.25

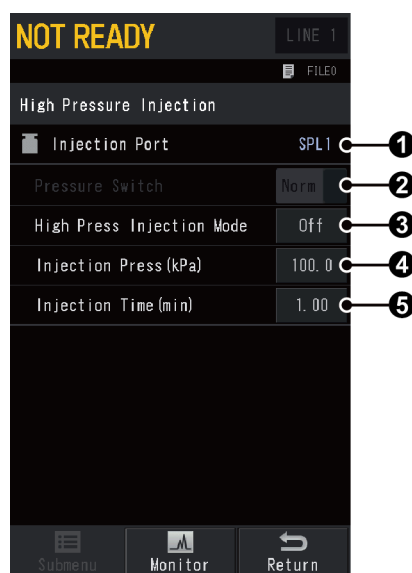
No.	Item	Description
④	Creating a program	You can create a purge flow program (1 to 7 steps).
	Step	Displays the number of steps currently set. Press [Init] or the number to insert or delete the step. Inserted step includes the same content as the step of [Init] or specified number.
	Rate	Sets the program rate. Press [Add] under the last step to insert a step including the same content as the last step. When you set it at "0", [Add] appears and the program will end at the previous step.
		Range -400.00 to 400.00 mL/min ²
		Default -
	Flow	Sets the initial flow and the final flow of each step.
		Range 0.0 to 1300.0 mL/min
		NOTE Control range is different depending on the inlet pressure or the total flow. ▶▶ Reference "8.6.7 AFC and APC Control Ranges" P.434
	Time	Sets the hold time for the initial flow and the final flow of each step.
		Range 0.00 to 9999.99 min
		Default 0.00 min
⑤	Total Time	Displays the total time of the program.
⑥	Septum Purge	Select [Off] to stop septum purge.
		Items Off, On
		Default On

7.5.14 [High Pressure Injection] Screen

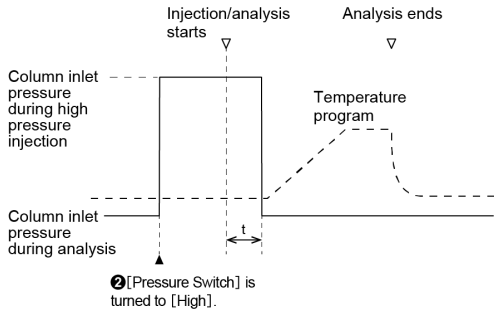
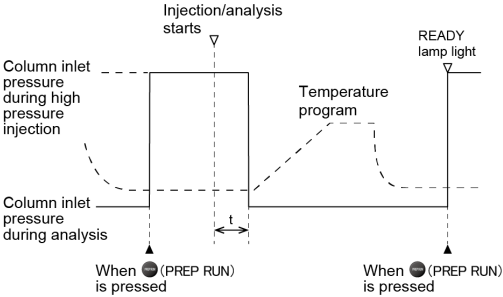
Press  (HOME) - [Injection Port] - [Submenu] - [High Press Setting] to display [High Pressure Injection] screen.

High pressure injection is a split/splitless injection method which keeps the column inlet pressure at a value higher than the analysis pressure for a specified period of time while the sample is injected. Then, the column inlet pressure returns to the normal analysis value. High pressure injection is effective especially for the splitless injection system. High pressure injection can reduce the total gas volume and reduce adsorption by increasing the speed of transition to the column, thus it may improve recovery rate. Sensitivity may be improved by increasing the injection amount in some cases.

NOTE Although it is available for split analysis, note that the split ratio is different from the set value during high pressure injection.



No.	Item	Description
①	Injection Port	Displays active injection port.
②	Pressure Switch	Displays the current control status of high pressure injection. Press [Default] or [High] to switch the control status. This can be set when ③ [High Press Injection Mode] is set at [On] or [Auto].
		Items Default, High
		Default -

No.	Item	Description	
③	High Press Injection Mode	Sets high press injection mode.	
		Items	• Off Disables high pressure injection. • On When ② [Pressure Switch] is set at [High], column inlet pressure is changed to the pressure for high pressure injection.  ② [Pressure Switch] is turned to [High]. • Auto Column inlet pressure is changed to the pressure for high pressure injection when you set ② [Pressure Switch] at [High] or you press  (PREP RUN) on the control panel.  When  (PREP RUN) is pressed When  (PREP RUN) is pressed
		Default	Off
④	Injection Press	Sets the inlet pressure for high pressure injection.	
		Range	0.0 to 970.0 kPa ▶▶ Reference "8.6.7 AFC and APC Control Ranges" P.434
		Default	100.0 kPa
⑤	Injection Time	Sets the period of time after analysis starts until the column inlet pressure returns to the value for analysis. Usually, set this value equal to the sampling time for splitless analysis.	
		Range	0.00 to 9999.99 min
		Default	1.00 min

7.5.15 [Splitter Hold] Screen

Press  (HOME) - [Injection Port] - [Submenu] - [Splitter Hold] to display [Splitter Hold] screen.

If the injected sample consists of a solvent with a high vaporization expansion coefficient, the pressure inside the injection port drastically increases when the solvent vaporizes. The pressure inside the injection port may also increase depending on the injection volume or injection speed during manual injection with a gas tight syringe. As a result, ESC (Electronic Split Controller) may operate to lower the inlet pressure which is higher than the set pressure and too much sample components may be discharged from the split vent, reducing sensitivity.

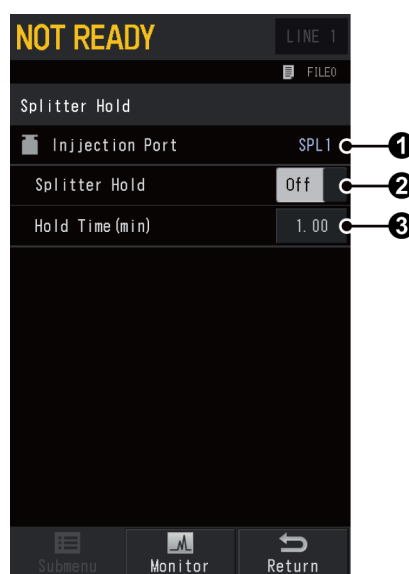
▶▶ Reference "8.6.4 Control by AFC" P.429

In the splitter hold mode, the voltage on the ESC is fixed right before the sample injection, which prevents the discharge of the sample at more than the specified split ratio.

The voltage on the ESC is fixed when [Splitter Hold] on [Splitter Hold] screen is turned [On].

When the time set in [Hold Time] has elapsed after the analysis starts, [Splitter Hold] is turned [Off].

- NOTE**
- When the splitter hold state is kept for a long time, the pressure cannot be maintained at a constant level and analysis cannot be performed with good repeatability. To use the splitter hold mode during manual injection, turn it [On] after the instrument is ready, wait for several seconds, and inject the sample to start analysis.
 - Not available when using autosampler or other sampler.



No.	Item	Description
①	Injection Port	Displays active injection port.

No.	Item	Description	
②	Splitter Hold	Displays the current control status of splitter hold. When you select [On], the voltage on the solenoid valve of the split flow line is fixed.	
		Items	Off, On
		Default	Off
③	Hold Time	Sets the period of time to maintain splitter hold mode after analysis starts.	
		Range	0.00 to 9999.99 min  Hint Normally, set it at about "1.00 min".
		Default	1.00 min

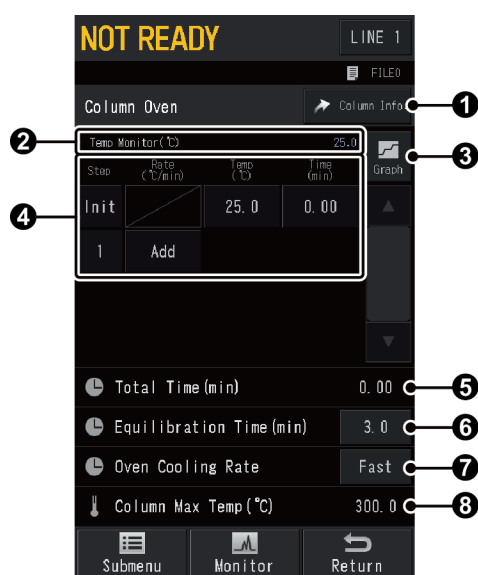
7.6 Column

You can set up the column and the column oven temperature program.

7.6.1 [Column Oven] Screen

Press  (HOME) - [Column] to display [Column Oven] screen.

You can create a column oven temperature program (1 to 32 steps) and set up the column oven.



No.	Item	Description
1	Column Info.	Displays [Column Information] screen. ▶▶ Reference "7.6.2 [Column Information] Screen" P.292
2	Temp Monitor	Displays current temperature of the column oven.
3	 (Graph)	You can see the set temperature program in graph form. ▶▶ Reference "Graph window" P.25

No.	Item		Description
4	Creating a temperature program		You can create a temperature program (1 to 32 steps).
	Step	Step	Displays the number of steps currently set. Press [Init] or the number to insert or delete the step. Inserted step includes the same content as the step of [Init] or specified number.
		Rate	Sets the program rate. Press [Add] under the last step to insert a step including the same content as the last step. When you set it at "0", [Add] appears and the program will end at the previous step.
			Range 0, -250.00 to 250.00 °C/min ▶▶ Reference "Controllable ranges of temperature program rates" P.290
			Default 0.0 °C
	Temp	Sets the initial temperature and the final temperature of each step.	
		 CAUTION  The column oven temperature should never exceed the maximum operating temperature of the column. This can damage the column. Keep the column temperature as low as possible to prolong the column life and reduce detector noise.  Never increase the column oven temperature while air (oxygen) is mixed with the carrier gas. This can degrade the liquid phase of the column (especially for polar columns).	
		 NOTE Enter the upper limit of the column temperature correctly into [Max Usable Temp] on [Column Information] screen. The maximum column temperature set on [Column Information] screen is the upper limit of the column oven temperature. ▶▶ Reference "7.6.2 [Column Information] Screen" P.292	
		Range	0.0 °C to displayed value in [Column Max Temp]
		Default	25.0 °C

No.	Item		Description	
④		Time	Sets the hold time for the initial temperature and the final temperature of each step.	
			Range	0.00 to 9999.99 min
			Default	0.00 min
⑤	Total Time		Displays the total time of the program.	
⑥	Equilibration Time	Set equilibration time to stabilize the temperature in the column oven and to achieve even temperature distribution. After the oven temperature returns to the set value (initial value in programmed analysis), the instrument waits the equilibration time and then goes into Ready mode.		
		Range	0.0 to 9999.9 min	
		Default	3.0 min	
⑦	Oven Cooling Rate	Sets cooling rate of the oven.		
		 NOTE When it is set at [Fast], the oven is cooled at the fastest rate from the start of the cooling, therefore, liquid phase of the column may be damaged and it may shorten the life under some conditions. To reduce damage of the column, set Oven Cooling Rate at [Mid] or [Slow].		
		 Hint Cooling rate switching temperature can be set on [Column Oven Temp Control Settings] screen. ▶▶ Reference "7.6.3 [Column Oven Temp Control Settings] Screen" P.294		
		Items	• Fast Cools the oven at the fastest rate from the start of the cooling. • Mid Cools the oven at the specified rate (50 °C/min) until it reaches cooling rate switching temperature, and then at the fastest rate. • Slow Cools the oven at the specified rate (30 °C/min) until it reaches cooling rate switching temperature, and then at the fastest rate. • Custom Cools the oven at the set rate until it reaches cooling rate switching temperature, and then at the fastest rate.	
		Default	Fast	

No.	Item	Description
⑧	Column Max Temp	Displays the maximum operating temperature of the column. The lower value of the value set in [Max Usable Temp] on [Column Information] screen and the value set in [Column] on [Max Temperature] screen is displayed. ▶▶ Reference • "7.6.2 [Column Information] Screen" P.292 • "[Max Temperature] Screen" P.336

Submenu

Item	Description	See also
Column Oven Temp Control Settings	Displays [Column Oven Temp Control Settings] screen. You can set column oven control after analysis.	P.294
Fan	Sets operation of the column oven fan. [Off] is displayed when the column oven fan is turned on, while [On] when the fan is turned off. NOTE - This item cannot be changed when the column oven temperature is higher than 50 °C or any program is running. - During the GC stop sequence, the oven fan automatically stops based on settings in [Fan Off Temp] on [Other Configurations] screen. ▶▶ Reference "[Other Configurations] Screen" P.350	-

Temperature program

• Types of temperature program

• Isothermal analysis

The isothermal analysis technique keeps the column oven temperature at a constant value, which is optimal for separating compounds.

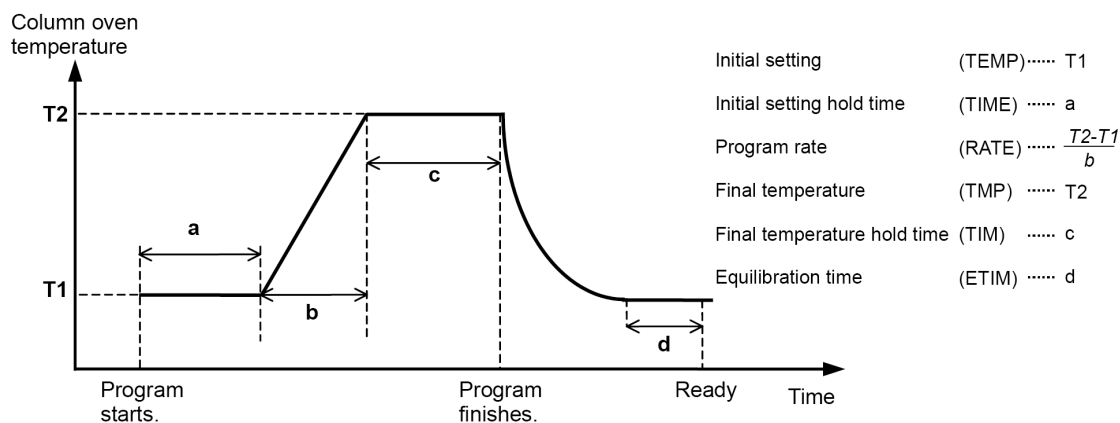
• Programmed analysis

Programmed analysis technique increases the column oven temperature gradually from lower temperature.

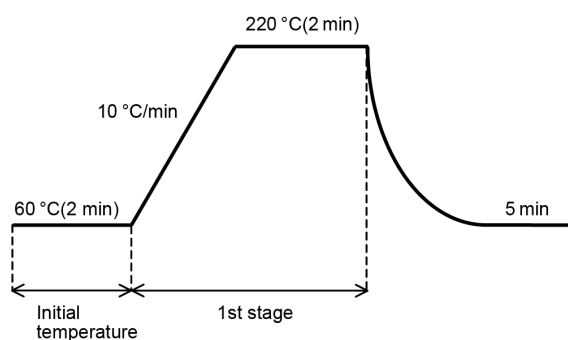
When isothermal analysis is performed on a sample containing components over a wide boiling point range at a temperature optimum for separating low-boiling components, elution of high-boiling components is delayed. As a result, peaks become wide and the detection of minor components is difficult. When isothermal analysis is performed at a temperature where high-boiling components elute rapidly, low-boiling components elute extremely fast, making separation difficult. This means there is an optimal temperature for separating each component. In isothermal analysis however, a temperature can be optimum for certain components but inadequate for other components.

When analyzing samples containing components over a wide boiling point range, each component elutes at a temperature suitable for it while the column oven temperature increases gradually from lower temperature.

- Creating a temperature program
Screen terminology (1-ramp temperature program)

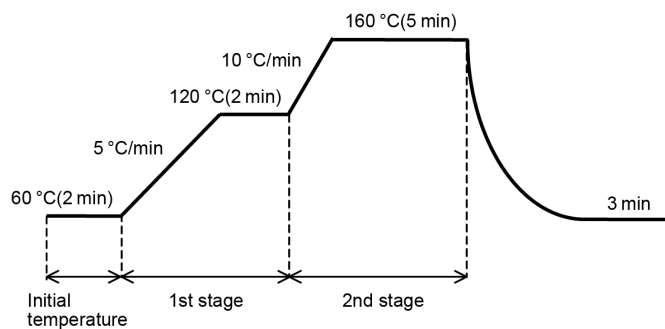


- Example for 1-ramp temperature program



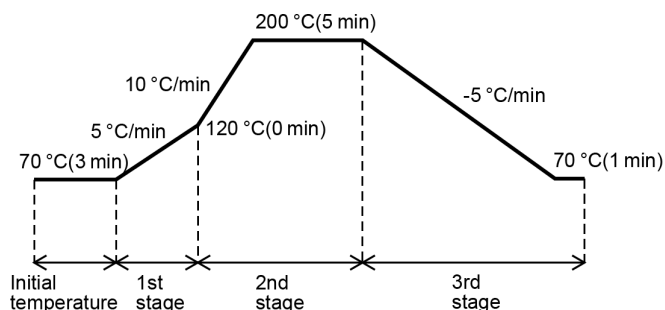
NOT READY		LINE 1	
Column Oven		Column Info.	
Temp Monitor (°C)		25.0	
Step	Rate (°C/min)	Temp (°C)	Time (min)
Init		60.0	2.00
1	10.00	220.0	2.00
2	Add		
Total Time (min)		20.00	
Equilibration Time (min)		5.0	
Oven Cooling Rate		Fast	
Column Max Temp (°C)		300.0	
Submenu		Monitor	
		Return	

- Example for 2-ramp temperature program



NOT READY		LINE 1	
Column Oven		Column Info.	
Temp Monitor (°C)		25.0	
Step	Rate (°C/min)	Temp (°C)	Time (min)
Init		60.0	2.00
1	5.00	120.0	2.00
2	10.00	160.0	5.00
3	Add		
Total Time (min)		25.00	
Equilibration Time (min)		3.0	
Oven Cooling Rate		Fast	
Column Max Temp (°C)		300.0	
Submenu		Monitor	
		Return	

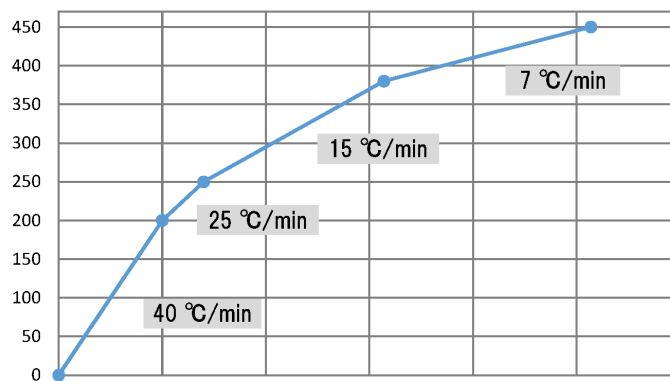
- Example for multi-ramp temperature program (with temp increase /decrease)



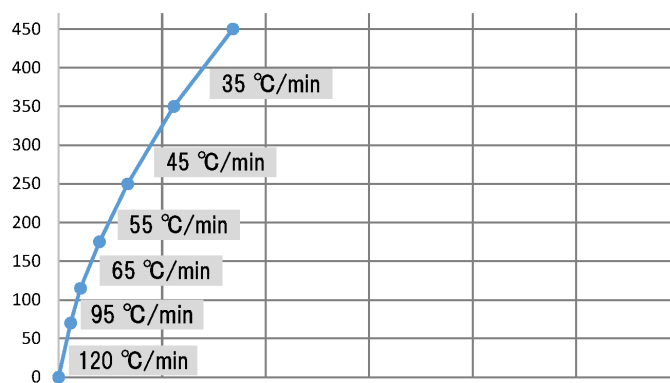
Controllable ranges of temperature program rates

Item		Control range
Heating Normal oven	to 200 °C	0 °C to 40 °C/min
	to 250 °C	0 °C to 25 °C/min
	to 380 °C	0 °C to 15 °C/min
	to 450 °C	0 °C to 7 °C/min
Heating High power oven	to 70 °C	0 °C to 120 °C/min
	to 115 °C	0 °C to 95 °C/min
	to 175 °C	0 °C to 65 °C/min
	to 250 °C	0 °C to 55 °C/min
	to 350 °C	0 °C to 45 °C/min
	to 450 °C	0 °C to 35 °C/min
Cooling		Different depending on the room temperature or the oven temperature.

- Normal oven



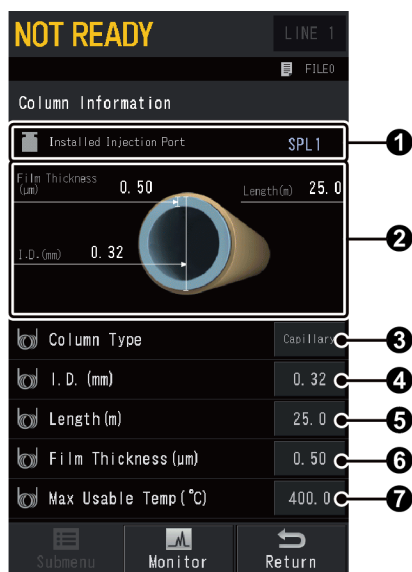
- High power oven



7.6.2 [Column Information] Screen

Press  (HOME) - [Column] - [Column Info.] to display [Column Information] screen.

When you set [Inner Diameter], [Length] and [Film Thickness] of the capillary column and then set the column inlet pressure, the instrument automatically calculates the carrier gas flow rate and the linear velocity at column initial temperature. When you set the carrier gas flow rate or linear velocity, the instrument automatically calculates the column inlet pressure at column initial temperature.



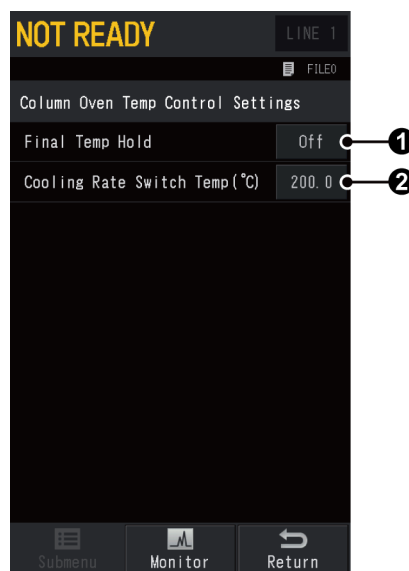
No.	Item	Description
①	Installed Injection Port	Displays installed injection port.
②	Column Info.	Illustrates the column information.
③	Column Type	Sets the column type to be used.
		Items Capillary, Packed
		Default Capillary
④	I.D.	Sets the inner diameter of the column.
		Range 0.01 to 6.00 mm
		Default 0.32 mm
⑤	Length	Sets the length of the column.
		Range 0.1 to 250 m
		Default 25.0 m

No.	Item	Description				
6	Film Thickness	Sets the film thickness of the column. You cannot set this item when [Column Type] is set at [Packed].  NOTE When you use columns with unknown film thickness (such as PLOT or WCOT), enter an arbitrary number or [0]. In these cases, pressure, flow rate, and linear velocity are not correct.				
		<table><tr><td>Range</td><td>0.00 to 300.00 μm</td></tr><tr><td>Default</td><td>0.50 μm</td></tr></table>	Range	0.00 to 300.00 μm	Default	0.50 μm
		Range	0.00 to 300.00 μm			
Default	0.50 μm					
7	Max Usable Temp	Sets the upper limit of the column temperature.  Hint • This item is linked with the setting for the maximum operating temperature of the column on [Max Temperature] screen. • Some capillary column have 2 kinds of the maximum operating temperature. Select either of them depending on the analysis conditions. • Higher : Use it for short-time (about temperature 30 min.) programmed analysis. • Lower : Use it for isothermal analysis temperature or long-time (over 30 min.) programmed analysis. ▶▶ Reference "[Max Temperature] Screen" P.336				
		<table><tr><td>Range</td><td>0.0 to 470.0 °C</td></tr><tr><td>Default</td><td>400.0 °C</td></tr></table>	Range	0.0 to 470.0 °C	Default	400.0 °C
		Range	0.0 to 470.0 °C			
Default	400.0 °C					

7.6.3 [Colum Oven Temp Control Settings] Screen

Press  (HOME) - [Column] - [Submenu] - [Column Oven Temp Control Settings] to display [Oven Temp Control Settings] screen.

You can set column oven control after analysis.

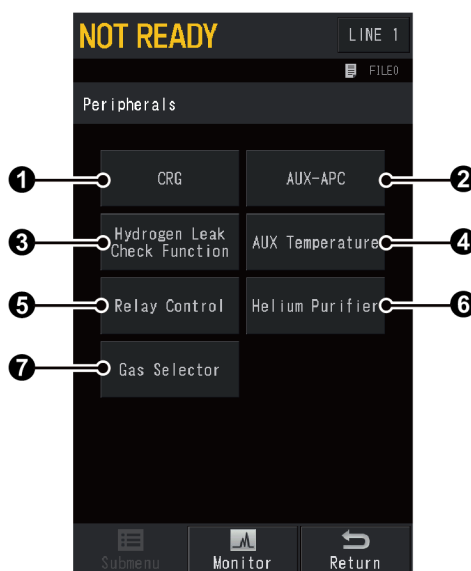


No.	Item	Description
①	Final Temp Hold	Select [On] to maintain the temperature in the last step of column oven temperature program after analysis. ▶▶ Reference "7.6.1 [Column Oven] Screen" P.285
		Items Off, On
		Default On
②	Colling Rate Switch Temp	Sets the temperature to switch cooling rate during oven cooling. Cools the oven at the rate set in Oven Cooling Rate until it reaches the temperature set here, and then at the fastest rate. ▶▶ Reference "7.6.1 [Column Oven] Screen" P.285
		 NOTE It is available except when [Oven Cooling Rate] is set at [Fast].
		Range 0.0 to 470.0 °C
		Default 200.0 °C

7.7 Peripherals

You can set up optional devices including CRG and AUX-APC.

The items on the screen are different depending on the units installed on the instrument and settings.



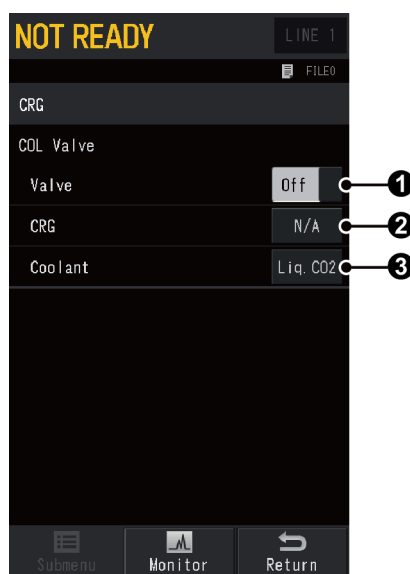
No.	Item	Description	See also
①	CRG	Set this item when using low-temperature oven controller CRG.	P.296
②	AUX-APC	Set this item when using APC other than detector gas (AUX-APC).	P.297
③	Hydrogen Leak Check Function	Set this item when using hydrogen sensor.	P.300
④	AUX Temperature	Sets temperature controllers other than column oven, injection port, and detector.	P.301
⑤	Relay Control	Sets relay control.	P.302
⑥	Helium Purifier	Set this item when using helium purifier.	P.305
⑦	Gas Selector	Set this item when using gas selector.	P.306

7.7.1 [CRG] Screen

Press  (HOME) - [Peripherals] - [CRG] to display [CRG] screen.

Set these parameters when using oven low-temperature control solenoid valve CRG. CRG is a device to cool the column oven with coolant (liquid CO₂ or liquid N₂). CRG enables analysis at lower temperatures than room temperature. Control range of the column oven temperature becomes -50.0 °C to 450.0 °C when using liquid CO₂, and -99.0 °C to 450.0 °C when using liquid N₂.

▶▶ Reference "8.7.1 CRG CO₂/CRG N₂" P.443



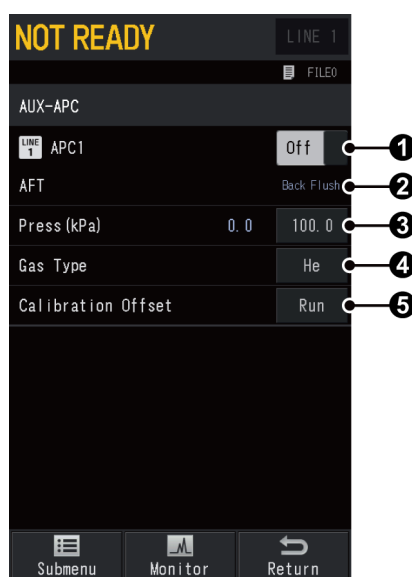
No.	Item	Description	
❶	Valve	Displays the control status of coolant valve. Press [Off] or [On] to switch the control status. Set at [On] to control the coolant valve.	
		 NOTE If you set ❶ [Valve] at [Off] after setting the temperature lower than room temperature using CRG, the instrument will not be READY state because the temperature does not return the set value.	
		Items	Off, On
		Default	Off
❷	CRG	Set ❶ [Valve] at [On] and ❷ [CRG] at [Usable] to control the column oven with CRG. Set ❶ [Valve] at [On] and ❷ [CRG] at [N/A] to control the valve with CRG.	
		Items	N/A, Usable
		Default	N/A

No.	Item	Description	
③	Coolant	Sets coolant.	
		Items	Liq. CO2, Liq. N2
		Default	Liq. CO2

7.7.2 [AUX-APC] Screen

To display [AUX-APC] screen, press  (HOME) - [Peripherals] - [AUX-APC] after you install optional AUX-APC.

You can set pressure and gas type for AUX-APC. APC is available up to APC18.



No.	Item	Description	
①	AUX-APC Control	Displays the current status of AUX-APC control. Press [Off] or [On] to switch the control status. Set at [On] to control AUX-APC.	
		Items	Off, On
		Default	Off
②	AFT	Displays AFT mode. Cannot set this item.	
③	Press	Sets the pressure. Blue text is the actual value.	
		Range	0.0 to 970.0 kPa
		Default	100 kPa
④	Gas Type	Selects the gas type supplied to the APC.	
		Items	He, N2, H2, Ar
		Default	He

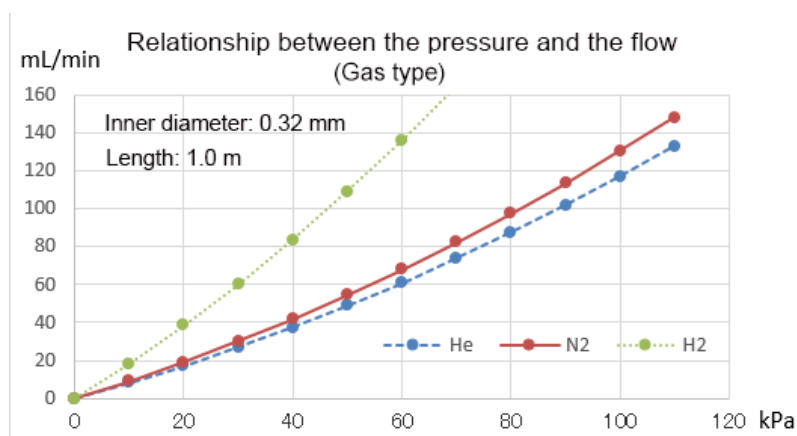
No.	Item	Description
⑤	Calibration Offset	Press [Run] to perform calibration so that the displayed AUX-APC pressure becomes "0 kPa" at atmospheric pressure. Use this function before GC starts or if the displayed pressure is not "0 kPa" while the gas supply stops (exposed to atmospheric pressure).

Submenu

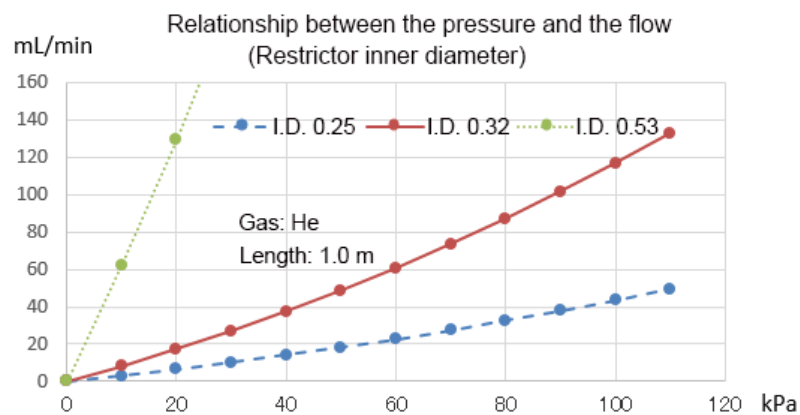
Item	Description	See also
Back Flush Setting	Displays [Back Flush Settings] screen. This item is displayed when AFT and the injection port are configured in the same analytical line.	P.275
APC Program	Displays [AUX-APC Pressure Program] screen.	P.299

Relationship between the pressure and the flow

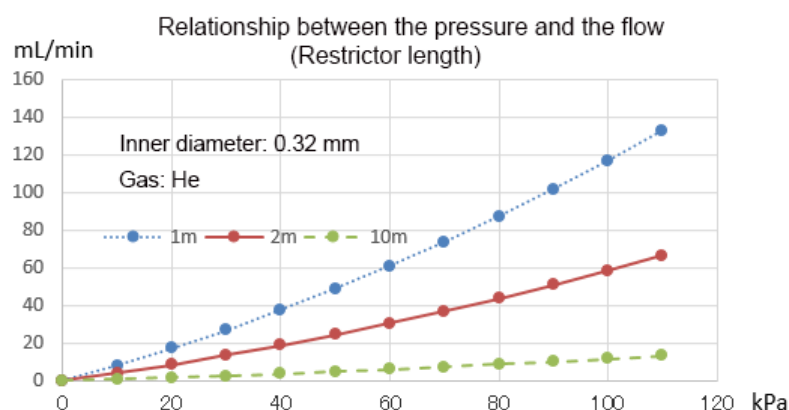
- Relationship between the pressure and the flow of different gas types



- Relationship between the pressure and the flow when using the restrictor with different inner diameters

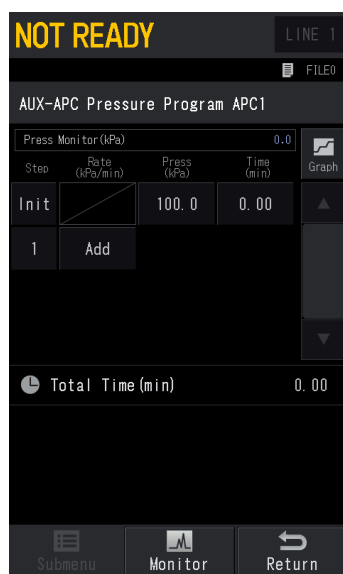


- Relationship between the pressure and the flow when using the restrictor with different length



■ [AUX-APC Pressure Program] Screen

To display [AUX-APC Pressure Program] screen, press (HOME) - [Peripherals] - [AUX-APC] - [Submenu] - [APC Program] after you install optional AUX-APC. You can create a program (1 to 7 steps).



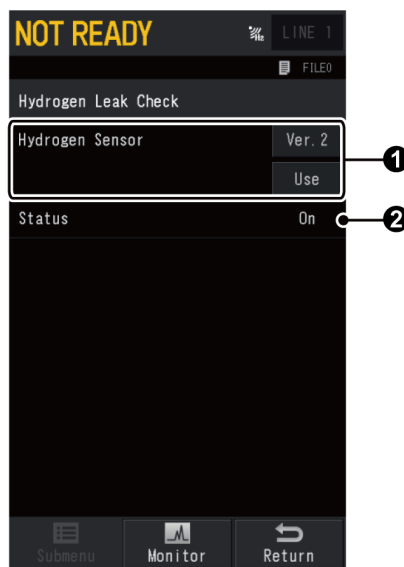
▶▶ **Reference** Creating procedure is the same as analysis program. For details, see each program sections.
"7.5.6 [Column Inlet Press Program] Screen" P.267

7.7.3 [Hydrogen Leak Check] Screen

Press  (HOME) - [Peripherals] - [Hydrogen Leak Check Function] to display [Hydrogen Leak Check] screen.

Set this item when an optional hydrogen sensor (P/N: S221-78910-41/S221-88999-41) is connected.

▶▶ Reference "8.7.3 Hydrogen Sensor" P.447



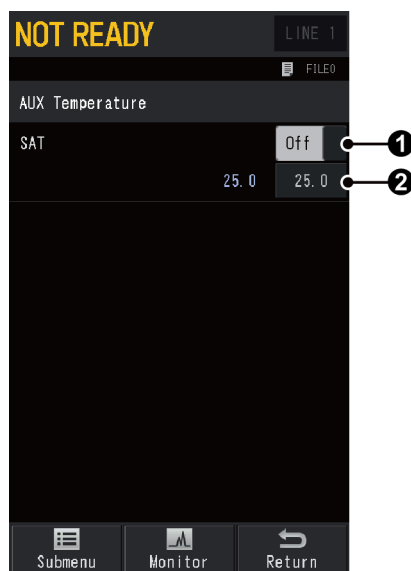
No.	Item	Description	
①	Hydrogen Sensor	Installation	Set [Ver.2] to display  (hydrogen sensor) icon on the screen, monitors hydrogen leak.
			Items N/A, Ver.1, Ver.2
			Default N/A
		Aspiration	When you set [Use], aspirate atmosphere in the column oven.
			Items Not Use, Use
			Default Use
②	Status*	Display the status of the hydrogen sensor.	

* The status is displayed when ① the hydrogen sensor is set to [Ver.2].

7.7.4 [AUX Temperature] Screen

To display [AUX Temperature] screen, press  (HOME) - [Peripherals] - [AUX Temperature] after you install optional heater, etc.

On this screen, set temperatures other than column oven, injection port, and detector.



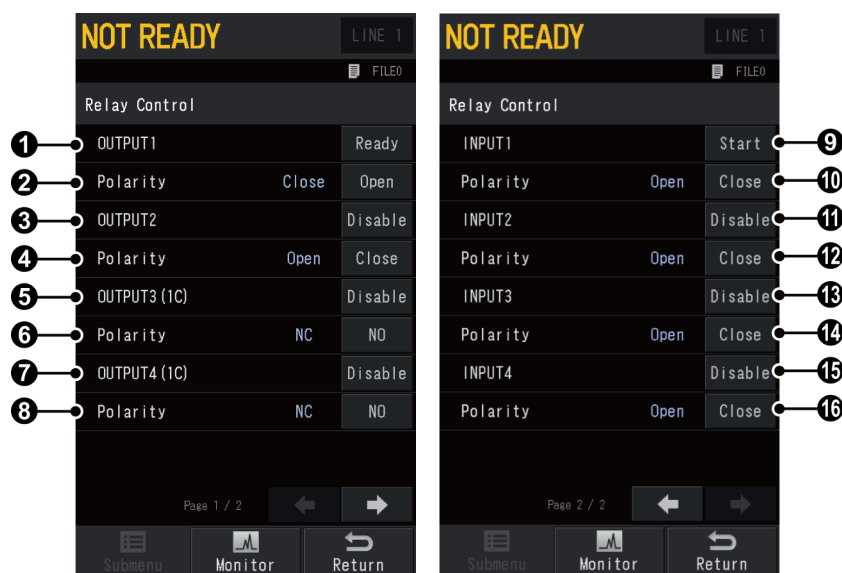
No.	Item	Description
①	Temp Control	Displays the current control status. Press [Off] or [On] to switch the control status. Select [On] to control the temperature of each unit.
		Items Off, On
		Default On
②	Temp Setting	Sets the temperature. This can be set when ① [Temp Control] is [On].
		Range 0.0 to 450.0 °C  NOTE The maximum value when using a satellite oven is 420 °C.
		Default 25.0 °C

7.7.5 [Relay Control] Screen

Press  (HOME) - [Peripherals] - [Relay Control] to display [Relay Control] screen.

Set it to perform auto sample injection using solenoid valve or sample cock, or signal switching.

▶▶ Reference "8.9.4 Connecting to Relay Cable" P.464



No.	Item	Description	
①	OUTPUT1	Sets the type of relay output 1. Outputs the signal set in ② [Polarity] when the instrument is in the state set in [Item].	
		Items	Ready, Run, Start, Error, Disable
		Default	Ready
②	Polarity	Sets the polarity of relay output 1. Relay switches to the set polarity when the instrument outputs signals.	
		Items	Open, Close
		Default	Open
③	OUTPUT2	Sets the type of relay output 2. Outputs the signal set in ④ [Polarity] when the instrument is in the state set in [Item].	
		Items	Ready, Run, Start, Error, Disable
		Default	Disable
④	Polarity	Sets the polarity of relay output 2. Relay switches to the set polarity when the instrument outputs signals.	
		Items	Open, Close
		Default	Close

No.	Item	Description
⑤	OUTPUT3 (1C)	Sets the type of relay output 3. Outputs the signal set in ⑥ [Polarity] when the instrument is in the state set in [Item]. When [Event91] is selected, you cannot set ⑥ [Polarity].
		Items Ready, Run, Start, Error, Event91, Disable
		Default Disable
⑥	Polarity	Sets the polarity of relay output 3. Relay switches to the set polarity when the instrument outputs signals. ※NO:(NO=OPEN, C-NC=CLOSE), NC(C-NO=CLOSE, NC=OPEN)
		Items NO, NC
		Default NO
⑦	OUTPUT4 (1C)	Sets the type of relay output 4. Outputs the signal set in ⑧ [Polarity] when the instrument is in the state set in [Item]. When [Event92] is selected, you cannot set ⑧ [Polarity].
		Items Ready, Run, Start, Error, Event92, Disable
		Default Disable
⑧	Polarity	Sets the polarity of relay output 4. Relay switches to the set polarity when the instrument outputs signals. ※NO:(NO=OPEN, C-NC=CLOSE), NC(C-NO=CLOSE, NC=OPEN)
		Items NO, NC
		Default NO
⑨	INPUT1	Sets the type of relay input 1. Performs the set action when the signal set in ⑩ [Polarity] is inputted.
		Items Start, Wait, PREP RUN, Stop, Error, Disable
		Default Start
⑩	Polarity	Sets the polarity of relay input 1. Performs the action set in ⑨ [INPUT1] when a signal with the set polarity is inputted.
		Items Open, Close
		Default Close
⑪	INPUT2	Sets the type of relay input 2. Performs the set action when the signal set in ⑫ [Polarity] is inputted.
		Items Start, Wait, PREP RUN, Stop, Error, Disable
		Default Disable
⑫	Polarity	Sets the polarity of relay input 2. Performs the action set in ⑪ [INPUT2] when a signal with the set polarity is inputted.
		Items Open, Close
		Default Close
⑬	INPUT3	Sets the type of relay input 3. Performs the set action when the signal set in ⑭ [Polarity] is inputted.
		Items Start, Wait, PREP RUN, Stop, Error,Disable
		Default Disable

No.	Item	Description	
14	Polarity	Sets the polarity of relay input 3. Performs the action set in 13 [INPUT3] when a signal with the set polarity is inputted.	
		Items	Open, Close
		Default	Close
15	INPUT4	Sets the type of relay input 4. Performs the set action when the signal set in 16 [Polarity] is inputted.	
		Items	Start, Wait, PREP RUN, Stop, Error, Disable
		Default	Disable
16	Polarity	Sets the polarity of relay input 4. Performs the action set in 15 [INPUT4] when a signal with the set polarity is inputted.	
		Items	Open, Close
		Default	Close

[PRG] tab is displayed when optional PRG is installed.

In [PRG] tab, you can check and change relay status.

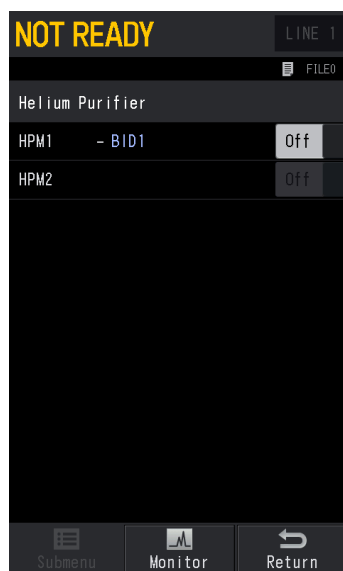


7.7.6 [Helium Purifier] Screen

To display [Helium Purifier] screen, press  (HOME) - [Peripherals] - [Helium Purifier] after you install optional helium purifier (P/N: S221-77730-41).

Displays the current control status of helium purifier connected to the unit.

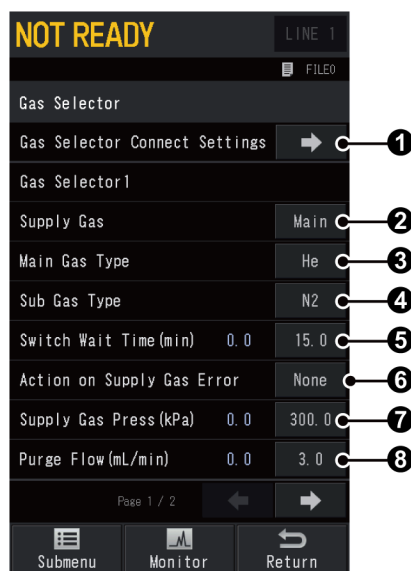
Press [Off] or [On] to switch the control status.



7.7.7 [Gas Selector] Screen

To display [Gas Selector] screen, press  (HOME) - [Peripherals] - [Gas Selector] after you install optional gas selector (P/N: S221-84916-41).

Set the gas type supplied by the gas selector. Up to 2 gas selectors can be connected.



No.	Item	Description	
①	Gas Selector Connect Settings	Displays [Gas Selector Connect Settings] screen. Sets the flow controller connected to the gas selector. ▶▶ Reference "[Gas Selector Connect Settings] Screen" P.311	
②	Supply Gas	Sets the gas supplied by the gas selector.	
		Items	Main, Sub
		Default	Main
③	Main Gas Type	Sets the main gas type.	
		Items	He, N2, H2, Ar ▼ NOTE Available items depend on the type of the connected flow controller. (Example) When FID is connected, "H2" is not available because H2 cannot set as the makeup gas of FID.
		Default	He

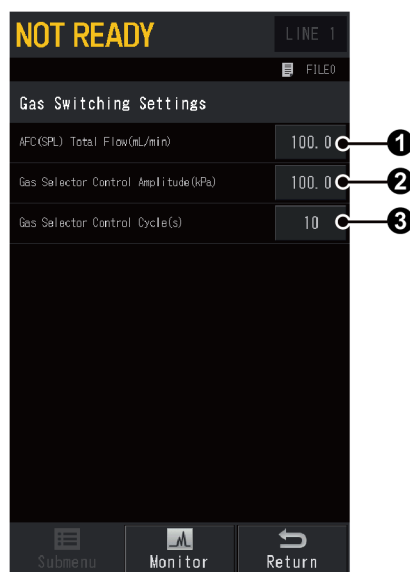
No.	Item	Description	
④	Sub Gas Type	Sets the sub gas type.	
		Items	He, N2, H2, Ar  NOTE Available items depend on the type of the connected flow controller. (Example) When FID is connected, "H2" is not available because H2 cannot set as the makeup gas of FID.
		Default	N2
⑤	Switch Wait Time	Sets the waiting time until the instrument becomes READY state after the gas supplied by the gas selector is switched.	
		 Hint - When the GC is started for the first time after turning on the power of the instrument, the value set in ⑤ [Switch Wait Time] is counted even if the supply gas is not switched. - When the count value (measured value) of the waiting time for gas switching reaches the set value, the count value returns to "0". - The count value (measured value) of the waiting time for gas switching remains "0" before starting the GC.	
		 NOTE If using the gas selector with TCD carrier gas supply or make up gas supply, do not perform analysis until the baseline becomes stable. Since the current is turned off temporarily when switching the gas, wait for the baseline to stabilize after switching the gas.	
		Range	0.0 to 9999.0 min
	Default	15.0 min	
⑥	Action on Supply Gas Error	Sets the action when an error occurs in the gas supply on the supplying side leading to an error in the gas selector. When set to [Gas Switch], the supplied gas is switched and the gas supply is continued.	
		Items	None, Gas Switch
		Default	None
⑦	Supply Gas Press	Sets the pressure supplied by the gas selector. Set it aligning to the supply pressure of Main gas or Sub gas, whichever is lower.	
		Range	0.0 to 970.0 kPa
		Default	300 kPa
⑧	Purge Flow	Purges the flow in the gas selector with supply gas.	
		Range	0.0 to 1200.0 mL/min
		Default	3.0 mL/min

Submenu

Item	Description	See also
Gas Switching Settings	Displays [Gas Switching Settings] screen.	P.308

■ [Gas Switching Settings] Screen

Press  (HOME) - [Peripherals] - [Gas Selector] - [Submenu] - [Gas Switching Settings] to display [Gas Switching Settings] screen.



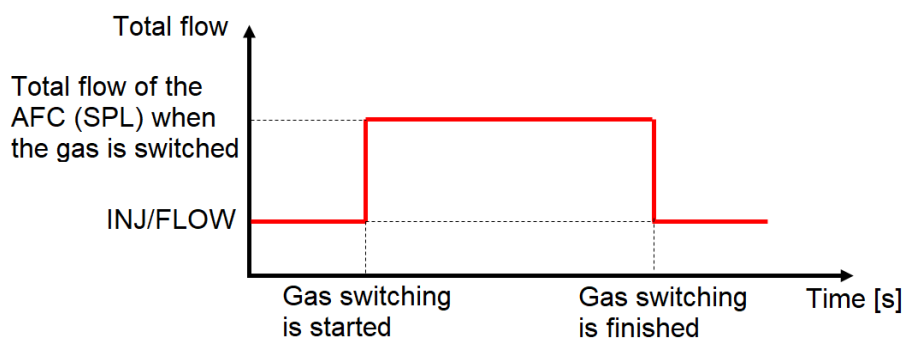
No.	Item	Description
①	AFC(SPL) Total Flow	Sets the total flow of the AFC for split/splitless when the gas is switched.
		Range 0.0 to 500.0 mL/min
		Default 100.0 mL/min
②	Gas Selector Control Amplitude	Sets the control amplitude of the gas selector when the gas is switched.
		Range 0.0 to 970.0 kPa
		Default 100.0 kPa
③	Gas Selector Control Cycle	Sets the control cycle of the gas selector when the gas is switched.
		Range 0 to 60 s
		Default 10 s

Sequence when the gas is switched

- Total flow of the AFC (SPL) when the gas is switched

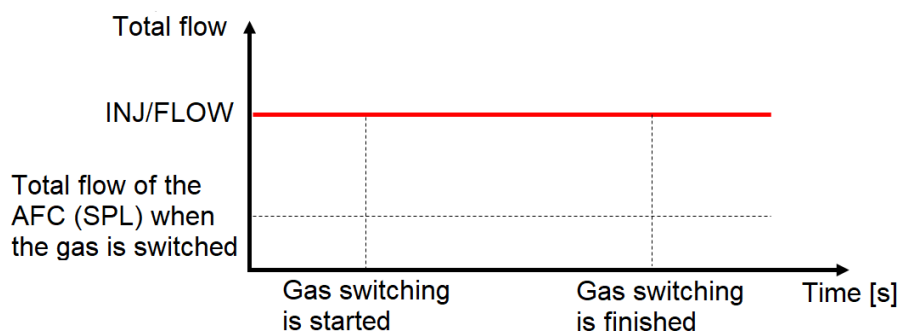
When the set value of [Total Flow] on the [INJ/FLOW] screen is smaller

When gas switching is started, the set value of [AFC(SPL) Total Flow] on the [Gas Switching Settings] screen has priority.



When the set value of [Total Flow] on the [INJ/FLOW] screen is larger

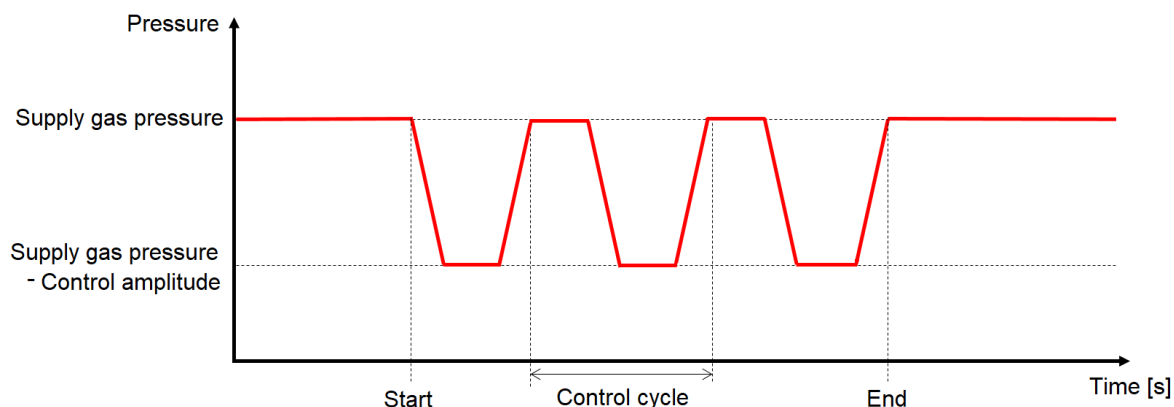
Even after gas switching is started, the value of [Total Flow] on the [INJ/FLOW] screen has priority.



NOTE Only when the AFC for split/splitless analysis is used, the total flow changes as shown above when the gas is switched. When the AFC for direct analysis or DAFC for packed analysis is used, the flow is not changed from the value set on the [INJ/FLOW] screen after the gas is switched.

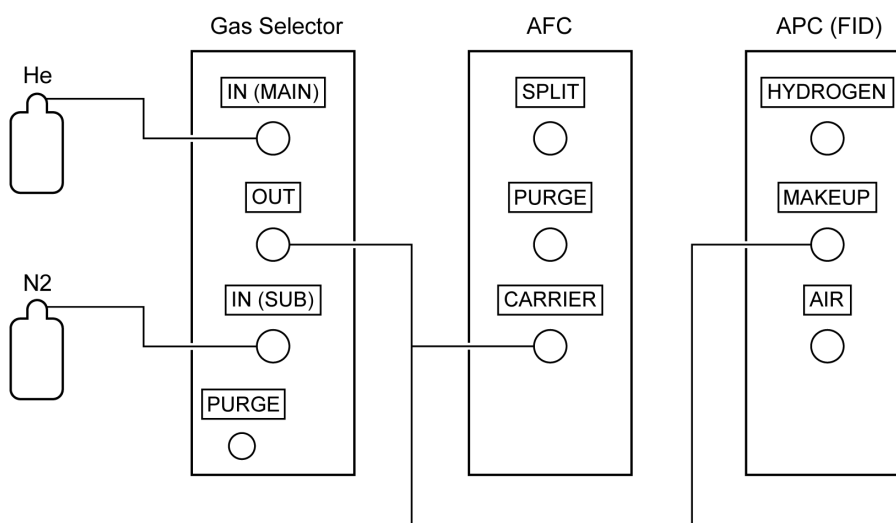
- Supply gas pressure of the gas selector
Supply gas pressure is modulated to improve the efficiency of purge in the flow.
Supply gas pressure is modulated as follows.

NOTE The value of (supply gas pressure - control amplitude) is controlled so that it does not fall below 150 kPa (if the set supply gas pressure exceeds 150 kPa).



■ Example of gas selector connection

Connect 2 types of gas lines to "IN(MAIN)" and "IN(SUB)" of the gas selector.
Connect "OUT" of the gas selector with the flow controller to be connected.

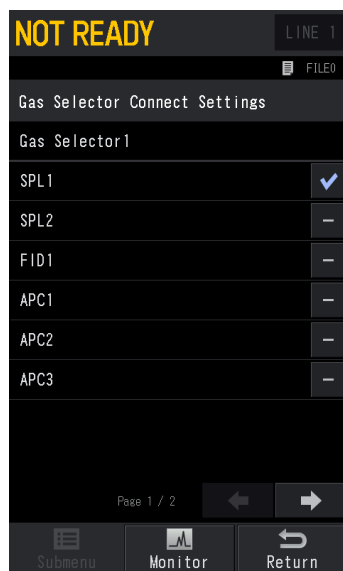


- NOTE**
- When "IN(SUB)" of the gas selector is not used, be sure to blind it.
If it is used without blinds, air may leak.
 - When using hydrogen gas, install attached tube (5 m) to the purge vent so that hydrogen is discharged to open air or ventilation equipment such as draft chamber.
 - Do not remove the G-shape piping connected to the purge vent because it includes the restrictor.

■ [Gas Selector Connect Settings] Screen

Press  (HOME) - [Peripherals] - [Gas Selector] - [Gas Selector Connect Settings] to display [Gas Selector Connect Settings] screen.

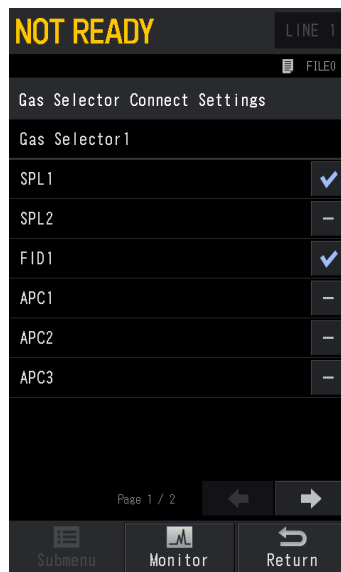
Sets the flow controller connected to the gas selector.



- The carrier gas flow controller, detector flow controller, and AUX-APC connected to the main unit of the instrument are displayed.
The detector flow controller is displayed when FID, TCD, FTD, or ECD, which can set the makeup gas type, is installed. Other detector flow controllers are not displayed because the makeup gas type cannot be set.
- When [Supply Gas] is changed on the [Gas Selector] screen, the gas type (carrier gas type or makeup gas type, AUX-APC gas type) of the flow controller connected with the gas selector is also changed.
- If 2 gas selectors are connected and the connection destinations are the same, the connection destination set later will be valid.

Example of gas selector setting

Connect the gas selector to makeup gas of SPL1 and FID1.



7.8 Settings

On this screen, you can set analysis conditions and line configuration.

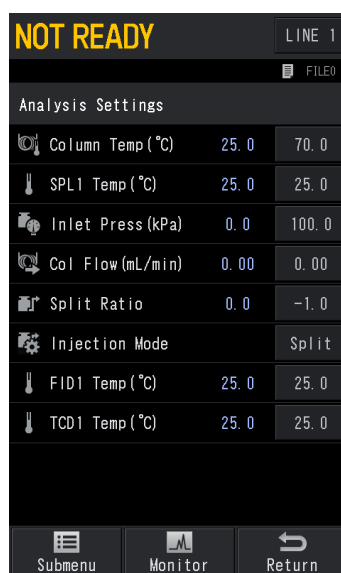
7.8.1 [Analysis Settings] Screen

Press  (HOME) - [Settings] to display [Analysis Settings] screen.

On [Analysis Settings] screen, you can set frequently changed conditions including various temperatures and conditions for carrier gas and detector by batch for parts configured in analytical lines on [Line Configuration] screen.

▶▶ Reference "7.8.2 [Line Configuration] Screen" P.314

Displayed items in [Analysis Settings] are different depending on the settings for analytical lines. Changes made on this screen are reflected to the settings on the corresponding screen such as Injection Port and Detector screen.



- ▶▶ Reference For details of displayed items, see sections describing column, injection port, and detector.
- "7.6 Column" P.285
 - "7.5 Injection Port" P.247
 - "7.4 Detector" P.185

Submenu

Item	Description	See also
Display Customization	Displays [Display Customization] screen. Sets items to be displayed on [Analysis Settings] screen.	-
Line Configuration	Displays [Line Configuration] screen. Configures a combination of injection port, detector, and option.	P.314

7.8.2 [Line Configuration] Screen

Press  (HOME) - [Settings] - [Submenu] - [Line Configuration] to display [Line Configuration] screen.

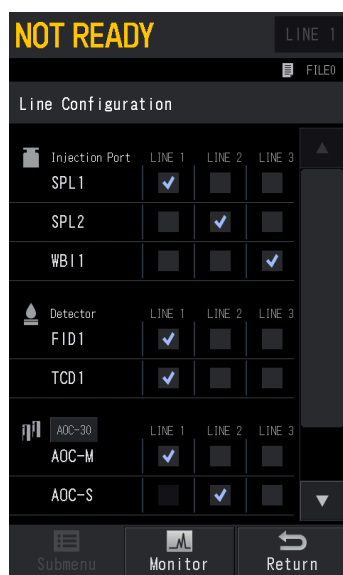
Line configuration is a function to configure a combination of units for analysis. The instrument can control each combination configured in analytical lines separately.

[Line Configuration] screen shows all units installed on the instrument. Configure a combination of injection port, detector, option, and AFT in analytical lines.

Up to four detectors, one injection port, one option, and one AFT can be configured in one analytical line.

After the GC starts, the instrument starts to control temperature of injection port and detector configured in analytical lines. If AFC or APC is installed, the carrier gas is supplied to the injection port and the detector gas is supplied to the detector. Temperature and gas supply of units which are not configured in analytical lines will not be controlled.

When using optional AOC or AFT, configure them in the analytical line same as injection port and detector.

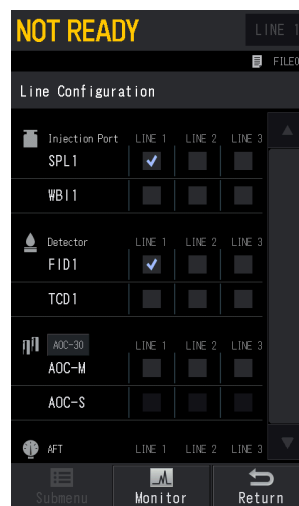
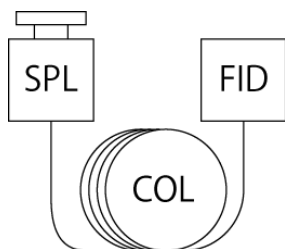


NOTE When using Heart-Cut or Detector Switching of AFT, set it at "LINE1".

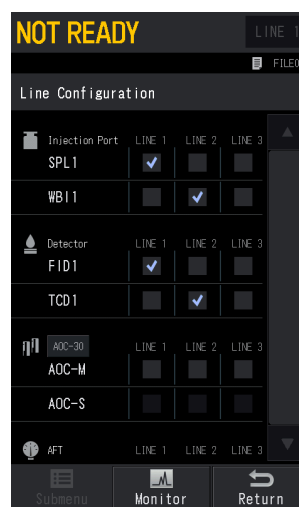
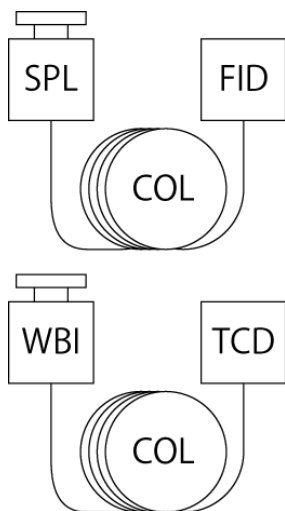
Example 1 for line configuration

When the instrument equipped with SPL and WBI for injection port, and FID and TCD for detector

- When using SPL and FID
Configure SPL and FID in [LINE 1].



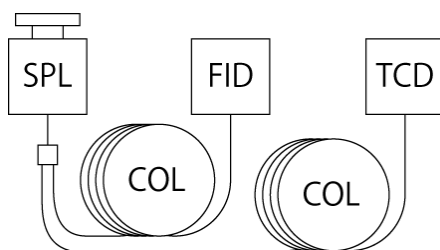
- When using two combinations; SPL and FID, WBI and TCD
Configure SPL and FID in [LINE 1], and WBI and TCD in [LINE 2].



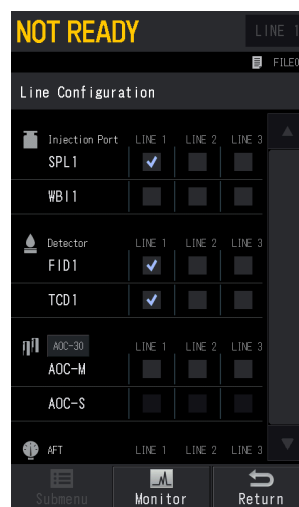
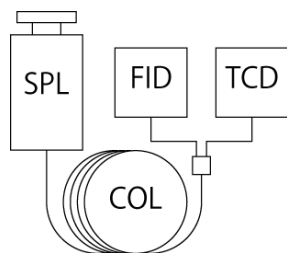
- When using SPL, FID, and TCD
Configure both detectors in [LINE 1].

(1) When branching the column inlet to connect two columns

NOTE Only one column information (inner diameter, length, film thickness, max temperature) can be set. When using columns with different column dimensions, calculations of column flow and velocity are not correct.



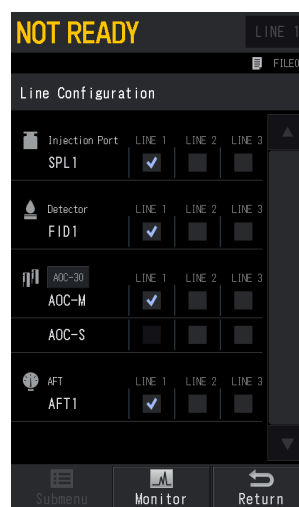
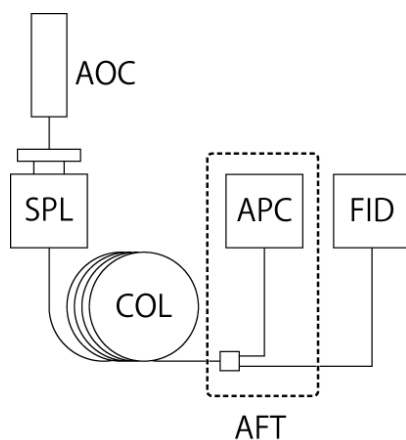
(2) When branching the column outlet



Example 2 for line configuration

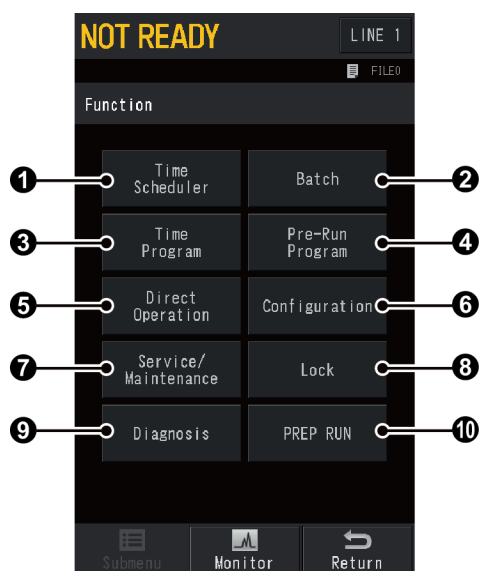
When the instrument equipped with SPL for injection port, and FID for detector

- When using SPL, FID, AOC, and AFT
Configure SPL, FID, AOC, and AFT in [LINE 1].



7.9 Function

You can set various items.

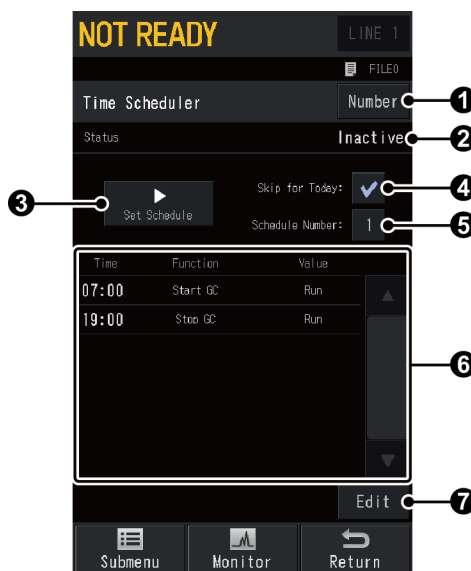


No.	Item	Description	See also
①	Time Scheduler	Use this function to set analysis schedule.	P.318
②	Batch	Use this function when you change analysis settings, etc. for each sample injection.	P.322
③	Time Program	Set this item to perform Auto Zero or relay control during analysis.	P.325
④	Pre-Run Program	Set this item to perform flow controller control or relay control before analysis (sample injection).	P.329
⑤	Direct Operation	Set this item to run programs registered as events.	P.333
⑥	Configuration	Set this item depending on the instrument usage.	P.334
⑦	Service/Maintenance	Checks the installed status and initializes settings.	P.352
⑧	Lock	Sets screen lock and parameter lock.	P.360
⑨	Diagnosis	Diagnoses units and checks the instrument status.	P.366
⑩	PREP RUN	Sets items related to PREP RUN function.	P.381

7.9.1 [Time Scheduler] Screen

Press  (HOME) - [Function] - [Time Scheduler] to display [Time Scheduler] screen.

You can set analysis schedule by day or week with time scheduler function.



No.	Item	Description
①	Mode	Select [Number] to use same schedule every day. Select [Day] to use different schedule for each day. This item cannot be changed while time scheduler is running.
		Items Number, Day
		Default Number
②	Status	Displays the operation status of time scheduler.
③	Set Schedule/Cancel Schedule	Press [Set Schedule] to perform the set operations according to the set schedule. When ① [Mode] is set at [Number], the instrument performs analysis according to the set schedule and uses the same schedule from the next day. When ① [Mode] is set at [Day], the instrument performs analysis according to the day schedule and uses schedules for each day from the next day. [Cancel Schedule] is displayed while time scheduler is running. Press [Cancel Schedule] to stop the running time scheduler.
④	Skip for Today	Check here to start the set schedule from the next day.
⑤	Schedule Number	Select schedule number to be performed. This item is displayed when ① [Mode] is set at [Number].
⑥	Scheduler Display	Displays the set schedule.
⑦	Edit	Displays the screen to edit schedules. ▶▶ Reference "Editing time scheduler" P.319

Submenu

Item	Description
Event Split Ratio Setting	Displays [Event Split Ratio Setting] screen. Sets split ratio to control the carrier gas saver using events such as time scheduler. Normally, use Carrier Gas Saver function. ▶▶ Reference "7.10.1 [Eco Setting] Screen" P.384



Hint

Correspondences between schedule number and day are shown in the following table.

Number	Day
1	Sun
2	Mon
3	Tue
4	Wed
5	Thu
6	Fri
7	Sat

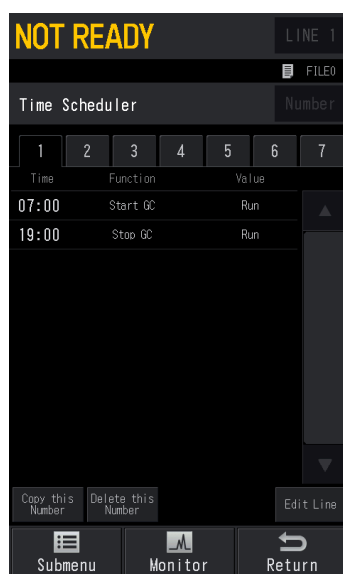
For example, if you set [Mode] at [Number] and then register a schedule to [1], the same schedule as [1] is displayed in [Sun] when you set [Mode] to [Day].

Editing time scheduler

Press [Edit] on [Time Scheduler] screen to display the screen to edit time scheduler.

Press [Edit Line] to edit a schedule. Up to 100 line are available for a schedule. Range of time setting is 00:00–23:59 and increments are 1 minute.

You can set several schedules during the same time period. After editing, schedules will be sorted in the order of start time.



Parameters available in the time scheduler

Item		Description
Relay		Set it when controlling relay or optional devices. ▶▶ Reference "Available parameters for [Relay]" P.321
Detector	Auto Zero	Sets Auto Zero at On/Off for each detector.
	Flame	Turns On/Off ignition when the detector is FID or FPD.
	Detector Cont.	Turns On/Off detector control during analysis program for each detector.
Flow controller	Flow Controller On/Off	Turns On/Off flow controller control.
	High Press Injection Mode	Turns On/Off high press injection mode.
	Carrier Gas Saver	Sets carrier gas saver at On/Off and sets split ratio while the carrier gas saver is active for each injection port.
Temp	Off	Turns Off all temperature control.
	On	Turns On all temperature control.
Scheduler Repeat/Stop	Repeat	Repeats a schedule the specified number of times. Select the schedule to be used.
	Stop	Repeats the schedule the specified number of times and then stops it. Select the schedule to be used.
Load File		Sets the file to be changed.
Program Start	Program	Sets when the program starts; immediately or after the instrument is READY.
	Clean Up	Sets when the cleanup program starts; immediately or after the instrument is READY.
	Pre-Run Program	Sets when the pre-run program starts; immediately or after the instrument is READY.
GC Start/Stop	Start GC	Starts GC.
	Stop GC	Stops GC.
Other		Sets parameters by entering an event No. ▶▶ Reference "8.10 Event No." P.467

Available parameters for [Relay]

Relay	Switch Point	Event 91,92 *1	V91	NO
				NC
		PRG *2	V92	NO
				NC
			V93	NO
				NC
	Relay On/Off *2	Event 1 to 16	V94	NO
				NC
	CRG INJ *3	Off		
		On		
	CRG COL *3	Off		
		On		
	INJ2 Fan *3	Off		
		On		
	AUX5 Fan *3	Off		
		On		

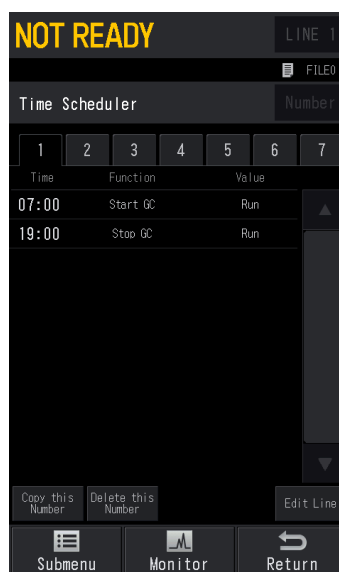
*1 Relays on CPU board in this instrument. Switches relay NO and NC.

*2 Relays on optional PRG board.

*3 Settings for I/O port of optional 24 V power supply board.

Time schedule example

Starts GC at 7:00 and stops GC at 19:00.



7.9.2 [Batch] Screen

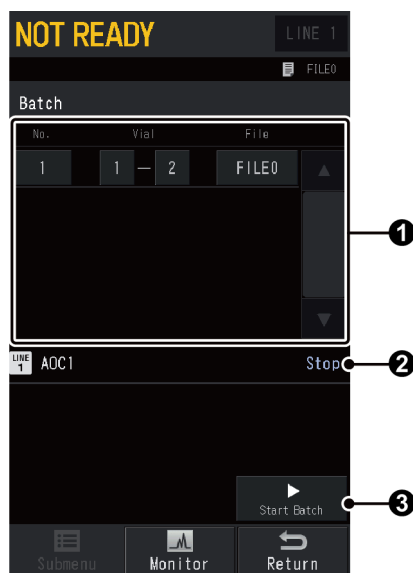
Press  (HOME) - [Function] - [Batch] to display [Batch] screen.

Set this item when analyzing several samples continuously with AOC (optional) or when the order of sample analysis is decided.

Up to 150 lines are available when AOC is single configuration. Up to 75 lines are available when AOC is dual configuration.

NOTE Do NOT use this batch settings when using LabSolutions to set batch schedule.

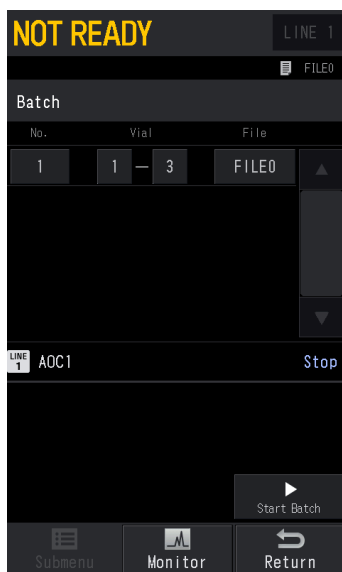
- ▶▶ **Reference** For advanced settings for AOC, refer to the manuals shown below:
- User's Manual for AOC
 - ["7.3 AOC" P.165](#)



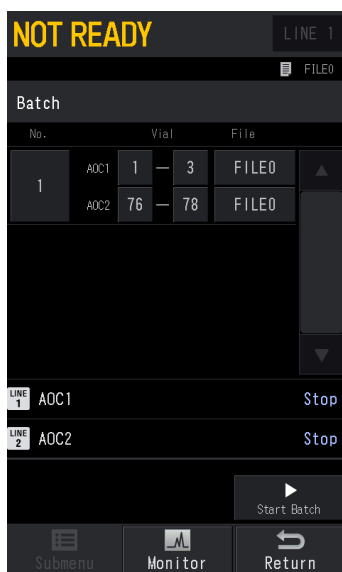
No.	Item		Description	
1	Batch Setting		Sets batch schedule. Several lines are displayed when AOC is dual configuration.	
	Vial	No.	Displays line No. of the batch schedule. Press the number to delete or insert a line.	
		Range	Sets the initial and final vial No. Range is different depending on the type and the number of vials.	
			• Without Autosampler	
			• Short rack: 1 to 6	
	Default	• Long rack, without additional rack: 1 to 12		
• Long rack, with additional rack: 1 to 15				
File	Sets the file to be used for batch schedule.			
	0 (Not Set)			
2	AOC status		Displays the current status of AOC. Several lines are displayed when AOC is dual configuration.	
			Screen display	Status
			Stop	AOC is not operating.
			Taking vial	A vial is being picked up.
			Preparation	AOC is operating (before injection).
			Rinse	AOC is operating (after injection).
			Putting vial	The instrument is putting vial.
			Waiting	AOC is waiting for analysis.
3	Start Batch/Stop Batch		Press [Start Batch] to start the batch schedule. [Stop Batch] is displayed while the batch schedule is running. Press [Stop Batch] to stop the batch schedule.	

Batch schedule example

- Single configuration
To use [File 0] and analyze vial No.1 to 3.



- Dual configuration
To use [File 0] and analyze vial No.1 to 3 with main AOC and 76 to 78 with sub AOC.



7.9.3 [Time Program] Screen

Press  (HOME) - [Function] - [Time Program] to display [Time Program] screen.

Use a time program to execute zero point adjustment and relay control during analysis.



No.	Item	Description
①	Time Program	Displays the set time program.
②	Edit	Displays the screen to edit time programs. ▶▶ Reference "Editing time program" P.325

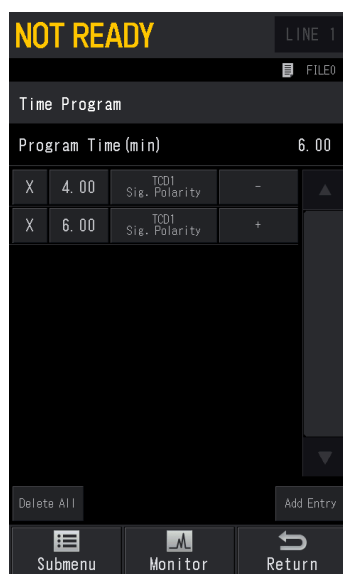
Submenu

Item	Description
Event Split Ratio Setting	Displays [Event Split Ratio Setting] screen. Sets split ratio to control the carrier gas saver using events such as time scheduler. Normally, use Carrier Gas Saver function. ▶▶ Reference "7.10.1 [Eco Setting] Screen" P.384

Editing time program

Press [Edit] on [Time Program] screen to display the screen to edit time program.
Up to 100 lines are available for a time program. Setting range for time program run time is 0.00 to 9999.00 minutes.
You can set several time programs during the same time period. After editing, time programs will be sorted in the order of start time.

Time program starts upon analysis start.



Parameters available in the time program

Item		Description
Relay		Set it when controlling relay or optional devices. ▶▶ Reference "Available parameters for [Relay]" P.327
Detector	Range	Sets range or attenuation for each detector.
	Sig. Polarity	Sets polarity to + or - when the detector is TCD.
	Current	Sets the current value when the detector is FTD, ECD, or TCD.
	Auto Zero	Sets Auto Zero at On/Off for each detector.
	Flame	Turns On/Off ignition when the detector is FID or FPD.
	FTD Feedback	Turns On/Off the voltage feedback to keep the current passing thorough FTD constant when the detector is FTD.
	Detector Cont.	Turns On/Off detector control during analysis program for each detector.
Flow controller	Flow Controller On/Off	Turns On/Off flow controller control.
	High Press Injection Mode	Turns On/Off high press injection mode.
	Carrier Gas Saver	Sets carrier gas saver at On/Off and sets split ratio while the carrier gas saver is active for each injection port.
Temp		Changes temperature of heater port, which cannot be changed with the temperature program, using the time program.
Stop Time Program	Repeat	Repeats the program the specified number of times and then stops it.
	Stop	Performs analysis one time only.

Item	Description
Other	Sets parameters by entering an event No. ▶▶ Reference "8.10 Event No." P.467

Available parameters for [Relay]

Relay	Switch Point	Event 91, 92 ^{*1}	V91 ^{*2}	NO
				NC
		PRG ^{*3}	V92 ^{*2}	NO
				NC
			V93 ^{*2}	NO
				NC
	Relay On/Off ^{*3}	Event 1 to 16 ^{*2}		Off
				On
	CRG INJ ^{*4}	Off		
			On	
	CRG COL ^{*4}	Off		
			On	
	INJ2 Fan ^{*4}	Off		
			On	
	AUX5 Fan ^{*4}	Off		
			On	

*1 Relays on CPU board in this instrument. Switches relay NO and NC.

*2 After parameters are set, Vx (x: 1 to 16, 91 to 94) is displayed on the screen on the instrument. In Time Program of LabSolutions, Relay x (x: 1 to 16, 91 to 94) is displayed. Their meanings are the same.

*3 Relays on optional PRG board.

*4 Settings for I/O port of optional 24 V power supply board.

Time program example

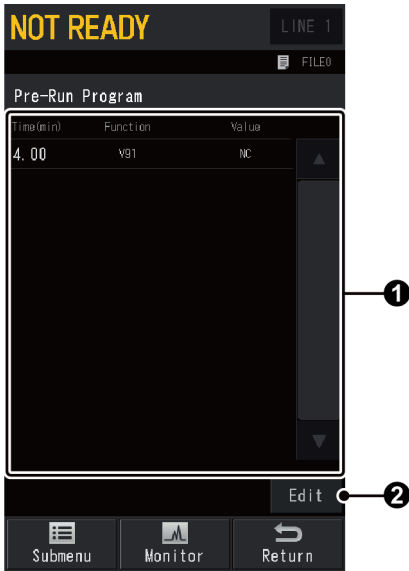
Four minutes after analysis starts, the polarity of the detector TCD is switched from plus to minus. Two minutes later (six minutes after the program starts), the polarity is switched back to plus.

Time (min)	Function	Value
4.00	TCD1 Sig. Polarity	-
6.00	TCD1 Sig. Polarity	+

7.9.4 [Pre-Run Program] Screen

Press  (HOME) - [Function] - [Pre-Run Program] to display [Pre-Run Program] screen.

Use a pre-run program to perform flow controller control or relay control before analysis (sample injection).



No.	Item	Description
❶	Pre-Run Program	Displays the set pre-run program.
❷	Edit	Displays the screen to edit pre-run programs. ▶▶ Reference "Editing pre-run program" P.329

Submenu

Item	Description
Event Split Ratio Setting	Displays [Event Split Ratio Setting] screen. Sets split ratio to control the carrier gas saver using events such as time scheduler. Normally, use Carrier Gas Saver function. ▶▶ Reference "7.10.1 [Eco Setting] Screen" P.384

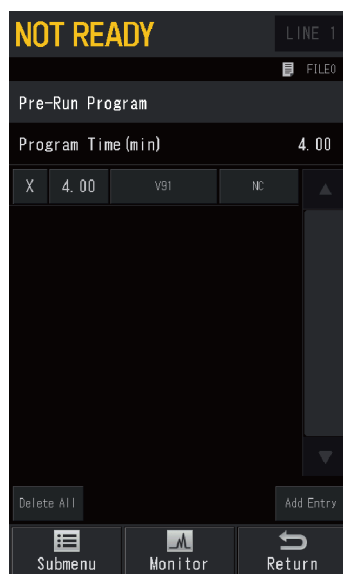
Editing pre-run program

Press [Edit] on [Pre-Run Program] screen to display the screen to edit pre-run program.

Up to 100 lines are available for a pre-run program. Setting range for pre-run program run time is 0.00 to 9999.00 minutes.

Set a pre-run program and then press  (START) on the control panel to run the pre-run program before analysis (sample injection). While the Pre-Run program is running, the elapsed time is displayed in [Hold Time] on the monitor screen.

You can set several pre-run programs during the same time period. After editing, pre-run programs will be sorted in the order of start time.



Parameters available in the pre-run program

Item		Description
Relay		Set it when controlling relay or optional devices. ▶▶ Reference "Available parameters for [Relay]" P.332
Detector	Range	Sets range or attenuation for each detector.
	Sig. Polarity	Sets polarity to + or - when the detector is TCD.
	Current	Sets the current value when the detector is FTD, ECD, or TCD.
	Auto Zero	Sets Auto Zero at On/Off for each detector.
	Flame	Turns On/Off ignition when the detector is FID or FPD.
	FTD Feedback	Turns On/Off the voltage feedback to keep the current passing thorough FTD constant when the detector is FTD.
	Detector Cont.	Turns On/Off detector control during analysis program for each detector.
Flow controller	Flow Controller On/Off	Turns On/Off flow controller control.
	High Press Injection Mode	Turns On/Off high press injection mode.
	Carrier Gas Saver	Sets carrier gas saver at On/Off and sets split ratio while the carrier gas saver is active for each injection port.
Temp		Changes temperature of heater port, which cannot be changed with the temperature program, using the pre-run program.

Item		Description
Stop Pre-Run Program	Auto	Operations after the pre-run program is finished are different depending on whether AOC is configured in the analytical line or not. • When AOC is configured in the analytical line: AOC will start to operate. • When AOC is not configured in the analytical line: Analysis will start.
	Manual (Stop Pre-Run Program)	After the Pre-Run program is finished, the instrument becomes ready.
	GC Start	After the Pre-Run program is finished, the instrument starts analysis. For example, use this function to switch the valve after the program stops by using an automated gas sampler.
	AOC/HSS Start	After the Pre-Run program is finished, the AOC/HSS starts and then the sample is injected.
	Clean Up	After the Pre-Run program stops, clean up starts. After clean up finishes, the instrument becomes ready.
Other		Sets parameters by entering an event No. ▶▶ Reference "8.10 Event No." P.467

**Hint**

- When no parameter is selected for [Stop Pre-Run Program] in the pre-run program, the instrument finishes the pre-run program in the same way as [Stop Pre-Run Program] is set at [AUTO] after the last line of the program is executed. Also when running the pre-run program in the batch schedule, the instrument finishes the pre-run program in the same way as [Stop Pre-Run Program] is set at [AUTO] after the last line of the program is executed.
- Some events automatically return to their original status when the pre-run program is finished.

Event No.	Description
131 to 134	Turns On/Off detector controller.
141 to 146, 159, 160	Turns On/Off carrier gas and septum purge.
147 to 158	Turns On/Off detector gas.
171	Turns On/Off high pressure injection.
181 to 198	Turns On/Off AUX-APC.

▶▶ Reference See ["8.10 Event No." P.467](#) for details about the event No.

Available parameters for [Relay]

Relay	Switch Point	Event 91, 92 ^{*1}	V91 ^{*2}	NO
				NC
		PRG ^{*3}	V92 ^{*2}	NO
				NC
			V93 ^{*2}	NO
				NC
	V94 ^{*2}	NO		
		NC		
	Relay On/Off ^{*3}	Event 1 to 16 ^{*2}	Off	
			On	
	CRG INJ ^{*4}	Off		
		On		
	CRG COL ^{*4}	Off		
		On		
	INJ2 Fan ^{*4}	Off		
		On		
AUX5 Fan ^{*4}	Off			
	On			

*1 Relays on CPU board in this instrument. Switches relay NO and NC.

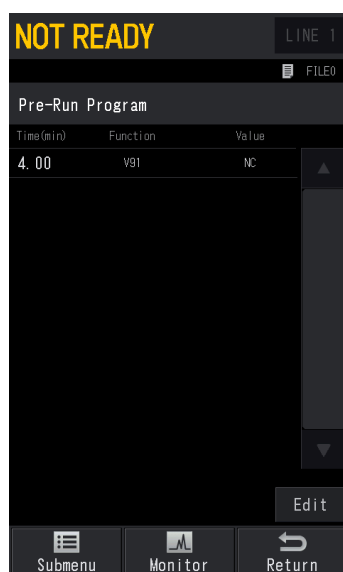
*2 After parameters are set, Vx (x: 1 to 16, 91 to 94) is displayed on the screen on the instrument. In Pre-Run Program of LabSolutions, Relay x (x: 1 to 16, 91 to 94) is displayed. Their meanings are the same.

*3 Relays on optional PRG board.

*4 Settings for I/O port of optional 24 V power supply board.

Pre-run program example

Switches the relay of Event 91 from NO to NC 4 minutes after the program starts.

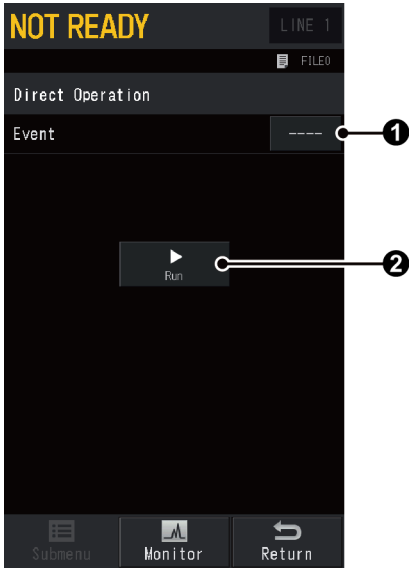


7.9.5 [Direct Operation] Screen

Press  (HOME) - [Function] - [Direct Operation] to display [Direct Operation] screen.

Use the direct operation to control the instrument with the event No.

▶▶ Reference See "8.10 Event No." P.467 for details about the event No.

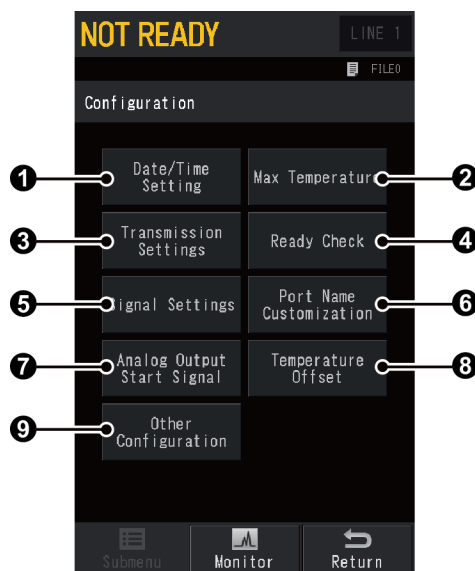


No.	Item	Description	
①	Event	Sets the event No.	
		Range	-500 to 500
		Default	-
②	Run	Runs the event.	

7.9.6 [Configuration] Screen

Press  (HOME) - [Function] - [Configuration] to display [Configuration] screen.

Set this item depending on the instrument usage.

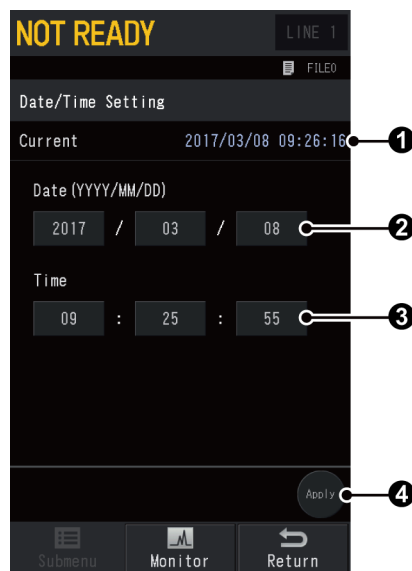


No.	Item	Description	See also
①	Date/Time Setting	Sets the date and the time.	P.335
②	Max Temperature	Sets the maximum temperature for each heater port.	P.336
③	Transmission Settings	Sets parameters for transmission.	P.337
④	Ready Check	Sets parameters for illumination of the status lights.	P.340
⑤	Signal Settings	Sets the output signal from the instrument.	P.343
⑥	Port Name Customization	Customizes the names of displayed items.	P.347
⑦	Analog Output Start Signal	Set this item when connecting the instrument to Chromatopac.	P.348
⑧	Temperature Offset	Sets the temperature offset for each heater port.	P.349
⑨	Other Configuration	Specify the configuration of miscellaneous setup items.	P.350

■ [Date/Time Setting] Screen

Press  (HOME) - [Function] - [Configuration] - [Date/Time Setting] to display [Date/Time Setting] screen.

The date and the time can be set. This setting is automatically saved even when the instrument is turned off.

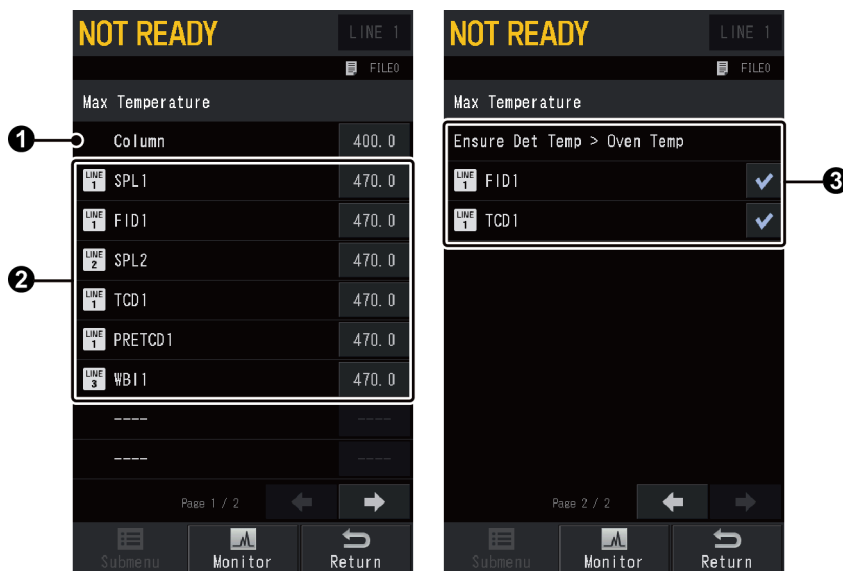


No.	Item	Description
①	Current	Displays the set date and time.
②	Date	Changes the date.
③	Time	Changes the time.
④	Apply	Press ④ [Apply] to confirm the change.

■ [Max Temperature] Screen

Press  (HOME) - [Function] - [Configuration] - [Max Temperature] to display [Max Temperature] screen.

The maximum temperature for each heater port can be set. The items on the screen are different depending on the units installed on the instrument.



No.	Item	Description
①	Column	Displays the maximum operating temperature of the column oven.
		Range 10.0 to 470.0 °C
		Default 450.0 °C
②	Heater Port	Sets the maximum operating temperature of injection port, detector, and optional heater. Line No. is displayed when they are configured in the analytical line.
		 CAUTION  Set this value below 400 °C when using ECD.
		Range • OCI, PTV, other than satellite oven 10.0 to 470.0 °C • OCI, PTV 10.0 to 520.0 °C • Satellite oven 10.0 to 420.0 °C
		Default 470.0 °C

No.	Item	Description
③	Ensure Det Temp > Oven Temp	When this item is checked, a warning message appears if the set value for detector temperature is lower than that for column oven temperature. Do NOT check this item to set detector temperature lower than column oven temperature. This item is displayed for each detector installed on the instrument.

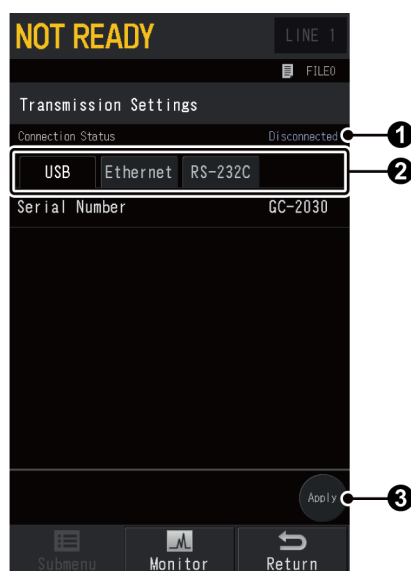
■ [Transmission Settings] Screen

Press  (HOME) - [Function] - [Configuration] - [Transmission Settings] to display [Transmission Settings] screen.

Set up the communication when the instrument is connected to an external device.

▶▶ Reference "8.9 Connecting to External Devices" P.457

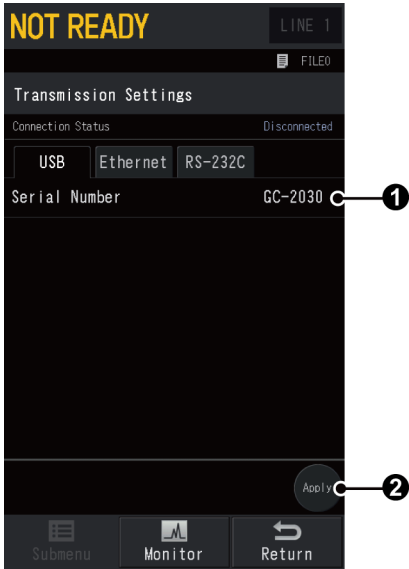
Common items



No.	Item	Description
①	Connection Status	Displays the current connection status. Also displays communication method when the instrument is connected.
②	Tab switching	Switch the tab to set each communication method.
③	Apply	Press ③ [Apply] to confirm the change.

[USB] tab

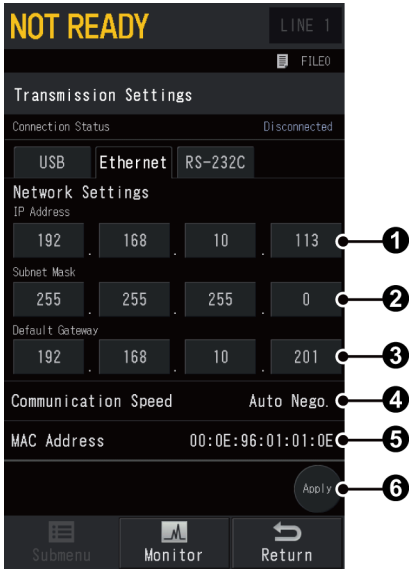
Set this item when connecting the instrument to PC with a USB cable.



No.	Item	Description
①	Serial Number	Displays serial number of the instrument.
②	Apply	Press ② [Apply] to confirm the change.

[Ethernet] tab

Set this item when connecting the instrument to PC with an Ethernet cable.

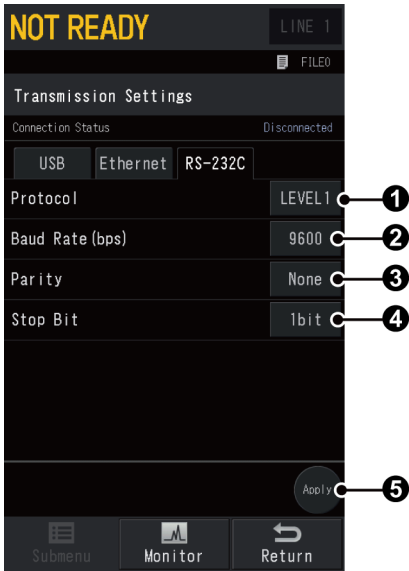


No.	Item	Description
①	IP Address	Sets IP address.
②	Subnet Mask	Sets subnet mask.
③	Default Gateway	Sets default gateway.
④	Communication Speed	Displays communication speed.

No.	Item	Description
⑤	MAC Address	Displays MAC address.
⑥	Apply	Press ⑥ [Apply] to confirm the change.

[RS-232C] tab

Normally, RS-232C is not used to connect the instrument with an external device.
Use it only for configurations such as system GC.



No.	Item	Description	
①	Protocol	Sets communication protocol.	
		Items	None, Level.1, Level.2, Level.3
		Default	Level.1
②	Baud rate	Sets the transmission speed.	
		Items	2400, 4800, 9600, 19200, 38400, 57600
		Default	9600
③	Parity	Sets the parity.	
		Items	None, Even, Odd
		Default	None
④	Stop Bit	Sets the stop bit.	
		Items	1 bit, 2 bit
		Default	1 bit
⑤	Apply	Press ⑤ [Apply] to confirm the change.	

■ [Ready Check] Screen

Press  (HOME) - [Function] - [Configuration] - [Ready Check] to display [Ready Check] screen.

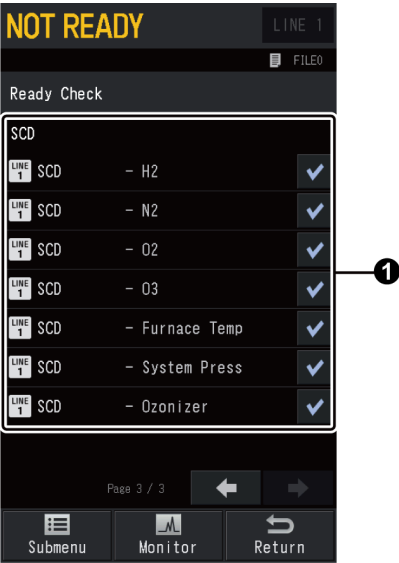
The instrument checks whether the checked items are ready. The status light on the control panel turns green when all checked items become ready.

The items on the screen are different depending on the units installed on the instrument. The units configured in the analytical line are accompanied with Line No. on their left.



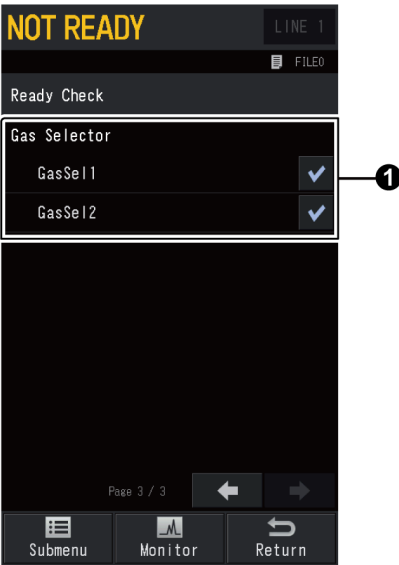
No.	Item	Description
①	Heater Port	Sets whether to perform ready check for each heater port.
②	Carrier Gas	Sets whether to perform ready check for each carrier gas.
③	Septum Purge	Sets whether to perform ready check for each septum purge.
④	Detector Gas	Sets whether to perform ready check for each detector gas. When several gases are displayed for one detector, the first gas is accompanied with the line No.
⑤	AUX APC	Sets whether to perform ready check for APC when the optional APC is installed. Displays up to 18 APCs.
⑥	Detector	Sets whether to perform ready check for each detector. • Controller : Checks whether the controller can detect signals. • Drift : Compares the baseline drift to the drift threshold for 10 minutes. ▶▶ Reference "[Drift] Screen" P.342 The instrument restarts the evaluation 10 minutes after the instrument changes from NOT READY to READY. • Wait Signal : Checks wait signal from external devices.

For the SCD detector



No.	Item	Description
1	SCD	Sets whether to perform ready check for the SCD detector when the SCD detector is installed.

For the Gas Selector



No.	Item	Description
1	GasSel	Sets whether to perform ready check for the gas selector when the gas selector is installed. If it is checked, the instrument status is "NOT READY" during gas switching.

Submenu

Item	Description	See also
Drift	Displays [Drift] screen.	P.342

■ [Drift] Screen

Press  (HOME) - [Function] - [Configuration] - [Ready Check] - [Submenu] - [Drift] to display [Drift] screen.
Sets the drift threshold.



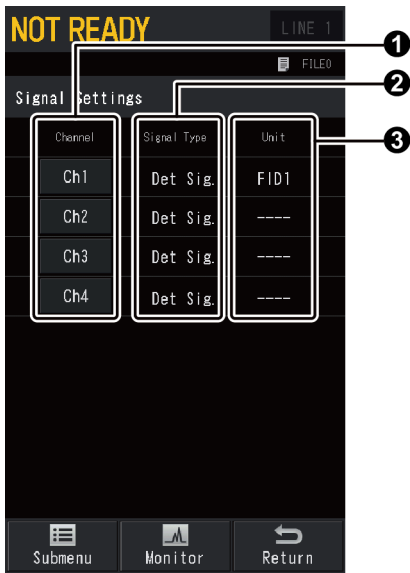
No.	Item	Description	
①	Drift Threshold	Sets the drift threshold for each detector. This item is displayed for each detector installed on the instrument.	
		Range	0 to 20000
		Default	100

■ [Signal Settings] Screen

Press  (HOME) - [Function] - [Configuration] - [Signal Settings] to display [Signal Settings] screen.

The instrument has 4 channels to output signals. On [Signal Settings] screen, parameters relating to output signals other than detector signal can be set.

▶▶ Reference See "7.4.10 [Signal Settings] Screen" P.229 for settings for detector signal.



No.	Item	Description
①	Channel	Press the channel name to display the setting screen. Output signal for each channel can be set. ▶▶ Reference "[Signal Setting] Screen" P.344
②	Signal Type	Displays the signal type. Select the signal type on the setting screen. ▶▶ Reference "[Signal Setting] Screen" P.344
③	Unit	Displays the heater port name of the unit. [----] is displayed when the signal type is not set.

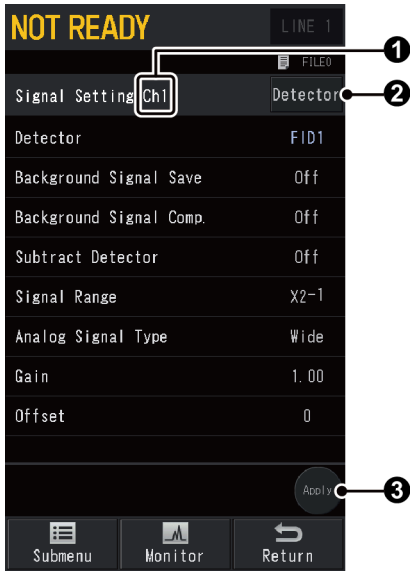
Submenu

Item	Description
Data File	Displays [Data File] screen. This item is automatically set after the instrument is connected to PC and establishes the link.

[Signal Setting] Screen

Press [Channel] on [Signal Settings] screen to display the setting screen.

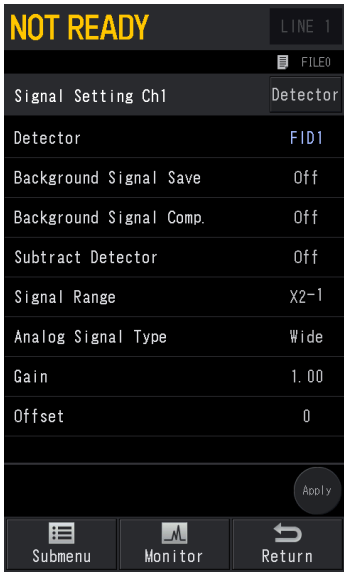
Common items



No.	Item	Description
❶	Channel name	Displays the channel name.
❷	Signal Type	Sets the signal type.
		Items Detector, Temp, Flow
❸	Apply	Press ❸ [Apply] to confirm the change.

When [Signal Type] is set at [Detector]

▶▶ Reference See "7.4.10 [Signal Settings] Screen" P.229 for settings for detector signal.

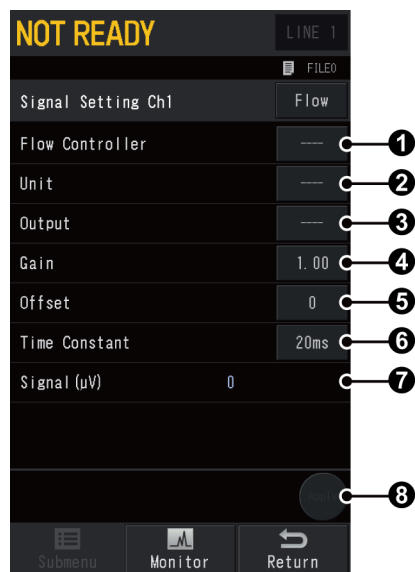


When [Signal Type] is set at [Temp]



No.	Item	Description
①	Unit	Selects a unit. The selections are different depending on the temperature control units installed on the instrument.
②	Gain	Sets the gain.
		Range 0.00 to 100.00
		Default 1.00
③	Offset	Sets the offset.
		Range -999999 to 999999
		Default 0
④	Time Constant	Sets the time constant.
		Items 2 ms, 4 ms, 10 ms, 20 ms, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s
		Default 20 ms
⑤	Signal	Displays the signal value.
⑥	Apply	Press ⑥ [Apply] to confirm the change. You can press ⑥ [Apply] after setting ① [Unit].

When [Signal Type] is set at [Flow]



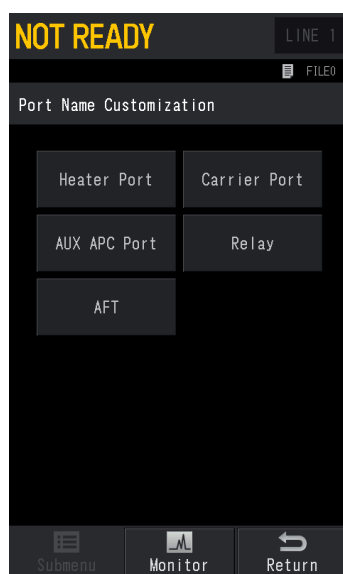
No.	Item	Description
①	Flow controller	Selects a flow controller. The selections are different depending on the flow controller types installed on the instrument.
②	Unit	Selects a unit. The selections are different depending on the settings in ① [Flow Controller].
③	Output	Selects the output signal. The selections are different depending on the settings in ① [Flow Controller] and ② [Unit].
④	Gain	Sets the gain.
		Range 0.00 to 100.00
		Default 1.00
⑤	Offset	Sets the offset.
		Range -999999 to 999999
		Default 0
⑥	Time Constant	Sets the time constant.
		Items 2 ms, 4 ms, 10 ms, 20 ms, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s
		Default 20 ms
⑦	Signal	Displays the signal value.
⑧	Apply	Press ⑧ [Apply] to confirm the change. You can press ⑧ [Apply] after setting ① [Flow Controller], ② [Unit], and ③ [Output].

■ [Port Name Customization] Screen

Press  (HOME) - [Function] - [Configuration] - [Port Name Customization] to display [Port Name Customization] screen.

Although the instrument automatically recognize the names of units installed on the instrument, you can change the displayed name to a desired name. You cannot change the name of unit which are not installed on the instrument.

You can use the alphabet, numbers, and extra characters. The number of maximum characters are 7.

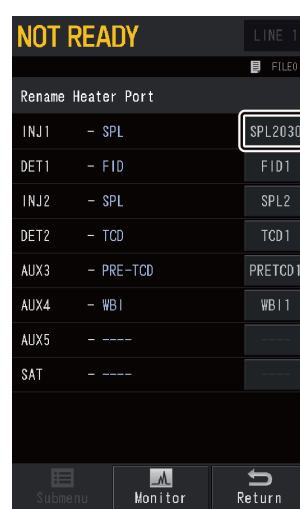


Example for name change

The following images show a case where you change the name of sample injection [INJ1] from "SPL1 (Default)" to "SPL2030".



Before change

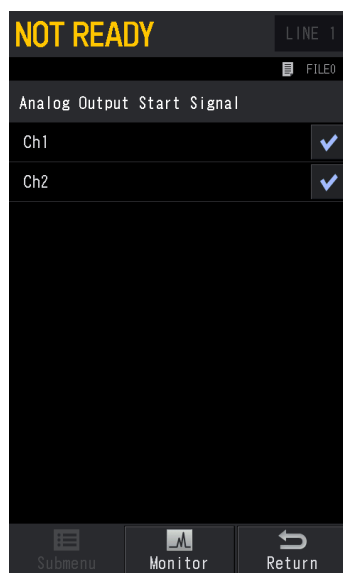


After change

■ [Analog Output Start Signal] Screen

Press  (HOME) - [Function] - [Configuration] - [Analog Output Start Signal] to display [Analog Output Start Signal] screen.

When connecting Chromatopac to the instrument, check the channel to be started as you press  (START) on the control panel. Up to 2 channels can be set.



■ [Temperature Offset] Screen

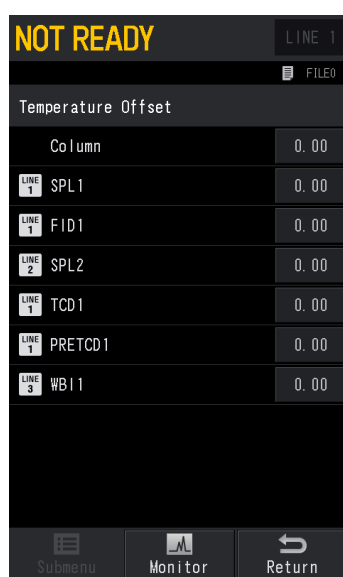
Press  (HOME) - [Function] - [Configuration] - [Temperature Offset] to display

[Temperature Offset] screen.

Set the offset value to adjust the displayed temperature of each units to the actual value measured by a thermometer.

For example, set the column offset at [-1.00] when the value obtained by subtracting the displayed temperature from the actual temperature of the column oven measured by a thermometer is "-1 °C".

[Column] is always displayed. The items other than the column are different depending on the units installed on the instrument. The units configured in the analytical line are accompanied with Line No. on their left.



■ [Other Configurations] Screen

Press  (HOME) - [Function] - [Configuration] - [Other Configurations] to display [Other Configurations] screen.

Various items other than those on [Configuration] screen can be set.



No.	Item	Description	
①	Language	Sets the language to be displayed on the touch panel.	
		Items	Alt., English
		Default	English
②	Backlight Auto Off	Sets the period of time until the backlight automatically turns off.	
		Range	0 to 9999 seconds
		Default	0 seconds
③	Pressure Unit	Sets the pressure units	
		NOTE The following items are expressed in the unit [kPa] regardless of the setting in ③ [Pressure Unit]. - Pressure axis on the monitor screen. - Set value and measured value of the primary pressure in the standard diagnosis result. - Displayed value in log files.	
		Items	kPa, bar, psi
④	Pressure Digits Display	Default	kPa
		Sets the digits of the pressure. Select [Explicit] to set pressure to three decimal places when ③ [Pressure Unit] is set at [psi].	
		Items	Default, Explicit
		Default	Default

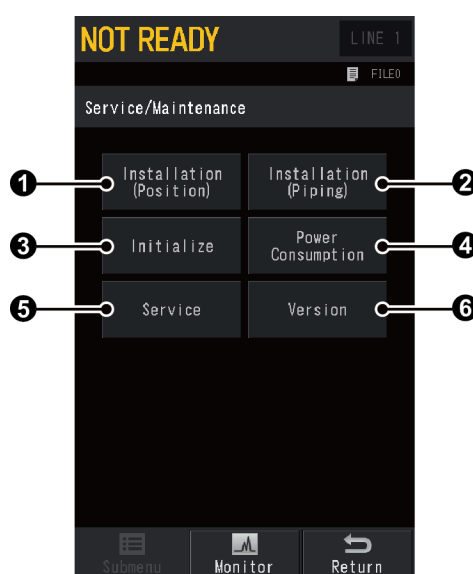
No.	Item	Description
⑤	Beep Volume	Sets the beep volume which sounds when errors occur or during the touch panel operation.
		Items Off, Low, Mid, High
		Default Low
⑥	Beep Pitch	Sets the beep sound. Use a different tone for different instruments to be able to discern which instrument has a problem.
		Items Low, High
		Default High
⑦	Atmospheric Compensation	Select [On] to compensate inlet pressure depending on the atmospheric pressure.
		Items Off, On
		Default Off
⑧	Auto Zero After Ready	Select [On] to automatically perform auto zero after all items checked on [Ready Check] screen become ready and the status light on the control panel illuminates in green. ▶▶ Reference " [Ready Check] Screen " P.340
		Items Off, On
		Default On
⑨	Auto Zero After Start	Select [On] to start analysis. The auto zero process runs when the status changes to RUN and the status light on the control panel illuminates in blue.
		Items Off, On
		Default Off
⑩	Primary Pressure	Sets the range of primary pressure of the gas supplied to heater port or carrier port. For example, set this item to [500–900 kPa] when the pressure of the cylinder supplying the gas to the instrument is 700 kPa.
		Items 500-900 kPa, 300-500 kPa, 900 kPa-
		Default 500-900 kPa
⑪	Fan Off Temp	Sets the turn-off conditions for the oven fan when the temperature control function is set to [Off].
		Items • COL The oven fan will be turned off when the column oven temperature drops below 50 °C. • ALL The oven fan will be turned off when both the column oven temperature drops below 50 °C and the temperature of heater ports such as the detector or sample injection port drops below 100 °C.
		Default COL

No.	Item	Description	
12	Oven Light	Sets the optional oven light. Select [On] to turn on the light when you open the column oven.	
		Items	Off, On
		Default	On

7.9.7 [Service/Maintenance] Screen

Press  (HOME) - [Function] - [Service/Maintenance] to display [Service/Maintenance] screen.

Use this screen to check the status of units installed on the instrument and to perform maintenance.



No.	Item	Description	See also
①	Installation (Position)	Specifies positions of units connected to heater ports.	P.353
②	Installation (Piping)	Sets up flow controllers of carrier gas, detector gas, and AFT.	P.354
③	Initialize	Initialize Configuration, installation status, and analysis conditions.	P.357
④	Power Consumption	Displays the sum of power consumption of all heaters.	P.358
⑤	Service	[Service] screen is used by Shimadzu service personnel.	-
⑥	Version	Displays the instrument version.	P.359

■ [Installation (Position)] Screen

Press  (HOME) - [Function] - [Service/Maintenance] - [Installation (Position)] to display [Installation (Position)] screen.

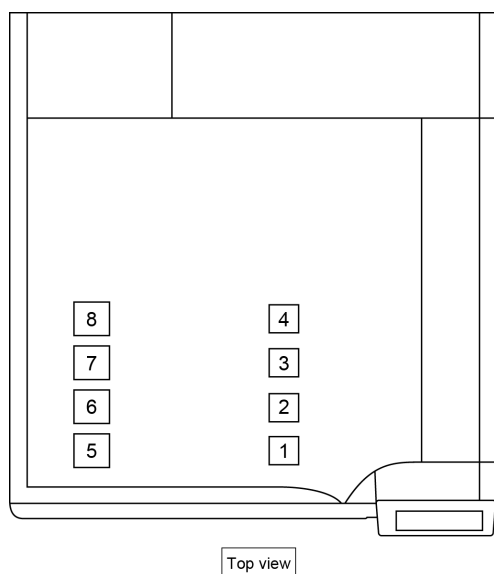
Specifies positions of units connected to heater ports.

NOT READY			LINE 1
			FILE0
Installation (Position)			
INJ1	- SPL		7
DET1	- FID		2
INJ2	- SPL		0
DET2	- TCD		0
AUX3	- PRE-TCD		0
AUX4	- WBI		0
AUX5	- ----		
SAT	- ----		
Submenu		Monitor	Return

When you connect injection port or detector to heater port, the instrument automatically recognizes the device type.

Set the position of installed injection port and detector by entering any number from 1 to 8. Set it at "0" when a unit is not installed or is a TCD pre-heater (PRE-TCD). Set it at "9" when you connect a device to a port other than 1 to 8.

Installation positions are shown below.



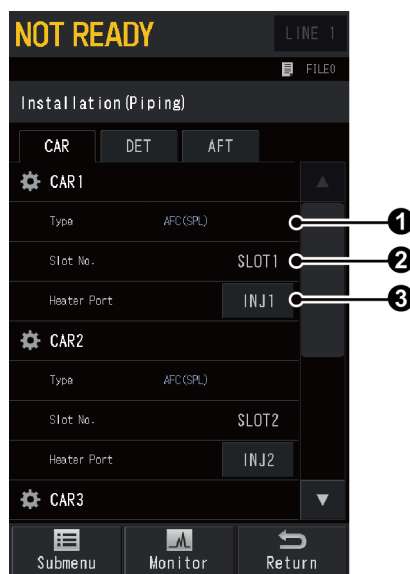
■ [Installation (Piping)] Screen

Press  (HOME) - [Function] - [Service/Maintenance] - [Installation (Piping)] to display [Installation (Piping)] screen.

Sets up flow controllers of carrier gas, detector gas, and AFT.

[CAR] tab

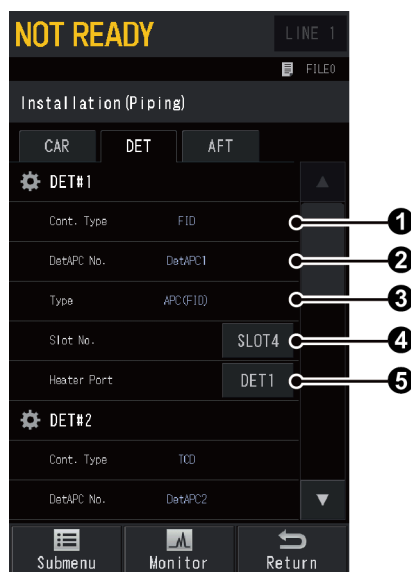
The names CAR1 to CAR4 are automatically assigned in ascending order of the slot No.



No.	Item	Description
①	Type	Automatically recognizes and displays flow controllers for carrier gas.
②	Slot No.	Automatically recognizes and displays installed slot No.
③	Heater Port	Sets the heater port for the injection port which the flow controller tubing is connected to. This associates the flow controller to the injection port. The available settings are different depending on the installation status of the instrument.
		Items None, INJ1, INJ2, DET1, DET2, AUX3, AUX4, AUX5

[DET] tab

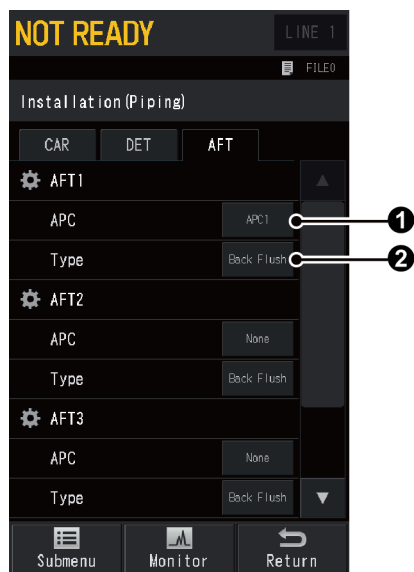
The names DET#1 to DET#4 are automatically assigned depending on the installation position of the detector (1 to 4 starting at the front of the instrument).



No.	Item	Description	
①	Cont. Type	Automatically recognizes and displays detector controller.	
②	DetAPC No.	Automatically recognizes and displays it according to the setting in ④ [Slot No.].	
③	Type	Automatically recognizes and displays it according to the setting in ④ [Slot No.].	
④	Slot No.	Sets the slot No.	
		Items	None, SLOT1, SLOT2, SLOT3, SLOT4, SLOT5, SLOT6
⑤	Heater Port	Sets the heater port for the detector which the flow controller tubing is connected to. This associates the flow controller to the detector. For TCD, there are two settings for heater ports. (Upper: TCD, Lower: PRE-TCD)	
		Items	None, INJ1, INJ2, DET1, DET2, AUX3, AUX4, AUX5

[AFT] tab

Up to 4 AFTs can be set.



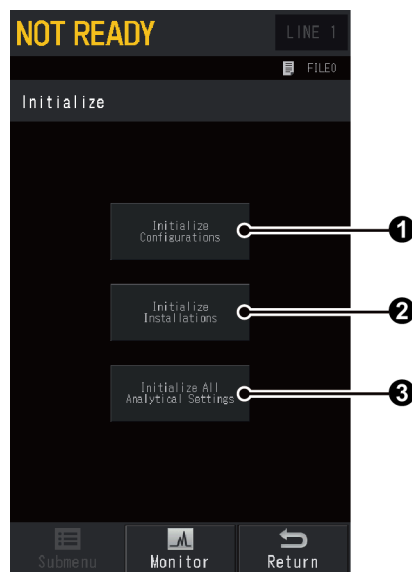
No.	Item	Description
①	APC	Sets the AUX-APC to be used.
		Items None, APC1 to APC18
②	Type	Sets the AFT type.
		▶▶ Reference "8.8 AFT (Advanced Flow Technology)" P.449
		Items Detector Splitting, Detector Switching, Back Flush, Heart-Cut

■ [Initialize] Screen

Press  (HOME) - [Function] - [Service/Maintenance] - [Initialize] to display [Initialize] screen.

When pressing items on this screen, the confirmation screen appears and you can initialize them.

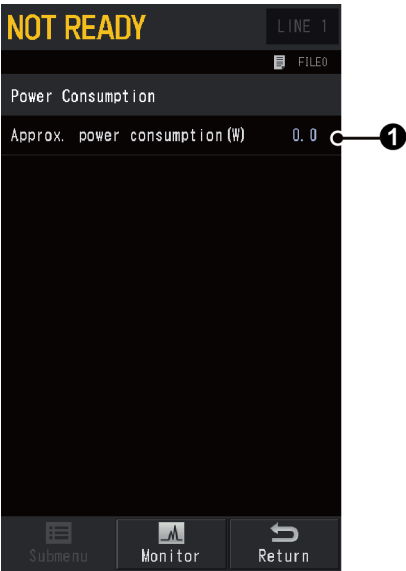
 **NOTE** After the initialization, you cannot restore the original settings.



No.	Item	Description
①	Initialize Configurations	This item initializes configuration settings such as heater port max temperature and ready check parameters. However the maximum operating temperature of the column oven is not reset.
②	Initialize Installations	This item initializes the installation settings of injection ports, detector, flow controllers piping, etc.
③	Initialize All Analytical Settings	This item initializes all analysis files (FILE0 to FILE9).

■ [Power Consumption] Screen

Press  (HOME) - [Function] - [Service/Maintenance] - [Power Consumption] to display [Power Consumption] screen.
You can check the power consumption of the instrument.



No.	Item	Description
①	Approx. power consumption	Displays approximate calculation of the total power consumption of all heaters.

■ [ROM Version] Screen

Press  (HOME) - [Function] - [Service/Maintenance] - [Version] to display [ROM Version] screen.

[ROM Version] screen shows the ROM version of the instrument.

Version information may be required for the instrument maintenance.

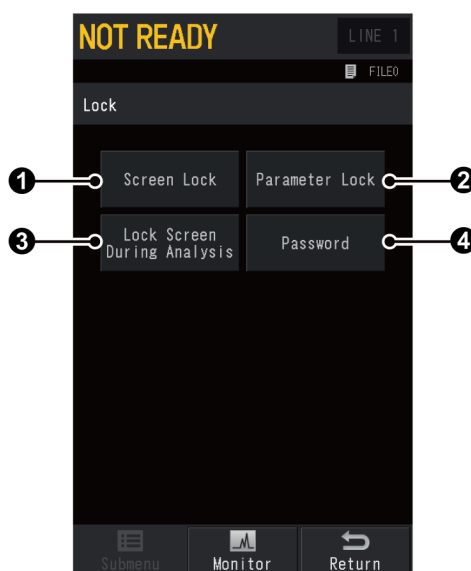
NOT READY		LINE 1
		FILE0
ROM Version		
Version	1.55 (820)	
GUI Version (C)	1.91 (00)	
FPGA Version	17	
SLOT1 - AFC (SPL)	0.00	
SLOT2 - APC (FID)	0.00	
SLOT3 - ----	----	
SLOT4 - ----	----	
SLOT5 - ----	----	
SLOT6 - ----	----	
Page 1 / 2		← →
Submenu	Monitor	Return

NOT READY		LINE 1
		FILE0
ROM Version		
Injector Model	30	
Injector Version (M)	9.40	
Injector Version (S)	9.40	
Sampler Model	20	
Sampler Version	5.00	
Page 2 / 2		← →
Submenu	Monitor	Return

7.9.8 [Lock] Screen

Press  (HOME) - [Function] - [Lock] to display [Lock] screen.

 **Hint** If either key lock or parameter lock has already been activated, the Unlock screen appears instead.

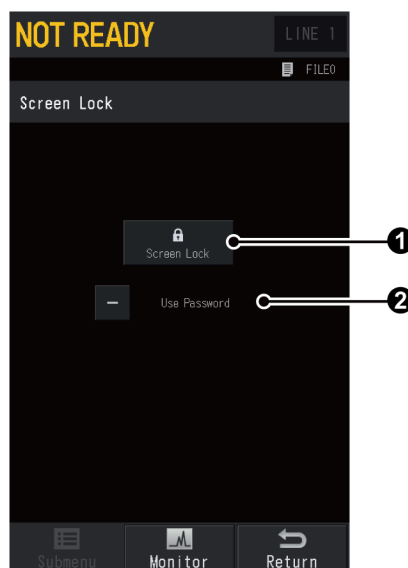


No.	Item	Description	See also
①	Screen Lock	Displays [Screen Lock] screen.	P.361
②	Parameter Lock	Displays [Parameter Lock] screen.	P.362
③	Lock Screen During Analysis	Displays [Lock Screen During Analysis] screen.	P.364
④	Password	Displays [Change] screen.	P.365

■ [Screen Lock] Screen

Press  (HOME) - [Function] - [Lock] - [Screen Lock] to display [Screen Lock] screen.

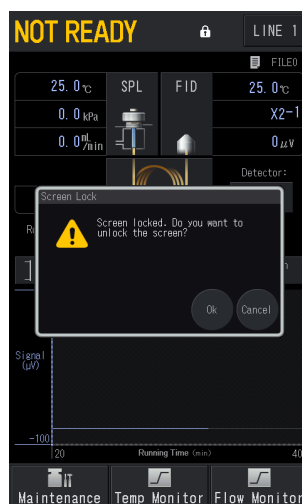
Use screen lock function to avoid misoperation of the screen.



No.	Item	Description
①	Screen Lock	Locks the screen operation. After pressing [Screen Lock],  (screen lock) appears on the monitor and no screen operation is accepted. However,  (START),  (STOP), and  (PREP RUN) on the control panel is available even while the screen lock is active.
②	Use Password	Check this item when using password.

Unlocking the screen

Press anywhere on the monitor to display the following screen.

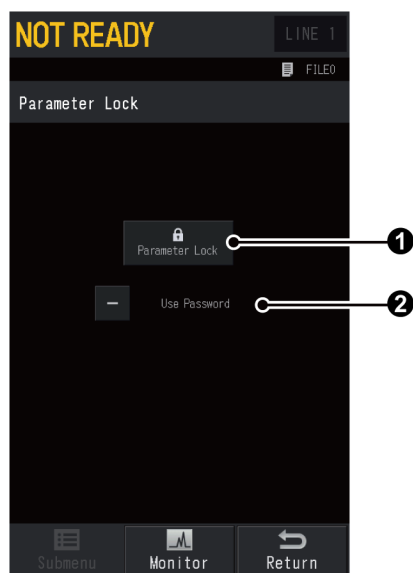


Press [Ok] to display [Screen Lock] screen and unlock the screen.

■ [Parameter Lock] Screen

Press  (HOME) - [Function] - [Lock] - [Parameter Lock] to display [Parameter Lock] screen.

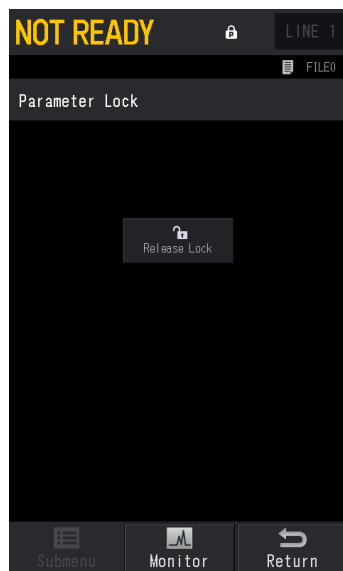
The parameter lock function prevents parameter changes in analytical conditions such as temperature, pressure and flow. Setup values can be monitored, but cannot be changed while parameter lock is active.



No.	Item	Description
①	Parameter Lock	Locks the parameter changes. After pressing [Parameter Lock],  (parameter lock) appears on the screen and no parameter change is accepted.
②	Use Password	Check this item when using password.

Unlocking the parameter

While the parameter lock is active, press  (HOME) - [Function] - [Lock] - [Parameter Lock] to display [Parameter Lock] screen.

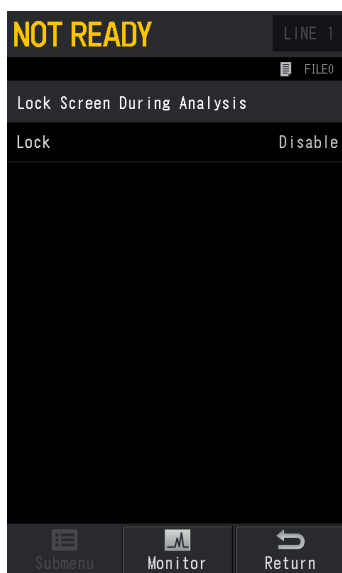


- Without password
Press [Release Lock] to unlock parameters.
- With password
Press [Release Lock] to display the password screen. Enter password to unlock parameters.

■ [Lock Screen During Analysis] Screen

Press  (HOME) - [Function] - [Lock] - [Lock Screen During Analysis] to display [Lock Screen During Analysis] screen.

NOTE To enable Screen Lock during analysis, contact Shimadzu service personnel.



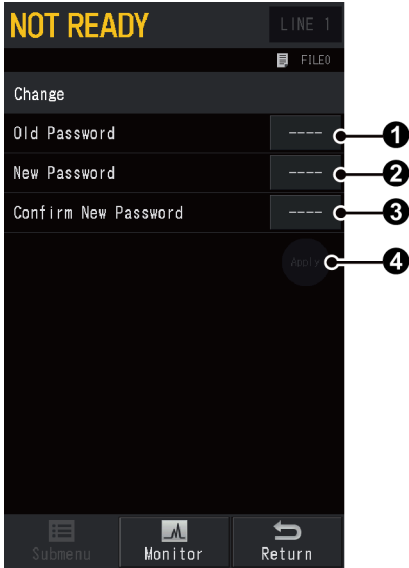
When Screen Lock is enabled during analysis and analysis is started while the instrument is communicating with the PC software, the Monitor screen is automatically displayed and all operations on the screen and button operations on the control panel are disabled. After analysis is completed, the lock is automatically released.



■ [Change] Screen

Press  (HOME) - [Function] - [Lock] - [Password] to display [Change] screen.

 **Hint** Remember the password.

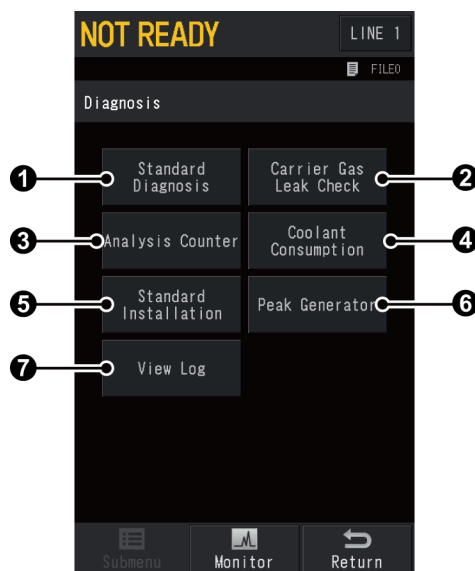


No.	Item	Description	
❶	Old Password	Enter old password.  Hint Factory default is "2030".	
❷	New Password	Enter new password.	
		Range	4-digits number from 0000 to 9999.
❸	Confirm New Password	Enter ❷ [New Password] again.	
❹	Apply	Press ❹ [Apply] to confirm the change. You can press ❹ [Apply] after you set all of ❶ to ❸.	

7.9.9 [Diagnosis] Screen

Press  (HOME) - [Function] - [Diagnosis] to display [Diagnosis] screen.

On [Diagnosis] screen, you can perform standard diagnosis and check analysis counter.

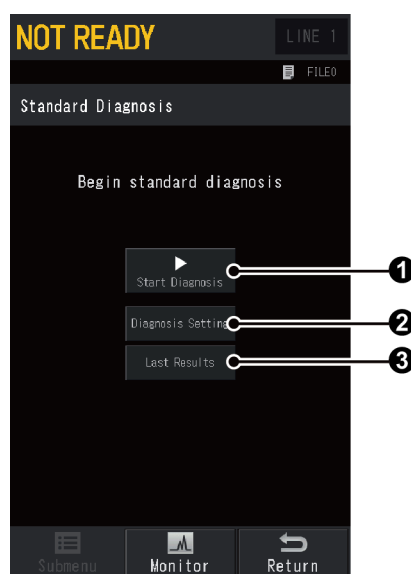


No.	Item	Description	See also
①	Standard Diagnosis	Displays [Standard Diagnosis] screen.	P.367
②	Carrier Gas Leak Check	Displays [Carrier Gas Leak Check] screen.	P.374
③	Analysis Counter	Displays [Analysis Counter] screen.	P.375
④	Coolant Consumption	Displays [Coolant Consumption] screen.	P.377
⑤	Standard Installation	Displays [Standard Installation Test] screen.	P.378
⑥	Peak Generator	Displays [Peak Generator] screen.	P.379
⑦	View Log	Displays [Log Reading Menu] screen.	P.380

■ [Standard Diagnosis] Screen

Press  (HOME) - [Function] - [Diagnosis] - [Standard Diagnosis] to display [Standard Diagnosis] screen.

On the [Standard Diagnosis] screen, you can check the thresholds for each consumable, presence/absence of sensor error, operation of gas flow and operation of over temp protection. Use this screen to maintain the instrument and diagnose problems.



No.	Item	Description	See also
①	Start Diagnosis	Press [Start Diagnosis] to start standard diagnosis program. After the diagnosis, test result and number of failures are displayed.	-
②	Diagnosis Setting	Displays [Diagnosis Setting] screen. Selects diagnosis items and determines setup values used for diagnostic reference.	P.369
③	Last Results	Displays [Diagnosis Report] screen. Displays the result of the last self-diagnosis. NOTE When Standard Diagnosis is not performed after the instrument is turned on, Last Results screen is not displayed.	P.372

Cautions when starting the standard diagnosis.

When the standard diagnosis is performed, among the units included in line configuration, the temperature is controlled for the column oven but not for the inlet and detector. Only gas is controlled for the inlet and detector.

Therefore, prepare the instrument for analysis before the standard diagnosis.

(For example, connect the column, supply each gas, and close the oven door)

Since the column temperature increases to 100 °C, when using the column of which maximum temperature is lower than 100 °C, remove the column and seal the column connection of the inlet and detector.

Diagnosis of ignition/illumination operation of the detector

The detector temperature is not controlled during the standard diagnosis, therefore, it is diagnosed by ignition/illumination operation after the instrument is turned on. When ignition/illumination operation is not performed after the instrument is turned on or ignition operation is not performed after the flame is extinguished, the result of diagnosis becomes [Not Tested].

Diagnosis of carrier gas control/purge flow control

It is diagnosed at set inlet pressure, total flow and purge flow. The result of diagnosis may become [Fail] when:

- The initial temperature of the column oven is set at a high value
- Split ratio is set at a low value
- Purge flow is set at a high value

When the result of diagnosis becomes [Fail], change each set value and perform the diagnosis again.

When the result becomes [Fail] even after changing the set value, contact your Shimadzu sales/service representative.

Diagnosis of over temp protection

It checks that the over temp protection operates correctly.

During diagnosis, gas control is started for the carrier gas of the inlet included in line configuration and AUX-APC and then the column temperature increases to about 100 °C. It is diagnosed by operating the over temp protection while increasing the temperature and checking that the heater is turned OFF.

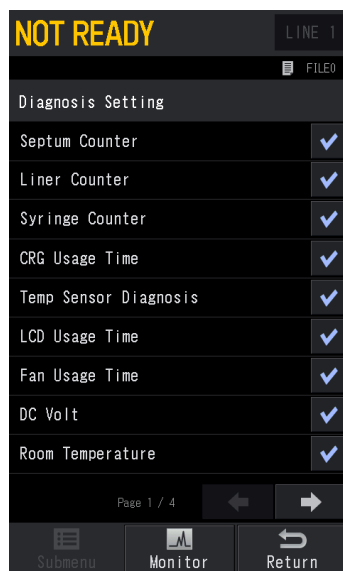
Diagnosis is terminated and the result becomes [Note Tested] when:

- The instrument detects that the oven door opens during diagnosis
- An error related to the flow controller occurs during diagnosis
- Diagnosis is started when the column maximum temperature is set lower than 100 °C.

■ [Diagnosis Setting] Screen

Press  (HOME) - [Function] - [Diagnosis] - [Standard Diagnosis] - [Diagnosis Setting] to display [Diagnosis Setting] screen.

Diagnosis items can be set on [Diagnosis Setting] screen.



Item	Description
Septum Counter Liner Counter Syringe Counter	Verifies whether the number of usage is below the threshold. The threshold can be set on [Analysis Counter] screen. ▶▶ Reference "[Analysis Counter] Screen" P.375
CRG Usage Time	Verifies whether the operating time of CRG coolant is below the threshold. The threshold can be set on [Coolant Consumption] screen. ▶▶ Reference • "7.7.1 [CRG] Screen" P.296 • "[Coolant Consumption] Screen" P.377
Temp Sensor Diagnosis	Verifies whether the temperature sensor operates correctly.
LCD Usage Time	Verifies whether the accumulated back light ON time is below the threshold. The threshold is 46380 hours.
Fan Usage Time	Verifies whether the accumulated fan operating time is below the threshold. The threshold is 61320 hours.
DC Volt	Verifies whether each DC voltage (5 V DC, 24 V DC) is below the threshold.
Room Temperature	Verifies whether the current room temperature is within the operation range. The threshold is 5 °C to 40 °C.
Atmospheric Press	Verifies whether the atmospheric pressure is within the operation range.
Primary Press	Verifies whether the carrier gas supply pressure is within the maximum set pressure.
CPU Register RTC Register	Verifies that each register is correctly written and read.

Item	Description
DET ROM	Verifies that the data saved in the detector ROM is read correctly.
DET ADC Register	Verifies that the data saved in the detector A/D converter register is read correctly.
DET HV Source	Verifies whether the detector high voltage power supply is below the threshold.
DET Ignite/Plasma ON Pulse	Checks that the ignition/plasma ON pulse is normal.
DET Ignition/Plasma ON	Checks that the ignition/plasma ON operation is normal.
ECD Frequency	Verifies whether the frequency of the pulse voltage applied to the ECD is below the threshold.
CAR Gas ROM DET Gas ROM APC ROM Gas Selector ROM	Verifies that the data saved in the flow controller ROM is read correctly.
CAR Gas ADC DET Gas ADC APC ADC Gas Selector ADC	Verifies that the data saved in the flow controller A/D converter is read correctly.
CAR Gas Control Purge Gas Control Makeup Gas Control H2 Gas Control Air Gas Control APC Gas Control Gas Selector Control	Checks that carrier gas, detector gas, AUX-APC, and gas selector are normally controlled.
Over Temp Protection	Ensure that the overheat protection circuit is normal.
ROM	Checks that the ROM is intact.
RAM	Verifies the RAM can be correctly written and read.
SCD Vacuum Pump SCD Ozone Scrubber SCD Inner Pyrotube SCD Outer Pyrotube	Verifies whether the number of usage is below the threshold. The threshold can be set on [SCD Parts Counter] screen. ▶▶ Reference "7.4.16 [SCD Parts Counter] Screen" P.245
SCD Furnace Temp. Sensor	Verifies whether the furnace temperature sensor operates correctly.
SCD ROM	Verifies that the data saved in the SCD ROM is read correctly.
SCD ADC	Verifies that the data saved in the SCD A/D converter is read correctly.
SCD Flow Control	Checks that SCD detector gas is normally controlled.

■ [Diagnosis Report] Screen

Press  (HOME) - [Function] - [Diagnosis] - [Standard Diagnosis] - [Last Results] to display [Diagnosis Report] screen.

You can see the list of items that Test Result and Diagnosis result are "Fail".

 **Hint** [Diagnosis Report] is displayed also when you press [Details] on the screen displayed after the standard diagnosis.



No.	Item	Description	See also
①	Diagnosis Report (Details)	Displays [Diagnosis Report (Details)] screen. You can see the results of self-diagnosis for each item.	P.372
②	Test Result	You can see the list of items that Test Result and Diagnosis result are "Fail". • Pass : Displayed when the diagnosis result is below the threshold. • Fail : Displayed when the diagnosis result exceeds the threshold. ▶▶ Reference "Troubleshooting for [Fail]" P.373 • Cancel : Displayed when the self-diagnosis was stopped.	-

■ [Diagnosis Report (Details)] Screen

Press  (HOME) - [Function] - [Diagnosis] - [Standard Diagnosis] - [Last Results] - [Diagnosis Report (Details)] to display [Diagnosis Report (Details)] screen.
You can see the results of self-diagnosis for each item.



• Test Result

Item	Description
Pass	Displayed when the diagnosis result is below the threshold.
Fail	Displayed when the diagnosis result exceeds the threshold. ▶▶ Reference "Troubleshooting for [Fail]" P.373
Cancel	Displayed when the self-diagnosis was stopped.

• Detailed Diagnosis Result

Item	Description
Pass	Displayed when the diagnosis result is below the threshold.
Fail	Displayed when the diagnosis result exceeds the threshold. ▶▶ Reference "Troubleshooting for [Fail]" P.373
Not Tested	Displayed when the self-diagnosis was stopped or when an item is excluded from the test.
Not Applicable	Displayed when diagnostic test is disabled for the unit (ignition test for a TCD, for example).
Not Selected	Displayed when the diagnosis were not performed on the item because it has not been configured in the analytical line. Certain diagnosis items can be performed for components which have not been configured. (Example: Does not check make up gas control, but checks its detector ROM.)
Not Installed	Displayed when the diagnosis item is not installed.

Troubleshooting for [Fail]

Diagnosis Item	Solution
Septum Counter	Replace the septum. ▶▶ Reference Maintenance Help
Liner Counter	Replace the glass insert as needed. ▶▶ Reference Maintenance Help
Syringe Counter	Replace the AOC syringe as needed. ▶▶ Reference Maintenance Help
Room Temperature	Check the operation range.
Atmospheric Press	Check the operation range.
Primary Press	• Adjust supply pressure to the GC (with the regulator of the cylinder). • Replace the cylinder.
DET Ignition	▶▶ Reference • "5.4.2 Cannot Ignite or Flame Is Extinguished (FID)" P.63 • "5.7.2 Cannot Ignite or Flame Is Extinguished (FPD)" P.70
Any other item	Contact your Shimadzu sales/service representative.

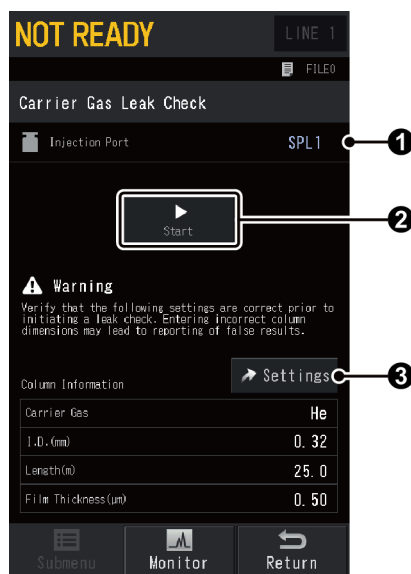
■ [Carrier Gas Leak Check] Screen

Press  (HOME) - [Function] - [Diagnosis] - [Carrier Gas Leak Check] to display [Carrier Gas Leak Check] screen.

This function checks the leakage of the carrier gas.

If the previous check result is displayed, press [Clear] to delete it. Press [Retry] to perform the leak check again.

▶▶ **Reference** For details of gas leak check, see "[Inspection method using the carrier gas leak check function](#)" P.441.



No.	Item	Description
①	Injection Port	Displays active injection port.
②	Start	Press [Start] to start carrier gas leak check.
③	Settings	Displays [Column Information] screen. ▶▶ Reference " 7.6.2 [Column Information] Screen " P.292

■ [Analysis Counter] Screen

Press  (HOME) - [Function] - [Diagnosis] - [Analysis Counter] to display [Analysis Counter] screen.

Use the analysis counter to display messages warning you to replace septum, glass insert, and syringe.



No.	Item		Description	
1	Batch Behavior at Threshold		Sets action to be performed when the number of analysis exceeds the threshold set on [Analysis Counter] screen during batch behavior. When [Continue] is selected, a message saying that the counter exceeds the threshold will appear in the message display, however, the instrument continues batch behavior. When [Stop] is selected, a warning message is displayed and the instrument stops batch behavior.	
			Items	Continue, Stop
			Default	Continue
2	Septum Usage Counter		Sets the septum counter.	
	Usage Counter	Select [Yes] to display a message in the message display when the number of uses of the septum exceeds the threshold.		
		Items	No, Yes	
		Default	Yes	
	Counter		Displays the number of uses of the septum. Press [Reset] to reset the count. When [Usage Counter] is set at [Yes] and the counter exceeds the threshold, the displayed color turns red.	
	Threshold	Sets the number of times where you should replace the septum.		
		Range	0 to 9999	
		Default	100	

No.	Item		Description
③	Liner Usage Counter		Sets the insert counter.
	Usage Counter	Select [Yes] to display a message in the message display when the number of uses of the glass insert exceeds the threshold.	
		Items	No, Yes
		Default	Yes
	Counter		Displays the number of uses of the glass insert. Press [Reset] to reset the count. When [Usage Counter] is set at [Yes] and the counter exceeds the threshold, the displayed color turns red.
	Threshold	Sets the number of times where you should replace the glass insert.	
		Range	0 to 9999
		Default	100
④	Syringe Usage Counter		Sets the AOC syringe counter. Displayed when AOC is configured in analytical line.
	Usage Counter	Select [Yes] to display a message in the message display when the number of uses of the AOC syringe exceeds the threshold.	
		Items	No, Yes
		Default	Yes
	Counter		Displays the number of uses of the syringe. Press [Reset] to reset the count. When [Usage Counter] is set at [Yes] and the counter exceeds the threshold, the displayed color turns red.
	Threshold	Sets the number of times where you should replace the syringe.	
		Range	0 to 9999
		Default	500

 NOTE

- The timing of replacement of septum and glass insert is different depending on the sample and outer diameter of the syringe needle. Check [Counter] and [Threshold] before analysis.
- If a message saying that the counter exceeds the threshold appears, replace the parts immediately.
- Reset the counter after you replace septum, glass insert or AOC syringe.

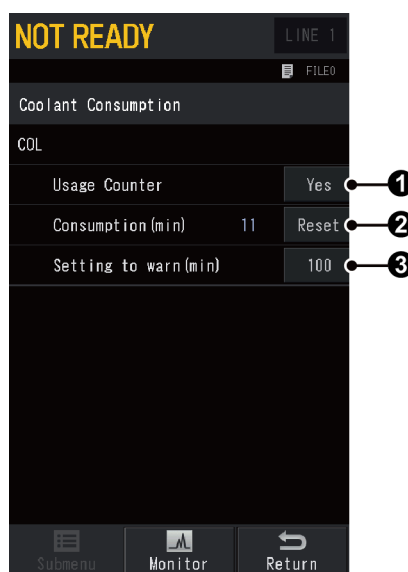
■ [Coolant Consumption] Screen

Press  (HOME) - [Function] - [Diagnosis] - [Coolant Consumption] to display [Coolant Consumption] screen.

When using low-temperature oven controller CRG, the instrument monitors total time that [Valve] on [CRG] screen is set at [On], and displays it on [Consumption] on [Coolant Consumption] screen.

▶▶ Reference "7.7.1 [CRG] Screen" P.296

When the coolant consumption counter is active and the coolant consumption exceeds the threshold, a warning message is displayed.



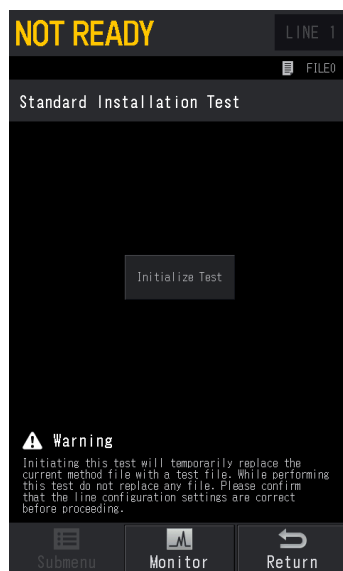
No.	Item	Description	
①	Usage Counter	Select [Yes] to display a message in the message display when the coolant consumption exceeds the threshold.	
		Items	No, Yes
		Default	Yes
②	Consumption	Displays total time that [Valve] on [CRG] screen is set at [On]. Press [Reset] to reset the count. When [Usage Counter] is set at [Yes] and the consumption exceeds the threshold, the displayed color turns red.	
③	Setting to warn	Sets the threshold where you should replace the coolant.	
		Range	0 to 9999 min
		Default	100 min

NOTE The coolant consumption time depends on the gas cylinder volume and the temperature settings. Set the threshold according to the analysis conditions. Perform analysis and check the actual coolant consumption before you set the threshold.

■ [Standard Installation Test] Screen

Press  (HOME) - [Function] - [Diagnosis] - [Standard Installation] to display [Standard Installation Test] screen.

On [Standard Installation Test] screen, you can check whether the instrument operates according to the set conditions after installation.



Test Procedure

- 1 Press [Initialize Test] on [Standard Installation Test] screen.
[Test] is displayed in the top-right of the screen.
- 2 Configure an injection port and a detector used for the standard installation test in the same analytical line.
▶▶ Reference ["7.8.2 \[Line Configuration\] Screen" P.314](#)
- 3 Set the column information.
▶▶ Reference ["7.6.2 \[Column Information\] Screen" P.292](#)
- 4 Set analytical conditions.
▶▶ Reference • ["7.5 Injection Port" P.247](#)
• ["7.4 Detector" P.185](#)
• ["7.8.1 \[Analysis Settings\] Screen" P.313](#)
- 5 Start the GC.
▶▶ Reference ["7.1.1 \[GC Start Sequence\] Screen" P.143](#)
- 6 Inject a sample into the injection port and press  (START).
- 7 Check whether the instrument performs the analysis according to the set conditions.

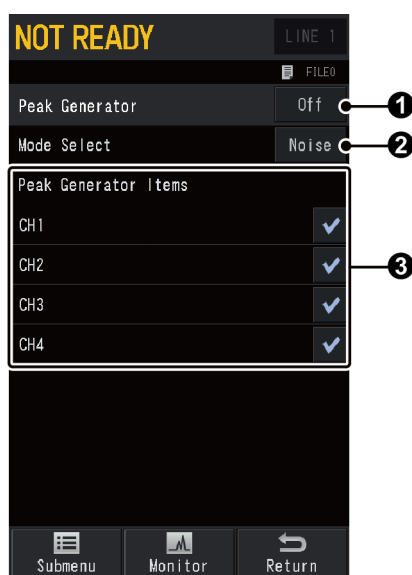
- 8 After the check, press [Unload] on [Standard Installation Test] screen to return the analysis conditions to the original values.

NOTE If the instrument does not obtain the data according to the set conditions, contact your Shimadzu sales/service representative.

■ [Peak Generator] Screen

Press  (HOME) - [Function] - [Diagnosis] - [Peak Generator] to display [Peak Generator] screen.

Use [Peak Generator] screen to generate dummy peaks to confirm the operation of the data processing unit.



No.	Item	Description
①	Peak Generator	Select [On] to generate dummy peaks to confirm the operation of the data processing unit.
		Items Off, On
		Default Off
②	Mode Select	Sets the type of the dummy peak.
		Items Noise, No Noise
		Default Noise
③	Peak Generator Items	Check the channel which the instrument outputs peaks to.

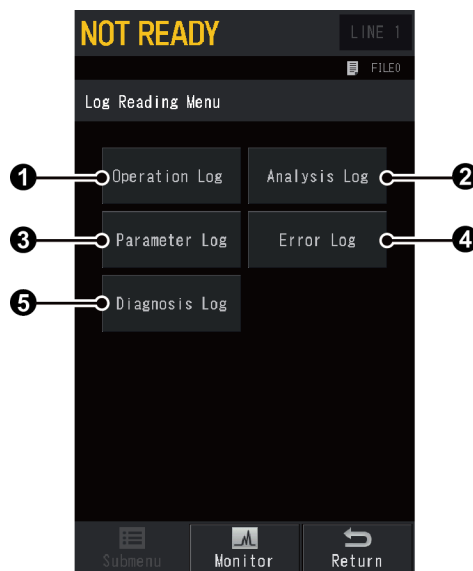
Submenu

Item	Description
Peak Information	Sets parameters of the dummy peaks outputted to the data processing unit (retention time, full width at half height, and peak height).

■ [Log Reading Menu] Screen

Press  (HOME) - [Function] - [Diagnosis] - [View Log] to display [Log Reading Menu] screen.

[Log Reading Menu] screen shows logs.



No.	Log type	Description	Max Logs	Note
①	Operation Log	Displays the Power and GC (System) On/Off log.	50	-
②	Analysis Log	Displays analysis log. If a parameter goes out of the setting, you can check the parameter.	5 to 525 * Different depending on the log size.	If the program rate (speed) is too high during a temperature program, it may not be controlled as the setting.
③	Parameter Log	Displays the date of parameter change, and the name and the set value of the parameter. Also displays the log of direct operation such as valve.	50	-
④	Error Log	Displays all error messages displayed on the screen and their time of occurrence.	100	When only one ignition sequence was re-attempted, it is not recorded in the error log.
⑤	Diagnosis Log	Displays the log of standard diagnosis.	50	For detailed result of the last self-diagnosis, see "[Diagnosis Report (Details)] Screen" P.372.

 **Hint** Press [Clear Log] to delete the log.

7.9.10 [PREP RUN] Screen

Press  (HOME) - [Function] - [PREP RUN] to display [PREP RUN] screen.

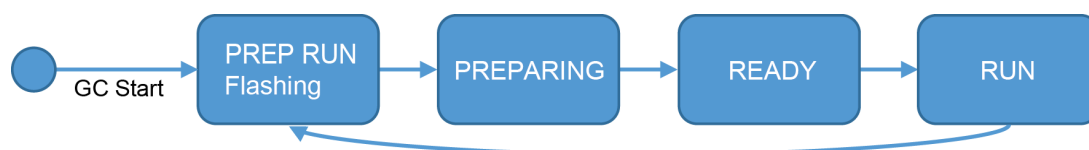
PREP RUN is a function to avoid contamination of columns or detectors and to reduce consumption of the carrier gas by putting the instrument not in the initial state (ready for analysis) but in analysis standby state after the GC startup or analysis.

PREP RUN function can be active when the instrument is in the following settings or situations:

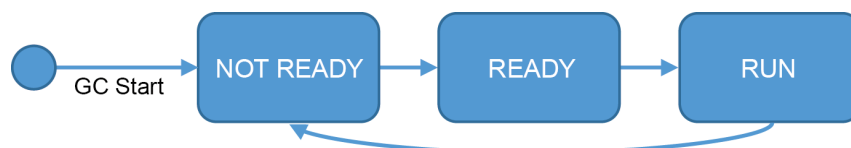
- [Carrier Gas Saver] is turned [On]
 ▶▶ Reference "7.10.1 [Eco Setting] Screen" P.384
- [Back Flush Mode] is turned [On]
 ▶▶ Reference "7.5.10 [Back Flush Settings] Screen" P.275
- [Split Mode] is set at [Splitless]
 ▶▶ Reference "7.5.1 [INJ/FLOW] Screen (SPL)" P.247
- [High Press Injection Mode] is set at [Auto]
 ▶▶ Reference "7.5.14 [High Pressure Injection] Screen" P.281
- Optional CRG is used, [Valve] is set at [On], and default value of [Temperature Program] is set under "Room Temperature + 2 °C".
 ▶▶ Reference "7.7.1 [CRG] Screen" P.296
- [Final Temp Hold] is turned [On] in the setting for column oven temperature control
 ▶▶ Reference "7.6.3 [Column Oven Temp Control Settings] Screen" P.294

The instrument status on the touch panel will flash when the instrument is set in waiting state by PREP RUN function.

State transition while PREP RUN function is active

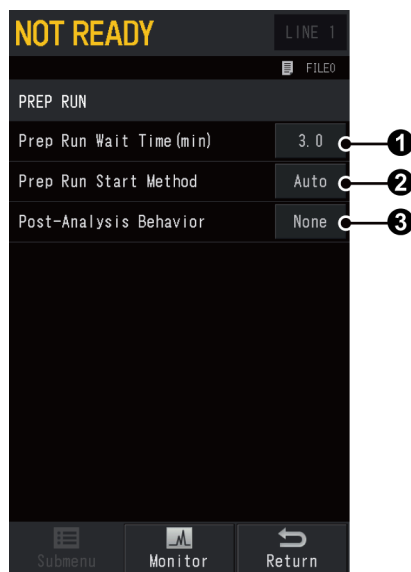


State transition while PREP RUN function is not active



When PREP RUN function is active, the instrument is in waiting status for analysis and cannot perform analysis. Press  (PREP RUN) on the control panel to change the instrument from waiting status for analysis to the status which enables analysis (READY).

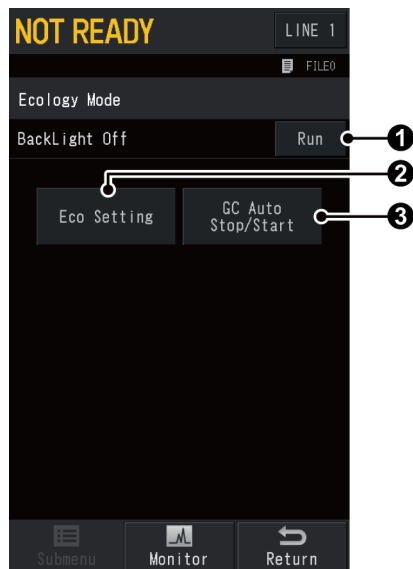
On [PREP RUN] screen, you can set items related to PREP RUN function.



No.	Item	Description	
①	Prep Run Wait Time	Sets the time to wait in READY status until PREP RUN function starts. If READY state remains for more than the set time, the instrument goes into PREP RUN state.	
		Range	0.0 to 9999.0 min
		Default	3.0 min
②	Prep Run Start Method	Sets PREP RUN function operation for batch analysis. Select [Auto] to run PREP RUN function automatically when batch analysis starts. Select [External] to run PREP RUN function upon input from an external device.	
		Items	Auto, External
		Default	Auto
③	Post-Analysis Behavior	Select [PREP RUN] to run PREP RUN function automatically after single analysis is completed.	
		Items	None, PREP RUN
		Default	None

7.10 Ecology Mode

Sets parameters to save resource and energy.



No.	Item	Description	See also
❶	BackLight Off	Press [Run] to turn off the backlight of the LCD. Touch the LCD to return the screen.	-
❷	Eco Setting	Displays [Eco Setting] screen.	P.384
❸	GC Auto Stop/Start	Displays [GC Auto Stop/Start] screen.	P.386

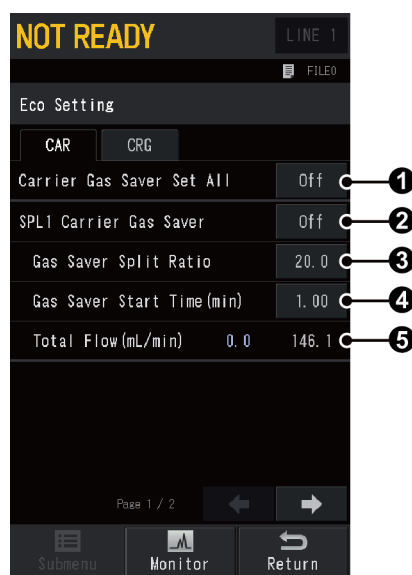
7.10.1 [Eco Setting] Screen

Press  (HOME) - [Ecology Mode] - [Eco Setting] to display [Eco Setting] screen.

On [Eco Setting] screen, you can set parameters to save carrier gas consumption (Carrier Gas Saver) when the injection port is SPL or PTV. When several injection ports are installed, you can set parameters for each injection port.

You can set up CRG when using optional CRG.

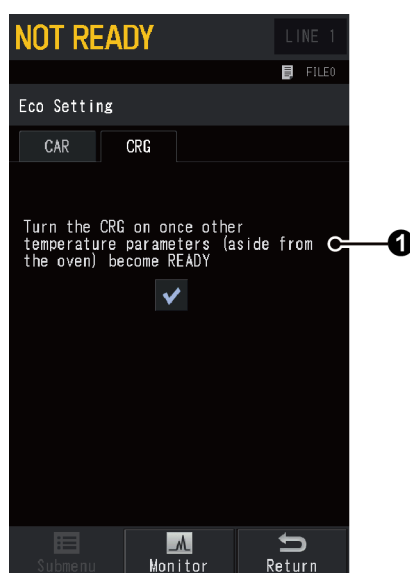
[CAR] tab



No.	Item	Description
①	Carrier Gas Saver Set All	Select [On] to set all ② [Carrier Gas Saver] at [On] when several injection ports are installed.
		Items On, Off
		Default Off
②	Carrier Gas Saver	Select [On] to use settings to save carrier gas consumption (Carrier Gas Saver).
		Items On, Off
		Default Off

No.	Item	Description
③	Gas Saver Split Ratio	Sets split ratio when using the carrier gas saver.
		 Hint Set this value so that the displayed value in ⑤ [Total Flow] (blue) is over 20 to 30 mL/min.
		 NOTE If flow value (blue) when using Carrier Gas Saver displayed in ⑤ [Total Flow] is less than 20 mL/min, column inlet pressure may not reach the set value or ghost peaks may appear. Make sure that the split ratio is set so that total flow is over 20 mL/min.
④	Gas Saver Start Time	Range 0.0 to 9999.9
		Default 20.0
		Sets the period of time after analysis starts until carrier gas saver starts. This period of time should be longer than the time required for the sample to move from the injection port to the column. If carrier gas saver starts before the sample moves to the column, repeatability of analysis may be impaired.
⑤	Total Flow	Range 0.0 to 9999.99 min
		Default 1.00 min
		Displays the flow. • Left value (blue): Flow when using carrier gas saver • Right value (black): Normal flow

[CRG] tab

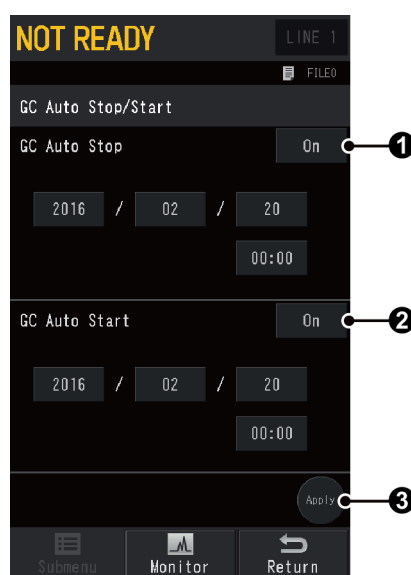


No.	Item	Description
①	Turn the CRG on once other temperature parameters (aside from the oven) become READY	Check this item not to use CRG until the actual temperatures of parts other than column oven (injection port etc.) reach near the set value after analysis. Cooling time becomes longer, however, you can save coolant because CRG usage time becomes shorter. Uncheck this item to cool the oven with CRG immediately after analysis.

7.10.2 [GC Auto Stop/Start] Screen

Press  (HOME) - [Ecology Mode] - [GC Auto Stop/Start] to display [GC Auto Stop/Start] screen.

Use [GC Auto Stop/Start] screen to set GC auto stop or GC auto start.



No.	Item	Description
①	GC Auto Stop	Select [On] to set the date and the time when the GC automatically stops.
		Items On, Off
		Default Off
②	GC Auto Start	Select [On] to set the date and the time when the GC automatically starts.
		Items On, Off
		Default Off
③	Apply	Press ③ [Apply] to confirm the change.

8 Technical Document

8.1 Specifications

■ The main body of the GC

Dimensions	515 mm (W) × 440 mm (H) × 540 mm (D) (excluding projections)*1*2
Mass	about 43.5 kg*1
Power requirements	100 V AC: 1800 VA*1, 50 Hz/60 Hz 115 V AC: 1800 VA*1, 50 Hz/60 Hz 230 V AC: 2600 VA*1, 50 Hz/60 Hz

*1 For SPL/FID model

*2 For the SINJ/PTCD model, the height is 500 mm.

■ Column oven

Range of temperature	Room temperature +2 °C to 450 °C
When using liquid CO ₂ *1	-50 °C to 450 °C
When using liquid N ₂ *1	-99 °C to 450 °C
Dimensions	280 mm (W) × 280 mm (H) × 175 mm (D)
Volume	13.7 L
Accuracy of temperature	Set value ±1% (K) (Calibrated at 0.01 °C)
Deviation of temperature	within 2 °C (on a circle which has a diameter of 200 mm, and is centered at 30 mm from the rear)
Temperature dependence	0.01 °C/°C
Program ramps	32 ramps possible (cooling available)
Program rate	-250 °C to 250 °C/min*2
Total time of total program	9999.99 minutes max
Cooling rate	Within 3.4 minutes cooling from 450 °C to 50 °C (Ambient temperature : 22 °C)
Oven Light	Available
Hydrogen Sensor	Available (optional)

*1 Optional parts are required to use liquid CO₂ or liquid N₂.

*2 For controllable ranges of temperature program rates of column oven, see ["Controllable ranges of temperature program rates"](#) P.290.

■ Injection unit

Maximum installation	Up to 3
Type	5 types (SPL unit, WBI unit, OCI unit, PTV unit, SINJ unit)
Range of temperature	450 °C max

■ Carrier gas flow controller

Maximum installation	Up to 3

■ Advanced Flow Controller (AFC)

Injection Mode	Split/Splitless mode, direct (full) mode
Range of pressure	0 to 1035 kPa ("psi" or "bar" can also be used.)
Program ramps	7 ramps possible (step-down program available)
Program rate	-400 to 400 kPa/min
Split ratio	0 to 9999.9
Range of total flow	He, H ₂ : 0 to 1300 mL/min N ₂ : 0 to 600 mL/min  NOTE The setting range of the flow is specified considering controllable range.  Reference "8.6.7 AFC and APC Control Ranges" P.434
Flow Control Mode	Constant Velocity Mode, Constant Pressure Mode, Constant Flow Mode
Function to keep the average of the column linear velocity during heating	Available
Settable pressure unit	0.001 psi, 0.001 bar, 0.1 kPa

■ Detector

Hydrogen flame ionization detector (FID)

Range of temperature	450 °C max
Minimum detection	1.2 pgC/s (dodecane): Capillary analysis 2.5 pgC/s (dodecane): Packed analysis
Dynamic range	10 ⁷

Thermal conductivity detector (TCD)

Range of temperature	400 °C max
Sensitivity	20000 mV × mL/mg (decane)
Dynamic range	10 ⁵

Thermal conductivity detector (PTCD)

Range of temperature	350 °C max
Sensitivity	40000 mV × mL/mg (decane)
Dynamic range	10 ⁵

Electron capture detector (ECD)

Range of temperature	400 °C max
Minimum detection	4 fg/s (γ-BHC)
Dynamic range	10 ⁵

Flame photometric detector (FPD)

Range of temperature	450 °C max
Minimum detection	• P: 0.045 pgP/s (45 fgP/s) (tributyl phosphate) • S: 2 pgS/s (dodecanethiol)
Dynamic range	• P: 10⁴ • S: 10³

Flame thermionic detector/Nitrogen phosphorous detector (FTD/NPD)

Range of temperature	450 °C max
Minimum detection	• N: 0.1 pgN/s (azobenzene) • P: 0.01 pgP/s (malathion)
Dynamic range	N, P: 10 ³

Barrier discharge ionization detector (BID)

Range of temperature	350 °C max
Minimum detection	0.8 pgC/s (dodecane)
Dynamic range	10 ⁵

Sulfur chemiluminescence detector (SCD)

Range of temperature	• Interface part : 300 °C max • Furnace: 900 °C max
Minimum detection	0.3 pgS/s
Dynamic range	10 ⁴
Dimensions	410 mm (W) × 405 mm (H) × 360 mm (D) (excluding projections)
Mass	27 kg
Power requirements	100 V AC to 120 V AC: 500 VA, 50 Hz/60 Hz 220 V AC to 240 V AC: 500 VA, 50 Hz/60 Hz

■ Others

Repeatability	Peak area	0.5 % ^{*1}
	Retention time	< 0.008 % or < 0.0008 min
Energy conservation		Power consumption during standby mode is reduced by 60 %.
Language		English, Chinese
Data communication		Ethernet and USB
Display		• Pixels: width 480 × height 800^{*2} • Method: pressure sensitive • Color depth: 24-bit color touch panel
Cooling rate of column oven temperature		Three steps (Fast, Mid, Slow), or Custom setting

*1 Auto Injector AOC-30i, FID as the detector.

Tetradecane (2.5 ng to the column) split injection.

Results may vary depending on the sample and the analytical conditions.

*2 The percentage of the effective pixels of the LCD panel is 99.99 % or more. Please note that 0.01 % or less of the pixels may be missing or constantly lit.

■ Peripherals

CRG CO₂

Temperature range of column oven	-50 °C to 450 °C ^{*1}
Accuracy of temperature control	Within ±0.2 °C ^{*2} or within set value ±1 % (K)
Coolant	Liquid CO ₂ ^{*3}
Injection method for coolant	Injected by container pressure
Continuous cooling time	About 4 hours when using 30 kg of liquid CO ₂ (one cylinder) ^{*4}

*1 When the column oven temperature is set at -50 °C, the maximum temperature of FID is 400 °C.

*2 When the column oven temperature is set at 0 °C and standard tubing supplied with the instrument is used (When using central tubing equipment, the instrument may not satisfy the specification).

*3 Order a cylinder with siphon tube from cylinder manufacturers.

*4 When the column oven temperature is set at -50 °C. The piping has the standard length (2 m) and the temperature around the CO₂ cylinder is 25 °C.

The available time may become shorter depending on the set column oven temperature, length of the piping, temperature around the CO₂ cylinder, and other installation conditions. The available time may become longer by insulating the piping connecting with the CO₂ cylinder.

CRG-LN2

Temperature range of column oven	-99 °C to 450 °C ^{*1}
Accuracy of temperature control	Within ± 0.2 °C (when column oven temperature is set to 0 °C) ^{*2} Within ± 1.0 °C (down to -50 °C) Within ± 2.0 °C (down to -99 °C)
Coolant	Liquid N ₂ ^{*3}
Injection method for coolant	Injected by container pressure
Continuous cooling time	About 20 hours when using 175 L of liquid N ₂ ^{*4}

*1 When the column oven temperature is set at -50 °C, the maximum temperature of FID is 400 °C.

*2 When the standard tubing supplied with the instrument is used (When using central tubing equipment, the instrument may not satisfy the specification).

*3 Use liquid N₂ prepared in a low-temperature liquefied gas container regulated to 50 to 200 kPa.

*4 When the column oven temperature is set at -50 °C. The piping has the standard length (2 m) and the temperature around the CO₂ cylinder is 25 °C. The available time may become shorter depending on the set column oven temperature, length of the piping, room temperature, liquid N₂ supply pressure, and other installation conditions.

PRG-2030 (for 24 V DC)

Event ^{*1}	1 to 16, 93, 94
PCB A ^{*2}	EVENT1 to 8: valve output, 24 V DC $\times$ 8 (Maximum supply current: 100 mA for each)
PCB B ^{*2}	EVENT9 to 16: valve output, 24 V DC $\times$ 8 (Maximum supply current: 100 mA for each)
PCB C ^{*2}	EVENT93, 94: relay output, 2c relay (2 form c relay) $\times$ 2 (Relay rating: 30 V DC, 2 A)

*1 Incorporate it into GC-2030 to use.

*2 Choose from PCB A+B or PCB A+C.

PRG box (for 100 V AC / 200 V AC)

Connect the valve output of PRG-2030 to a cable to use.

Power voltage	100 V AC series: 100 V AC to 120 V AC 200 V AC series: 220 V AC to 240 V AC
Relay rating	10 A, Relay a $\times$ 1 3 A, Relay c $\times$ 3 3 A, Relay a $\times$ 4
Power current	100 V series: 15 A max 200 V series: 10 A max

■ AFT (Advanced Flow Technology)

Back Flush

Method	Pressure control type
Max Temperature	450 °C
Back flush pressure	0 to 1035 kPa

Heart-Cut/Detector Switching (Switching Unit)

Method	Switching mechanism with fluidic devices
Max Temperature	450 °C
Switching pressure	0 to 1035 kPa

■ Room temperature, humidity, altitude

For optimal performance, use the instrument in the following environment. The instrument can work properly within the following operating temperature (humidity) range.

- Recommended temperature range : 18 °C to 28 °C
- Recommended humidity range : 40 % to 70 % (no condensation)
- Operating temperature range : 5 °C to 40 °C
- Operating humidity range : 5 % to 90 % (no condensation)
- Altitude : below 2000 m

8.2 Power Supply and Wiring

Before connecting the power supply, verify the following items.

WARNING



Prohibition

Do NOT put heavy objects on the power cable. **Do NOT** put the cable in the vicinity of heating devices.

Do NOT modify, bend, or pull the power cable.

Do NOT fix the power cable with nails or stapler.

Failure to observe these can cause fire, electric shock, and malfunction.

If the power cable is damaged, contact your Shimadzu sales/service representative.



Instruction

Ensure that the power switchboard and other associated equipment are turned off before connection if the power cable will be connected directly to terminals on the power switchboard.

It may cause electric shock.



Instruction

Use a wall outlet which satisfies the following conditions only for GC-2030. When using SCD-2030, be sure to ground it and GC-2030 with equal potential grounds and use the same power supply with GC-2030 if you can.

- Rated current for GC-2030

Power voltage	Standard model with FID	The maximum value for models with peripherals
100 V AC	18 A	26 A
115 V AC	15.7 A	22.6 A
230 V AC	11.3 A	14.8 A

- Rated current for SCD-2030

Power voltage	Rated current
100 V AC to 120 V AC	5 A
220 V AC to 240 V AC	2.3 A

- Independent earth leakage breaker (For SCD-2030, you can share it with GC-2030.)
- Three-prong grounded-type

 **NOTE** Earth leakage breaker automatically shuts off the power upon detecting of current leakage from circuits and devices to prevent electric shock and fire.

! WARNING

Instruction

Connect the power supply complying with the power-supply voltage shown on the label on the rear of the product.

Otherwise, fire or electric shock could result. Check that the power supply voltage is stable and that its current capacity is sufficient to operate all the components of the system. If not, the instrument will not operate at its rated performance.

Instrument Type	Power Supply Voltage* ¹ (indicated on the instrument)	Power Consumption	Frequency	Rated Breaking Capacity* ²
GC-2030 main unit	100 V AC (100 V~)	1800 VA	50 Hz/60 Hz	80 A
	115 V AC (115 V~)	1800 VA	50 Hz/60 Hz	80 A
	230 V AC (230 V~)	2600 VA	50 Hz/60 Hz	50 A
SCD-2030	100 V AC to 120 V AC	500 VA	50 Hz/60 Hz	50 A
	220 V AC to 240 V AC	500 VA	50 Hz/60 Hz	50 A

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

*2 Connect the instrument to a power outlet that is equipped with a circuit breaker that shuts off the current at the described value or less.

■ Power voltage

For optimal performance, use a power supply which satisfies the following voltage specifications.

Instrument Type	Power voltage	Recommended power voltage	Operating power voltage
GC-2030 main unit	100 V AC	95 V AC to 105 V AC, 50/60 Hz	90 V AC to 110 V AC, 50/60 Hz
	115 V AC	110 V AC to 120 V AC, 50/60 Hz	103.5 V AC to 126.5 V AC, 50/60 Hz
	230 V AC	218.5 V AC to 241.5 V AC, 50/60 Hz	207 V AC to 253 V AC, 50/60 Hz
SCD-2030	100 V AC to 120 V AC	95 V AC to 120 V AC, 50/60 Hz	90 V AC to 126.5 V AC, 50/60 Hz
	220 V AC to 240 V AC	218.5 V AC to 241.5 V AC, 50/60 Hz	207 to 253 V AC, 50/60 Hz

- Transient overvoltage: Installation category II (IEC)
- Pollution degree: 2

■ Power supply capacity

Calculate the power supply capacity by considering the total power consumption of the individual components as shown below.

Connect the power source to a terminal with sufficient capacity.

- GC-2030 main unit

Power voltage	Standard model with FID	Optional temperature control block (INJ, etc.) per one	Maximum power	Short-circuit current rating
100 V AC 115 V AC	1800 VA	150 VA	2600 VA	80 A
230 V AC	2600 VA	150 VA	3400 VA	50 A

- SCD-2030

Power voltage	Power Consumption	Power supply from GC	SCD short-circuit current rating
100 V AC to 120 V AC	500 VA	150 VA	50 A
220 V AC to 240 V AC	500 VA	150 VA	50 A

NOTE Performance of the unit may be affected if the power supply voltage fluctuates or the capacity is insufficient.

■ Connecting the power cable

! WARNING



Instruction

For assembling and repair of power plug, ask your Shimadzu sales/service representative or a person trained in electric wiring work.

Failure to observe this can cause fire, electric shock, and malfunction.



Instruction

When installing a power plug, make sure that you use a power plug which complies with laws and regulations and satisfies specifications for voltage and ampacity.

For detachable/attachable power cable of 230 V model, use specified power cable or a power cable which complies with laws and regulations and satisfies specifications for voltage and ampacity.

If you connect the power cable improperly, breaker of the power switchboard may trip off or a fuse may burn out. It may also cause fire, electric shock, and malfunction.

! CAUTION



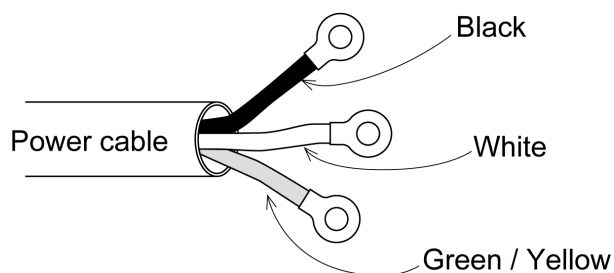
Instruction

Connect the power cable properly.

If you connect the power cable improperly, breaker of the power switchboard may trip off or a fuse may burn out.

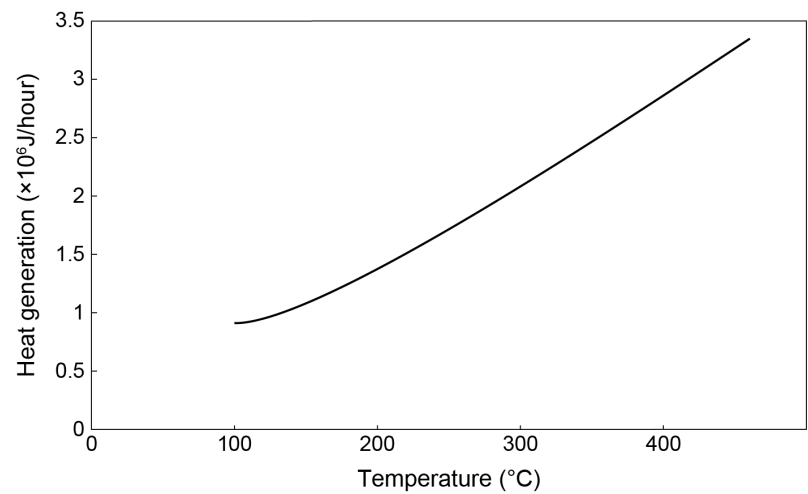
The power cables are color-coded as follows.

- Black : Connected to HOT of AC line.
- White : Connected to NEUTRAL of AC line.
- Green / Yellow : Grounding (GROUND)



■ Heating energy generation

The following graph shows the heating values generated by the instrument.



■ Fuse

The following fuses are used in the instrument. Classification depends on "IEC127".

Instrument Type		No.	Rated current/voltage	Type
GC-2030	Normal oven	F1, F2	8 A / 250 V	T
		F3, F4	10 A / 250 V	T
		F5, F6	15 A / 250 V	T
	High power oven	F1, F2	5 A / 250 V	T
		F3, F4	10 A / 250 V	T
		F5, F6	10 A / 250 V	T
SCD-2030		F1, F2	5 A / 250 V	T

■ Drying out of the instrument

NOTE The instrument may get wet from humidity in some transport conditions. In such case "drying-out" is necessary to avoid a short circuit at the heater in the injection port or the detector.

If the instrument gets wet from humidity, dry condensation in the injection port or the detector after you install units according to the following procedures.

1

Seal the connection of the column in the injection port and the detector without installing the column.

2

Remove the injection ports and the detectors from all configured analytical lines.

▶▶ Reference ["7.8.2 \[Line Configuration\] Screen" P.314](#)

3

Set the column oven temperature at "300 °C".

▶▶ Reference ["7.6.1 \[Column Oven\] Screen" P.285](#)

4

Start the GC.

▶▶ Reference ["7.1.1 \[GC Start Sequence\] Screen" P.143](#)

5

Ensure that the column temperature reaches set value on monitor screen, and wait for about 2 hours after that.

▶▶ Reference ["7.2.1 Monitor Screen" P.156](#)

8.3 Gas Supply

Read "Safety Instructions" P.xxvii and "Precautions on Handling Gases" P.xl before use for correct operation.

8.3.1 Gas Type and Purity

For optimal performance, use the following gases.

NOTE If a gas that does not satisfy the purity described below is used even once, the instrument may not satisfy the minimum detection specification even after changing the gas to a high-purity one.

■ FID

	Helium	Nitrogen	Hydrogen	Argon	Air
Carrier Gas	Purity of 99.999 % or more	Purity of 99.999 % or more	Purity of 99.999 % or more	Purity of 99.999 % or more	-
Makeup Gas	Purity of 99.999 % or more	Purity of 99.999 % or more	-	Purity of 99.999 % or more	-
Detector Gas	-	-	Purity of 99.999 % or more	-	High-purity air cylinder (including total hydrocarbons of 1 ppm or less)* ¹

*¹ Gases with a purity of 99.995 %, dry air excluding organic substances, and air compressed using an oilless compressor and then dehumidified can be used when high sensitivity analysis is not necessary.

■ TCD

	Helium	Nitrogen	Hydrogen	Argon
Carrier Gas	Purity of 99.999 % or more	Purity of 99.999 % or more	Purity of 99.999 % or more	Purity of 99.999 % or more
Makeup Gas	Purity of 99.999 % or more	Purity of 99.999 % or more	Purity of 99.999 % or more	Purity of 99.999 % or more
Detector Gas	-	-	-	-

■ PTC

	Helium	Nitrogen	Hydrogen	Argon
Carrier Gas (Reference gas)	Purity of 99.999 % or more	Purity of 99.999 % or more	Purity of 99.999 % or more	Purity of 99.999 % or more
Makeup Gas	-	-	-	-
Detector Gas	-	-	-	-

■ FTD

	Helium	Nitrogen	Hydrogen	Air
Carrier Gas	Purity of 99.999 % or more (Recommended)	Purity of 99.999 % or more (Allowable)* ¹	-	-
Makeup Gas	Purity of 99.999 % or more	Purity of 99.999 % or more (Allowable)* ¹	-	-
Detector Gas	-	-	Purity of 99.999 % or more	High-purity air cylinder (including total hydrocarbons of 1 ppm or less)* ¹

*¹ If you use nitrogen as FTD carrier gas or makeup gas, noise level may increase and sensitivity may decrease.

■ FPD

	Helium	Nitrogen	Hydrogen	Air
Carrier Gas	Purity of 99.999 % or more (Recommended)	Purity of 99.999 % or more (Allowable)	Purity of 99.999 % or more	-
Makeup Gas	-	-	-	-
Detector Gas	-	-	Purity of 99.999 % or more	High-purity air cylinder (including total hydrocarbons of 1 ppm or less)* ¹
Photomultiplier purge gas	-	Purity of 99.999 % or more	-	High-purity air cylinder (including total hydrocarbons of 1 ppm or less)

*¹ Air compressed using oilless compressor (and dehumidified) can be used, however, we recommend to use air cylinder to reduce fluctuation of air flow and noise level.
When using oilless compressor, we cannot assure sensitivity specification. Sulfurous compounds such as SO₂ in the atmosphere may be detected. Pay close attention when using compressors.

■ ECD

	Helium	Nitrogen	Hydrogen
Carrier Gas	Purity of 99.9999 % or more (Recommended)	Purity of 99.999 % or more (Allowable)	Purity of 99.999 % or more (Allowable)
Makeup Gas	-	-	-
Detector Gas	-	Purity of 99.999 % or more (Recommended)*1	-

*1 Set methane concentration at 5 % when using argon + methane gas.

■ BID

	Helium
Carrier Gas	Purity of 99.9999 % or more
Makeup Gas	-
Detector Gas	Purity of 99.9999 % or more

■ SCD

- NOTE**
- If you use the gas that does not meet the purity shown below even once, or the gas purity of the cylinder is adequate but the gas piping is contaminated, the SCD detector will be contaminated and the instrument may not operate correctly. Pay attention when using newly-installed piping.
 - Use the greaseless type for piping accessories such as stop valves.

	Helium	Nitrogen	Oxygen	Hydrogen
Carrier Gas	Purity of 99.9995 % or more	-	-	-
Makeup Gas	-	Purity of 99.9995 % or more	-	-
Detector Gas	-	-	Purity of 99.9995 % or more	Purity of 99.9995 % or more
Gas for ozone	-	-	Purity of 99.9995 % or more	-

8.3.2 Gas Supply Pressure

Gas type	Maximum pressure	Remarks
He, N ₂ , Ar	300 to 980 kPa	Carrier gas, Makeup gas, Detector gas
H ₂	• For carrier gas : 150 to 500 kPa • For detector gas (Other than SCD) : 150 to 300 kPa • For detector gas (SCD) : 200 to 300 kPa	Carrier gas, Detector gas
Air	300 to 500 kPa	Detector gas
O ₂	200 to 300 kPa	Detector gas, Gas for ozone

**Hint**

- The relationship of kPa and bar is as follows.
100 kPa = 1 bar
- Convert units between kPa and kgf/cm² as follows.
1 kPa = 1.02×10^{-2} kgf/cm²
1 kgf/cm² = 98.1 kPa
- Convert units between kPa and psi as follows.
1 kPa = 1.45×10^{-1} psi
1 psi = 6.89 kPa

8.3.3 Gas Leak Check After Piping Installation

After piping installation, check for gas leak according to the following procedure.

CAUTION



Prohibition

Do not use the leak detecting fluid nor soapy water for gas leak check on the connections above the carrier and detector gas controllers (AFC/APC).
The drips may damage the controller.

1

Open the main valve of the gas cylinder.

2

Adjust the gas supply to the specified pressures.

3

Check for leaks with leak detecting fluid (P/N: S670-11514) or soapy water on all connections.

Bubbles can be observed if a leak exists.

4

If a leak is detected, take the following measures.

- Further tighten the connection.
- Retighten the connection.
- Replace the seal material.

5

Wipe off the leak detecting fluid or soapy water using a wet cloth.



Hint Electronic leak detectors can also be used for hydrogen and helium leaks.

8.4 Sample Injection System

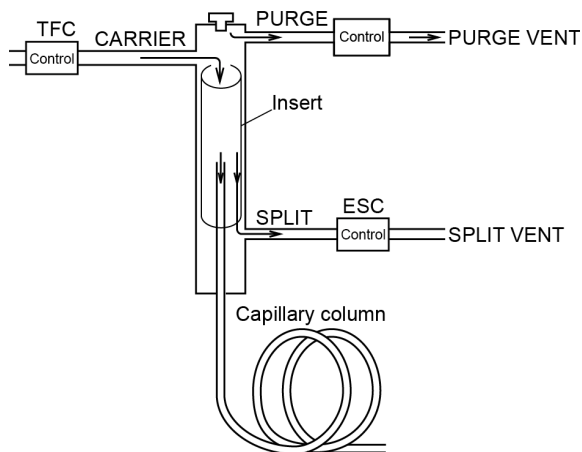
8.4.1 Split Injection System

Injection Unit: SPL, PTV

►► Reference See "8.6.4 Control by AFC" for details about control method.

In a split injection system, only a portion of the sample injected into the injection port is introduced into the capillary column. The remaining sample is sent to the split line due to high sample volume.

It shortens the sample injection time and reduces the load on column. In this mode, peaks become sharper.



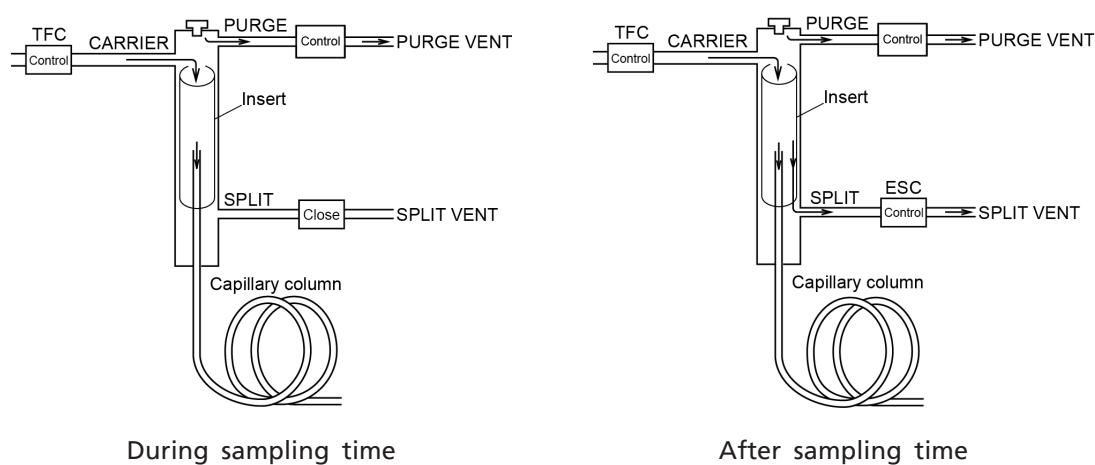
8.4.2 Splitless Injection System

Injection Unit: SPL, PTV

►► **Reference** See "8.6.4 Control by AFC" for details about control method.

In a splitless injection system, almost all of the sample amount injected is introduced into the column. Use this mode for low-concentration samples, which cannot be detected by split injection.

In a splitless injection system, the split vent is closed and the initial temperature of the column oven is low. Then, after injection, and once the vaporized sample has moved to the column, the split vent is open and the column temperature increased so that the condensed sample inside the column is vaporized again and separated.



8.4.3 Direct Injection System (WBI)

Injection Unit: WBI

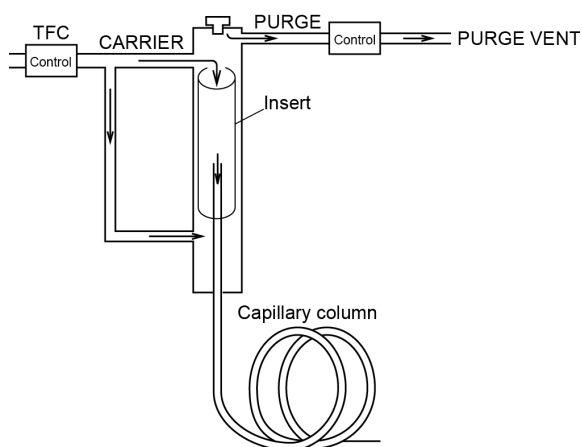
The direct injection system is an analysis method where a wide-bore column is connected to the injection port and almost the entire amount of the injected sample is injected into the column.

For the direct injection system, a WBI (wide-bore injection) injection port is used.

In the direct injection system, a wide-bore (0.53 mm or greater) column is usually used.

Analysis needs to be performed with a column flow rate larger than the value optimum for separation. Therefore, separation is not as good as analysis where a capillary column with a narrower bore is used. However, analysis is often performed with a relatively higher sensitivity because more sample can be injected into the column as compared to split analysis.

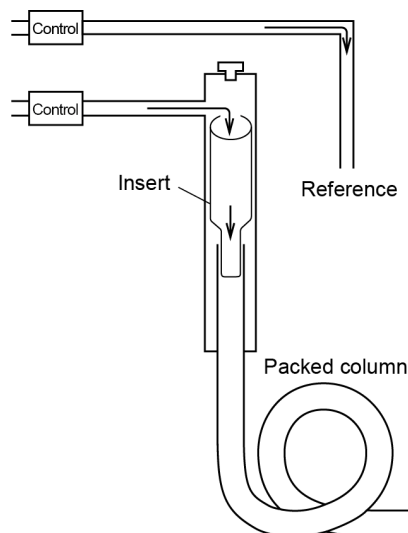
Also, the analysis method can be changed to capillary column analysis relatively easily because there is no limit on column temperature conditions and separation conditions of a packed column can be easily traced. However, peak shapes are broader as compared to analysis using a capillary column with a narrower bore. Thus, S/N ratio may not necessary be higher even when peak area is greater in some analysis conditions.



8.4.4 Direct Injection System (SINJ)

Injection Unit: SINJ

During analysis using packed columns, a sample is injected into an injection port and the entire evaporated sample is injected to the columns. A mass flow controller is used to control the column flow rate so gas is supplied at a specified flow rate even when the column flow path resistance and temperature change.



8.4.5 On-column Sample Injection System

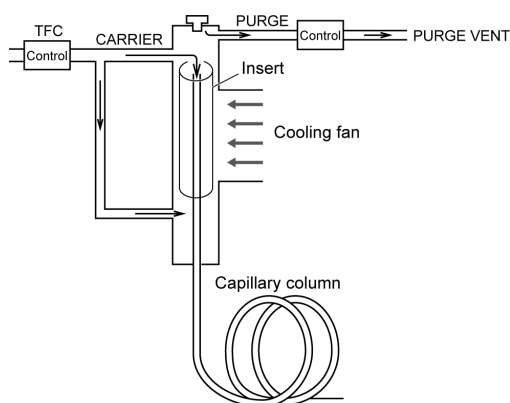
Injection Unit: OCI

The on-column injection system is an analysis method where the sample is injected directly to the column using heating program for injector inlet. On-column injection unit (OCI) is used and a wide-bore column is usually connected.

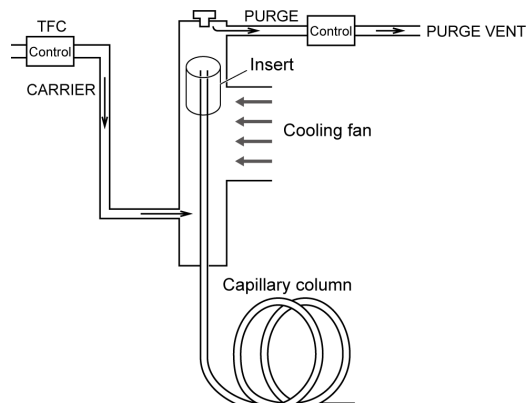
In on-column injection system, the inlet is set at a low temperature, and liquid sample is injected into the end of the column. And almost the entire amount of the injected sample is injected into the column, therefore, discrimination of the sample can be prevented.

In addition, this method is suitable for analysis of heat-sensitive, easily decomposable materials because inlet temperature increases after sample injection. However, periodic column maintenance is required because the sample is injected directly into the column without using glass insert.

Hint Discrimination (distillation) is a phenomenon where the compositions are different between the sample, and the sample injected into the column and detected by the instrument when using micro syringe to inject the sample. This change of sample composition is caused because the remaining sample in the needle is heated, and then low-boiling component is vaporized and is introduced into the column.



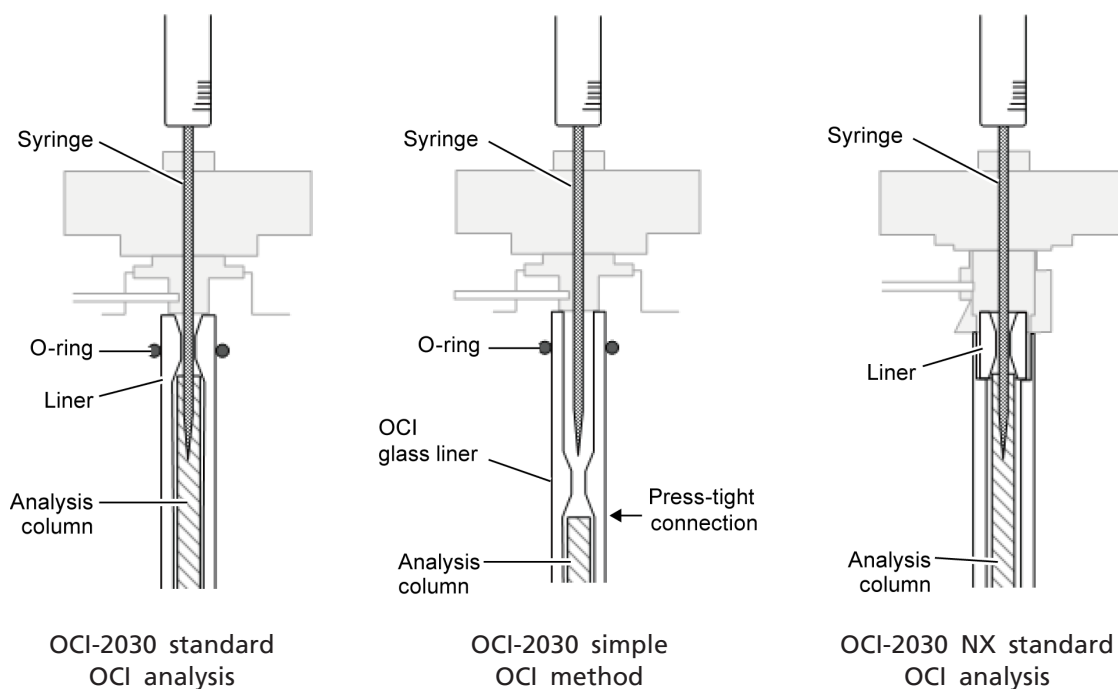
OCI-2030



OCI-2030 NX

NOTE The thermal design and flow line configuration of the OCI-2030 NX are different from those of the conventional OCI-2030/OCI-2010 series/OCI-17 series. When switching the system from conventional OCI to the OCI-2030 NX, it may be necessary to review the analysis methods. If compatibility with conventional OCI is emphasized, please use the OCI-2030.

 **Hint** The syringe positions when using OCI-2030 and OCI-2030 NX are as follows.



-  **NOTE**
- For OCI analysis, use a syringe with an outer diameter of 0.47 mm or less.
 - The minimum diameter of the taper of the OCI glass liner is 0.4 mm. Press-tight connection is not available for any columns with outer diameter of 0.4 mm or less.
 - The simple OCI method is not available for OCI-2030 NX.

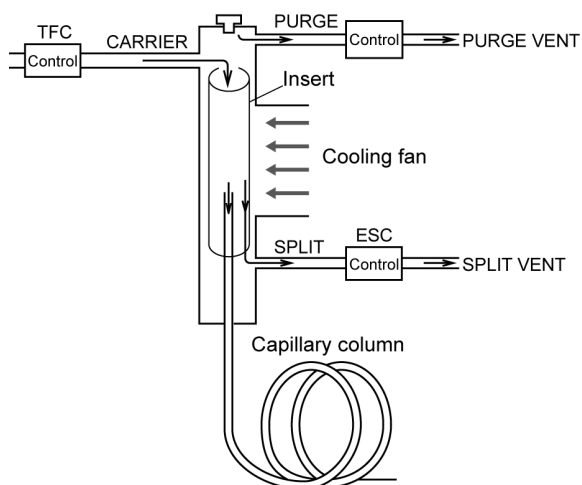
8.4.6 Programmed Temperature Sample Injection System

Injection Unit: PTV

This system is an analysis method where the sample is injected to the column with a glass insert using heating program for injector inlet. Columns with various inner diameters can be connected using Programmed Temperature Vaporizer (PTV).

This method is suitable for analysis of heat-sensitive, easily decomposable materials because temperatures of inlet and column increase after sample injection.

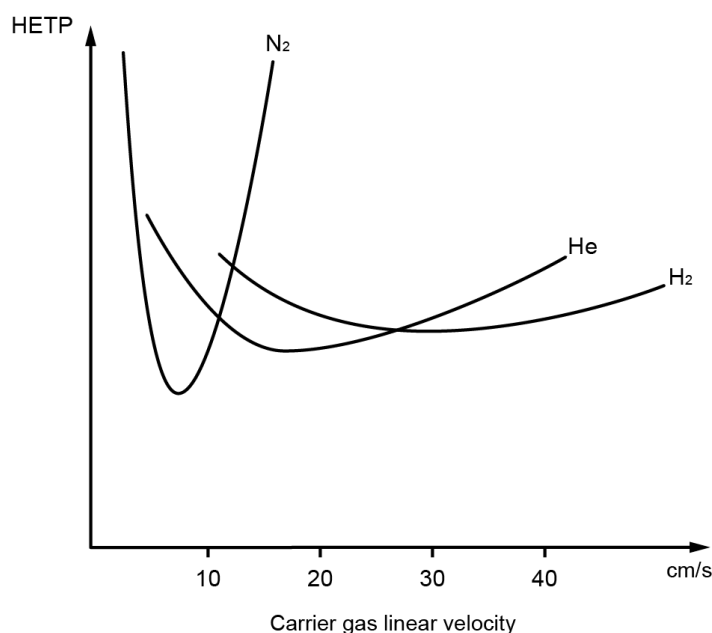
Unlike OCI, a glass insert is used in this method. Therefore, column contamination can be reduced. Samples with high/low concentration can be analyzed because split/splitless analysis is available.



8.4.7 Setting the Flow Rate Parameters

■ Linear velocity and carrier gas selection

In capillary analysis, the type and the linear velocity of the carrier gas have a considerable effect on the column efficiency. The figure below shows changes in the HETP (Height Equivalent to Theoretical Plate) at different linear velocity values for nitrogen, helium and hydrogen carrier gas. HETP is a parameter for column efficiency. The smaller the value is, the higher the column efficiency.



The graph above shows that the lowest HETP values are obtained when nitrogen is used as the carrier gas and the linear velocity is set to a value a little less than 10 cm/s. However, nitrogen is not a good carrier gas for capillary analysis for the following reasons.

- If the linear velocity deviates only slightly from the optimum value, the HETP increases dramatically. The resolution of peaks changes dramatically.
- To obtain the optional linear velocity, the flow rate must be low, resulting in long analysis times.

The lowest HETP value for helium is larger than the value for nitrogen. But helium is frequently used as the carrier gas because the following reasons.

- The HETP is low over a considerably wider linear velocity range starting at 20 cm/s.
- The HETP does not change significantly depending on flow.

The column efficiency of hydrogen is good at higher linear velocities than for helium. For this reason, hydrogen can be used for rapid analyses. However, hydrogen is seldom used in reality because it is extremely flammable, and therefore too dangerous.

■ Efficiency of an analysis

- Analyses can be performed with a velocity that is higher than the minimum optimal velocity, as long as separation of compounds is sufficient. This may reduce the analysis time.
- For helium carrier gas, setting the linear velocity to 30 cm/s is recommended.
The tables below show the column inlet pressure at which the linear velocity becomes approximately 30 cm/s. Use the tables as the guideline when setting the column inlet pressure for pressure control type.

Column oven temperature = 50 °C (carrier gas = helium)

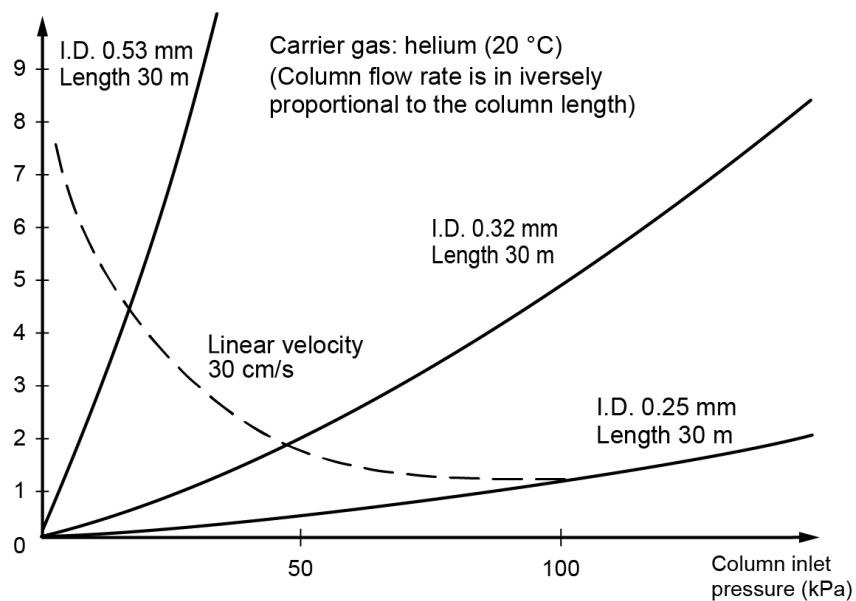
Length	I.D. of column	Film thickness	Inlet pressure
30 m	0.25 mm	0.25 µm	100 kPa
	0.32 mm	0.25 µm	60 kPa
	0.53 mm	1.5 µm	20 kPa
60 m	0.25 mm	0.25 µm	210 kPa
	0.32 mm	0.25 µm	120 kPa
	0.53 mm	1.5 µm	40 kPa

Column oven temperature = 200 °C (carrier gas = helium)

Length	I.D. of column	Film thickness	Inlet pressure
30 m	0.25 mm	0.25 µm	130 kPa
	0.32 mm	0.25 µm	80 kPa
	0.53 mm	1.5 µm	30 kPa
60 m	0.25 mm	0.25 µm	275 kPa
	0.32 mm	0.25 µm	160 kPa
	0.53 mm	1.5 µm	60 kPa

NOTE The following figure shows the relationship between the column flow rate and the column inlet pressure.

Column flow rate (mL/min)



$$F_c = \frac{60 \pi d^4 T_{std}}{256 \mu L T} \times \frac{(P^2 - P_0^2)}{P_{std}} \times 10^3$$

F_c	Column flow rate	: mL/min
V	Column linear velocity	: cm/sec
μ	Viscosity	: $\mu\text{Pa} \cdot \text{sec}$
d	Column I.D.	: mm
L	Column length	: m
P	Column inlet pressure	: kPa (Abs. press)
P_0	Column outlet pressure	: kPa (Abs. press)
T	Column temperature	: K

P_{std} : Standard pressure (101.325 kPa)

T_{std} : Standard temperature (298 K)

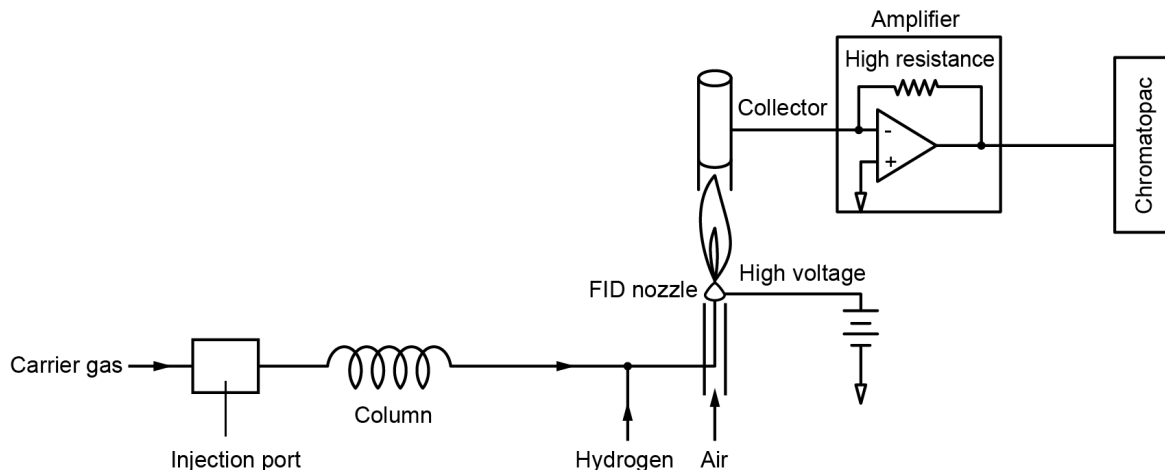
8.5 Detector

8.5.1 Hydrogen Flame Ionization Detector (FID)

In the hydrogen flame ionization detector (FID), hydrogen gas is mixed with the column outlet gas at a certain ratio and then the gas mixture is combusted in the air atmosphere. DC voltage is applied on the jet. A collector is located on the upper area of the FID. When only pure carrier gas (nitrogen, helium, or argon) and hydrogen gas are mixed, almost no current is produced between the FID jet and collector. When carrier gas containing an organic compound, which is sample components injected into the injection port and then separated by the column, is discharged from the FID jet, current is produced between the FID jet and collector proportionally to the amount of the organic compound.

This is because ions (mainly carbon ions) are generated when an organic compound combusts within the hydrogen flame and the generated ions are captured by the collector. For isomers, the ion quantity generated is almost proportional to the number of carbons contained in the compound. However, carbon atoms in a "C=O" form do not create a signal. The presence of halogens in the molecular construction decreases the ion quantity generated. Some organic compounds including formaldehyde and formic acid cannot be detected.

Because the ion current obtained by the FID as described above is very low, it is amplified by an amplifier and then output as a proper voltage.



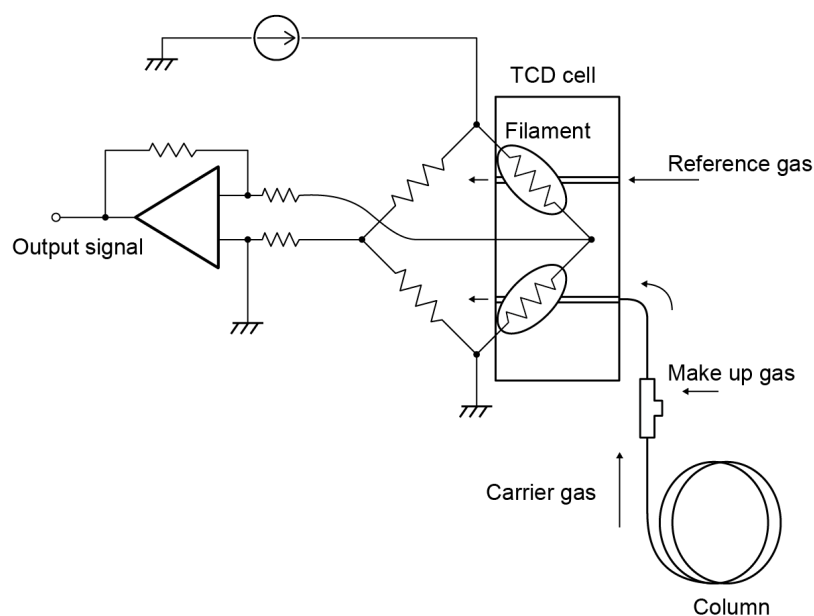
8.5.2 Thermal Conductivity Detector (TCD, PTCDD)

The thermal conductivity detector (TCD) can detect all compounds except the carrier gas itself.

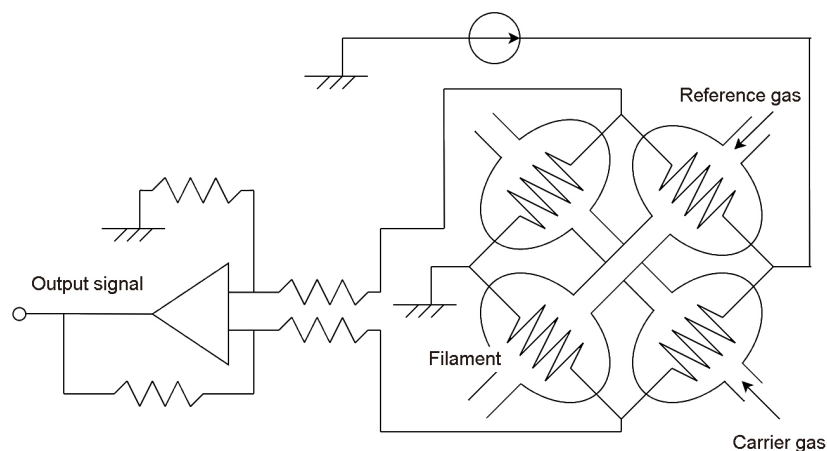
When a filament heated by the application of current is provided in a gas atmosphere with a high thermal conductivity such as helium, the filament temperature rises as sample components with a lower thermal conductivity pass the filament. The filament temperature changes affect its resistance; the resistance produces voltage.

A reference filament also exists, where only carrier gas flows, to eliminate background resistance fluctuations.

TCD Flow Line Diagram



PTCD Flow Line Diagram



8.5.3 Flame Thermionic Detector/Nitrogen Phosphorous Detector (FTD/NPD)

The flame thermionic detector/nitrogen phosphorus detector (FTD/NPD) is highly-sensitive for the analysis of organic nitrogen (N) and organic phosphorus (P) compounds depending upon analysis conditions. It exhibits its full performance in analysis of drug metabolites, analysis of residues of carbamates or phosphate agricultural chemicals, and trace analysis of nitrogen and phosphorus compounds such as nitrosamine, trimethylamine, acrylonitrile in resins, etc.

Although the precise reaction mechanism of this detector is not fully understood, an example of the proposed reaction mechanism for organic nitrogen and phosphorous compounds is described below.

1. Organic nitrogen compounds separated in the column become cyan radicals (CN*) and diphosphoric radicals (PO₂*) after thermal decomposition on the surface of the heated alkali metal bead (alkali source).



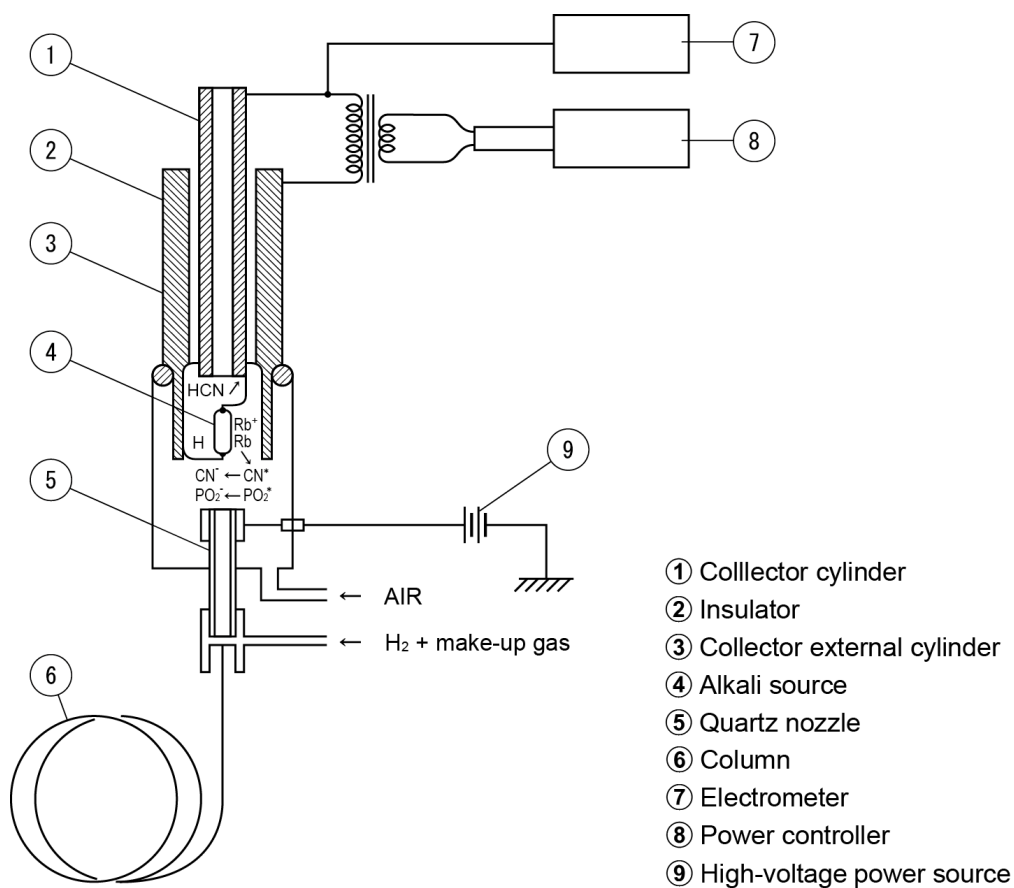
2. The radicals are supplied with electrons discharged from the surface of the heated alkali metal (Rb) bead, and become cyan ions (CN-) and diphosphoric ions (PO₂-).



3. Produced ions bind to hydrogen atom and form HCN and HPO₂. Alkali metal (Rb) which lost an electron is collected as a positive ion, and then, the instrument detects it.

In the FTD-2030, the ion source is an alkali metal bead bonded to a spiral of platinum wire, which is supplied with AC current to heat the platinum wire.

Sample components eluted from the column are discharged from the nozzle end after being mixed with a small amount of hydrogen. The components then collide with the red hot alkali metal bead above. Various reactions occur at the bead surface and in the surrounding environment, and the sample components are then discharged to the outside of the cell through the center of the collector.



References

- Sevcik, J, *Chromatographia*, 6, 139 (1973)
- Brazhnikov, V. V., Gurev, M. V., and Sakodynskiy, K. I., *Chrom. Rev.*, 12, 1 (1970)
- Aue, W. A., Gehrke, C. W., Tindle, R. C., Stalling, D. L. and Rugle, C. D., *J. of Gas Chrom.*, 28, 381 (1967)

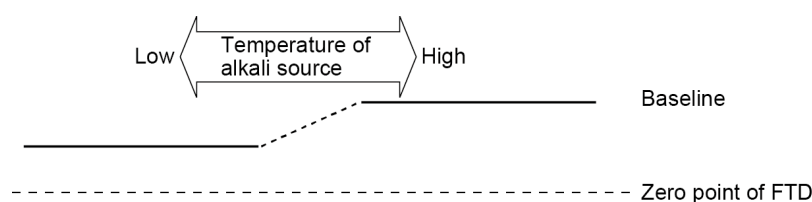
■ About background current

Background current is a current passing through FTD collector when no peak is detected. Background current is sent to data processing device as stable baseline level.

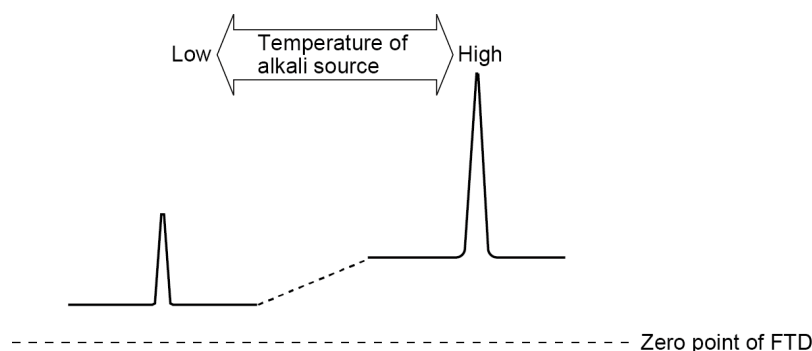
Alkaline source temperature

Background current is related to alkaline source temperature.

As alkaline source temperature increases, chemical reaction in alkaline source becomes more active. Therefore, more background current passes, resulting in increased baseline on data processing device.



If the same amount of sample is injected at different temperatures, peaks become larger when the alkali source is set at higher temperatures.



However, if the temperature of the alkali source is increased, the noise level also become higher. Therefore, S/N may not change significantly.

FTD-2030 heats the filament to increase alkaline source temperature, therefore, current passing through the filament should be increased to increase alkaline source temperature. (Alkaline source temperature is higher than 800 °C. Alkaline source temperature cannot be changed only by changing the detector temperature, therefore, the sensitivity will not change considerably.)

Reason for readjustment of background current

The same background current is required to obtain analytical data of the same sensitivity. After adjustment of the background current, it is changing due to consumption and contamination of the alkaline source.

If alkaline source is consumed, thermal capacity decreases. Thus, the temperature of alkaline source increases and the sensitivity also increases, however, it promotes consumption of alkaline source. Therefore, you need to readjust background current depending on the alkaline source status to perform analysis at the same sensitivity.

8.5.4 Flame Photometric Detector (FPD)

Air is mixed with the hydrogen/carrier gas mixture at the nozzle producing a hydrogen flame. The sample gas, carried by the carrier gas, is burnt by the hydrogen flame at the nozzle, emitting light of a certain wavelength.

The light emitted by the hydrogen flame at the nozzle is converted into a parallel light through the flat convex lens and reaches to the interference filter. The interference filter passes only light of a specific wavelength.

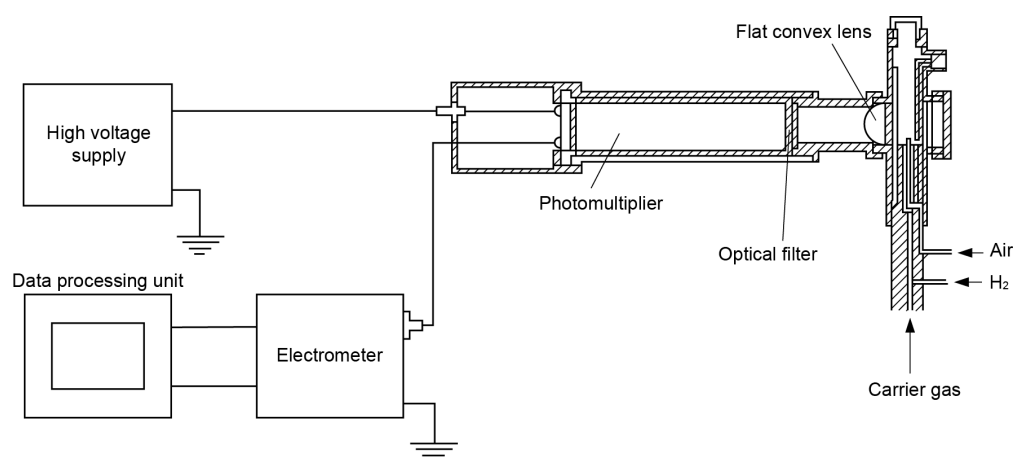
The wavelength is different depending on the compound, therefore, choose suitable one from the following interference filters.

- S compound: 394 nm
- P compound: 526 nm
- Sn compound: 610 nm

Light having only these wavelengths passes through the respective filters and reaches the photomultiplier.

The light intensity is converted into electrical signals by the photomultiplier, the signals are amplified in the electrometer, and then output to the data processor.

Approximately -700 V is applied to the cathode of the photomultiplier.

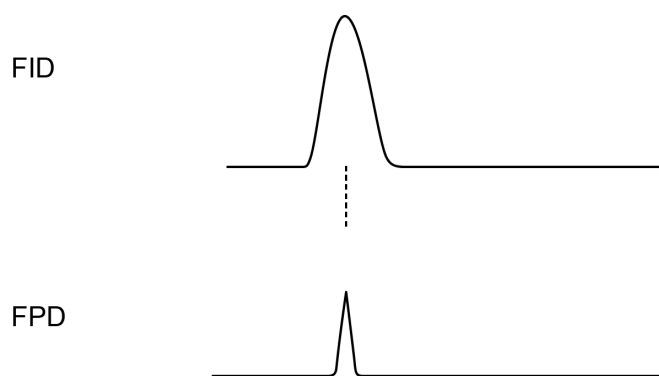


■ Quenching

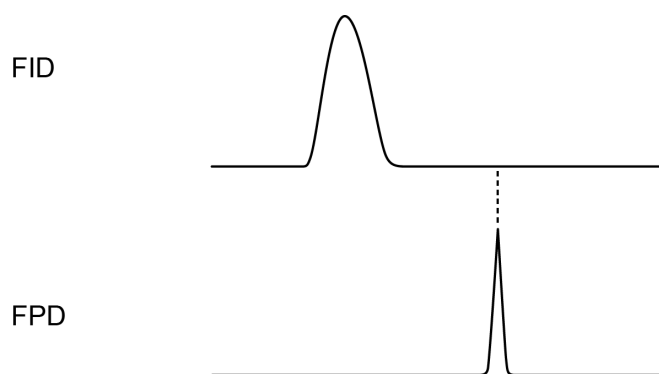
When hydrocarbon enters into the FPD, the effect is to reduce the detection response of the FPD for certain components, especially sulfur. This phenomena is referred to as "Quenching". Quenching does not occur for all components and varies according to the concentration and the kind of the hydrocarbon.

If elution of the targeted compound occurs during quenching, analysis repeatability that prevents correct quantitation may become worse. To enable accurate analysis, use the column and the temperature condition that the peak of hydrocarbon and that of the component detected by FPD can be separated. Especially, do not let it overlapped by a large peak such as solvent peak. Depending on samples, clean-up operation to remove interfering components by pre-processing may be effective. It is convenient if you use FID or TCD that allows detection of hydrocarbon when studying analysis conditions.

Peaks obtained by FID and FPD



Set conditions to avoid peak overlapping



8.5.5 Electron Capture Detector (ECD)

Radiation (Beta-ray) from the radiation source (^{63}Ni) sealed in the ECD cell ionizes an inert gas (N_2). If a pulse voltage is applied to the electrode in the cell, electrons are captured, allowing current to flow. If electrophilic molecules enter the cell, the molecules absorb the electrons to be negatively ionized. Negatively-charged molecules move more slowly than free electrons and take longer to reach the positive electrode. Additionally, they are more likely to be bonded with positive ions again. Accordingly, the electrons density in the detector drops so that a fewer number of electrons to be constant by increasing the pulse. The total number of electrons to be captured in a unit time (and thus the current) can be maintained constant by increasing the pulse frequency as the number of electrons decreases ; the variation in the number of pulses is proportional to the density of the electrophilic molecules passing through the detector.

$$\Delta f = f - f_0 = Ka$$

f : Pulse frequency

f_0 : Pulse frequency when carrier gas alone is allowed to flow (Basic frequency)

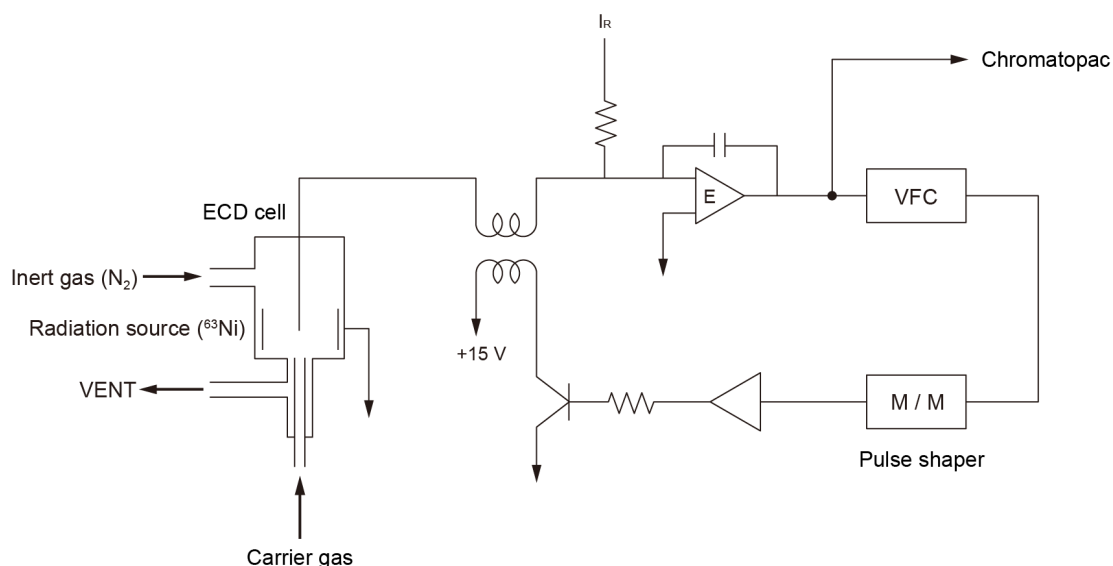
K : Constant determined by electron capture rate and other factors

a : Concentration of electron capturing substance

Reference

R.J.Maggs, et al Anal. Chem. 43(1971), 1966

The construction of the instrument is schematically shown below.



Amplifier E compares the average pulse current from the ECD cell with reference current I_R and outputs a voltage to the voltage-frequency converter (VFC) to make the two currents equal. The pulse from the VFC is shaped to have appropriate width and height before being sent to the ECD cell, closing a control loop.

■ Response characteristics of the detector

The electron capture detector has an extremely peculiar response characteristic. The response varies largely depending upon the kind of compound. Even with the same kind of compound, the response may change largely with minor differences in the molecular structure, e.g., with racemates.

For reference, relative sensitivities for various compounds are listed below. For the same component, response may vary depending upon the structure of the detector, temperature, applied voltage, etc.

Relative sensitivity for various compounds (example 1)

Compound	Sensitivity (Unit is arbitrary)
1-chlorobutane	1
2-chlorobutane	2
1-chloro-2-methyl propane	1.7
2-chloro-2-methyl propane	12
1-chloropentane	1
1-chlorohexane	1.1
1-chloroheptane	1.5
1-chlorooctane	1.6
1, 2-dichloroethane	190
1, 4-dichlorobutane	15
1, 1-dichlorobutane	110
trans-1, 2-dichloroethylene	370
cis-1, 2-dichloroethylene	90
chloroform	6×10^4
carbon tetrachloride	4×10^5
1-bromopropane	255
1-bromobutane	280
bromocyclopentane	280
1-bromopropene-2 (allyl bromide)	4×10^3
1, 1-dibromoethane	1.1×10^5
1-iodobutane	9×10^4
benzene	0.06
toluene	0.2
2-fluorotoluene	0.55
4-fluorotoluene	0.55
chlorobenzene	75
bromobenzene	450
1-butanol	1
di-n-butyl ether	0.6

Compound	Sensitivity (Unit is arbitrary)
acetone	0.5
methyl butyrate	0.9
2, 3-butanedione	5×10^4
n-heptyl trifluoroacetate	4.5
n-propyl pentafluoropropionate	450

* Reference
Phillippe Devaux, Georges Guiochon; in "Advances in Gas Chromatography 1967", A. Zlatkis, ed.

Relative sensitivity for various compounds (example 2)

Compound	Sensitivity (Unit is arbitrary)
Hexane	0.9
Heptane	1.2
Octane	1.5
Decane	2.6
Chlorobenzene	5.5
Atrazine	3,000
Dichloroethane	20,000
Lead Tetraethyl	30,000
Benzophenone	100,000
2, 4D	125,000
Tedion	180,000
Malathion	250,000
Diethyl Maleate	550,000
Thioctane	600,000
2, 4, 5, T	800,000
Kelthane	1,600,000
D D D	2,000,000
D D T (para, para)	2,000,000
D D E	3,200,000
Heptachlor	4,800,000
Dieldrin	8,000,000
Aldrin	10,000,000
Lindane	11,000,000
Dibromoethane	11,000,000
Fluothane	16,000,000
Carbon Tetrachloride	400,000,000

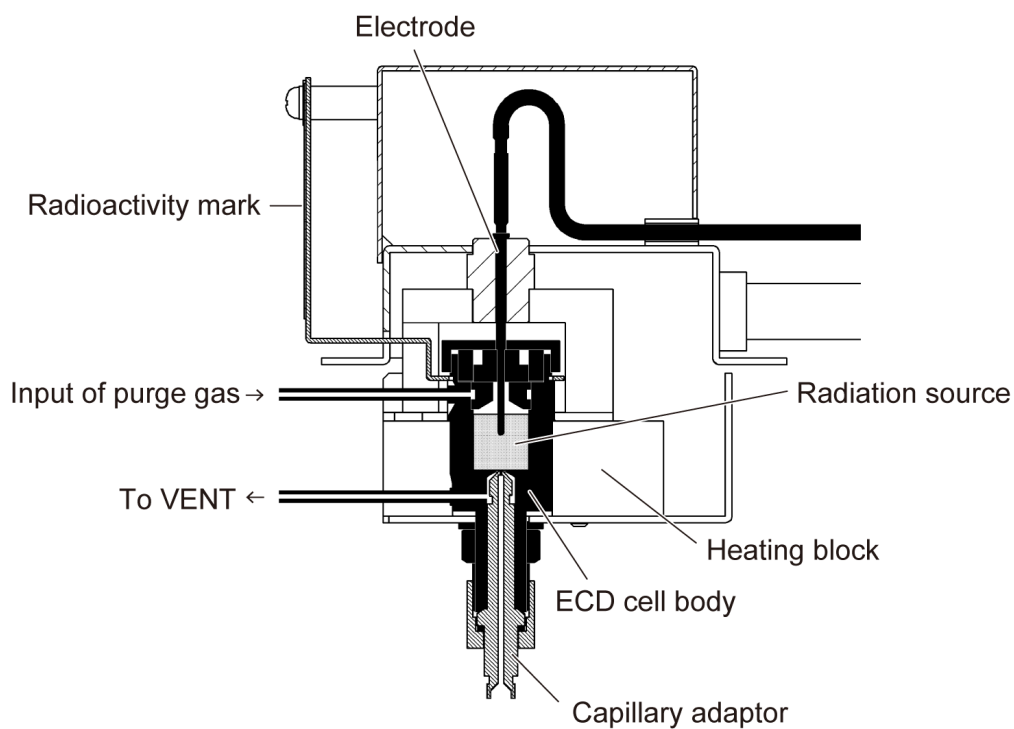
* Reference
K.P. Dimick, H. Hartmann; presented at ACS Winter Meeting Cincinnati, Ohio, January 13-18, 1963.

■ Structure of ECD cell

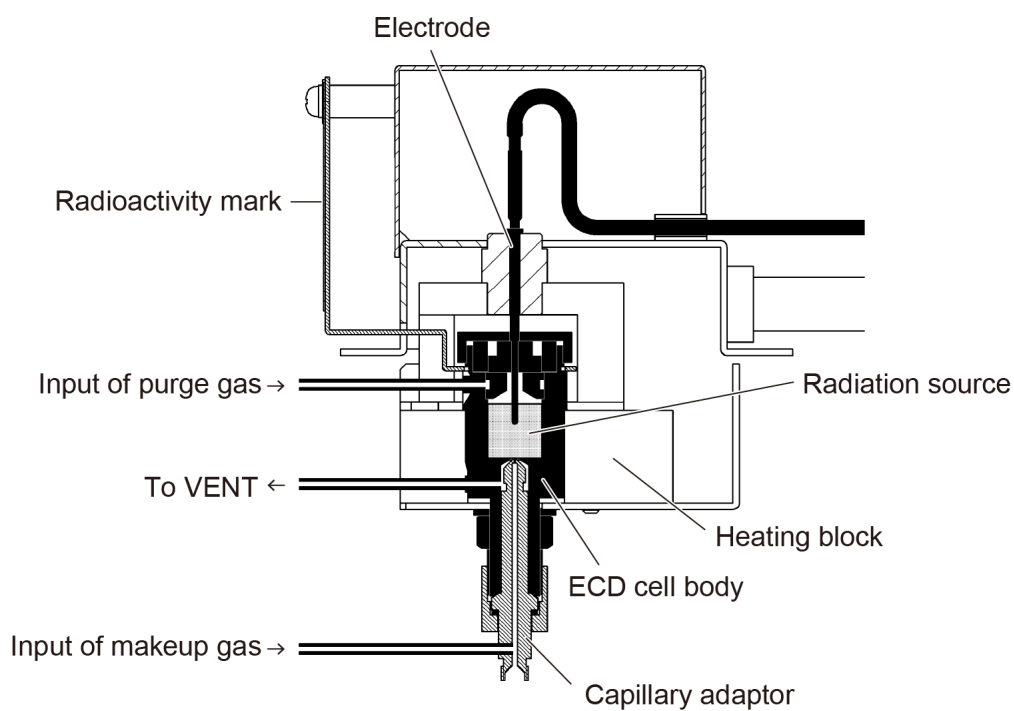
The ECD structure varies depending on the flow path configuration.

▶▶ Reference ["2.2.8 How to Differentiate ECD-2010 Exceed Flow Paths" P.20](#)

• Flow path A



• Flow path B



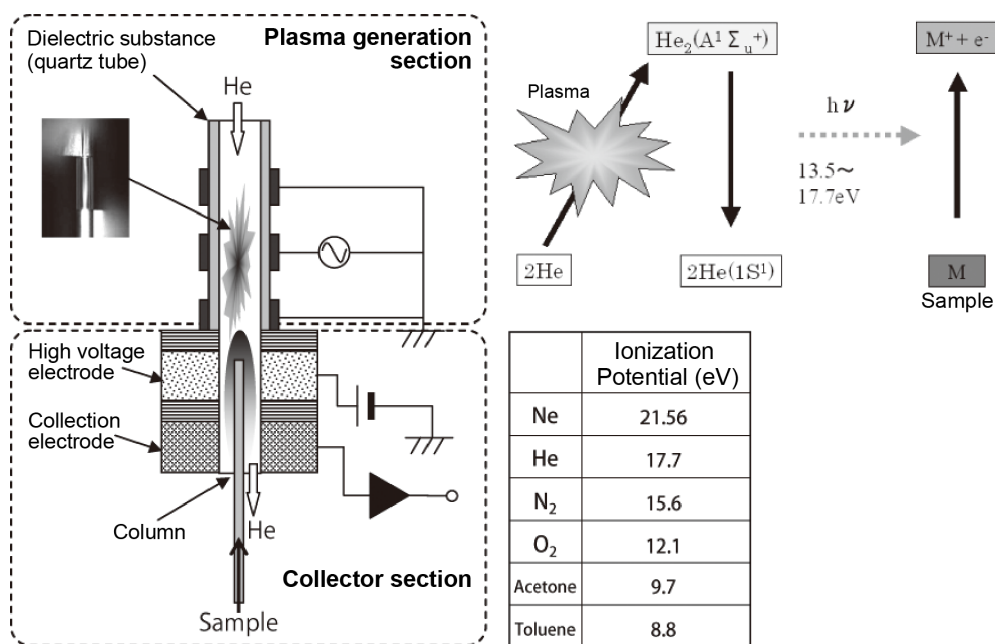
8.5.6 Barrier Discharge Ionization Detector (BID)

The Barrier Discharge Ionization Detector is constructed of two main sections, the plasma generation section and collector section. The plasma generation section contains three electrodes, and generates non-equilibrium plasma from the electrical discharge of the dielectric barrier by applying high voltage to the central electrode.

The metastable condition of the helium generated from the non-equilibrium plasma ionizes the sample using the photon energy emitted when it returns to the ground state. These ions are accumulated and amplified by the collector, and are output as a voltage value to the Chromatopac or computer.

Gases other than neon which has a higher ionization potential than helium can be ionized because the electrical excitation energy of the helium metastable condition is exceptionally high.

The inner wall of the plasma generation section suffers very little wear and remains stable over long periods because the neutral gas temperature of the non-equilibrium plasma generated by the dielectric barrier discharge is exceptionally low, and because the electrode is protected by the stable dielectric substance (fused quartz).



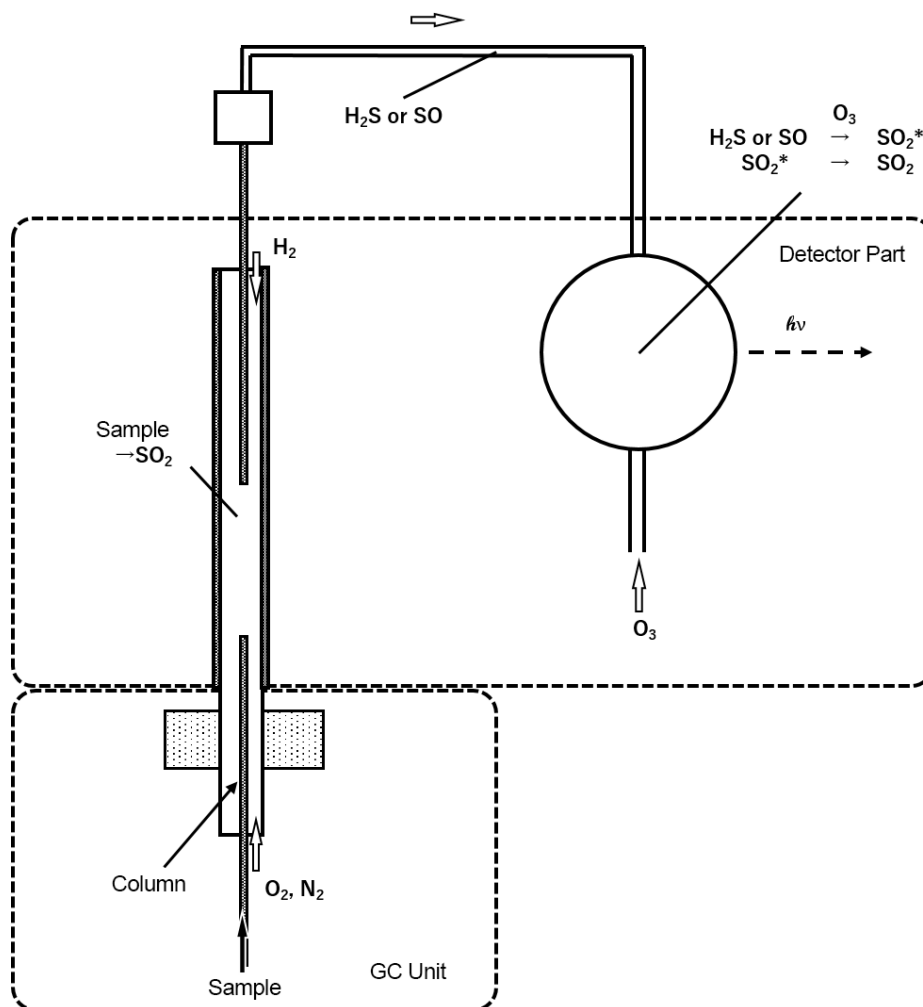
8.5.7 Sulfur Chemiluminescence Detector (SCD)

The Sulfur Chemiluminescence Detector is constructed of two main sections, the furnace section and reaction container section. In the furnace, sulfur compounds are decomposed into SO_2 by oxygen and then reduced to H_2S or SO in reaction with hydrogen. H_2S (or SO) reacts with ozone in the reaction container resulting in SO_2^* in the metastable state. This SO_2^* emits light when returning to the ground state. The photomultiplier amplifies the light and outputs it as a voltage value.

Even if hydrocarbons and sulfur compounds are mixed, hydrocarbons are decomposed into water and CO_2 in the furnace, therefore, influence on light emission in the reaction container is small.

It is noted that if a sample including halogen compounds is analyzed, the pyrotube inside the instrument may be damaged resulting in significant decrease of the sensitivity.

Note that the SCD may cause a relatively large sensitivity fluctuation, compared to general detectors such as FID. In such cases, it is recommended to apply the "internal standard method" for measurements.



8.6 AFC, APC

8.6.1 Overview

- 1.3.1 The AFC (Advanced Flow Controller) is an electronic flow controller which sets and controls carrier gas pressures and flow rates based on entered parameters.

The APC (Advanced Pressure Controller) is an electronic flow controller for controlling detector gas pressures. The AUX-APC can control the gas pressure of other optional devices.

8.6.2 Definition of Terms

Column inlet pressure

Column inlet pressure refers to the injection port pressure.

When set to "0 kPa", the injection port pressure is equal to atmospheric pressure.

Total flow rate

Total flow rate is the flow rate controlled by the TFC (Total Flow Controller) located upstream of the injection port.

►► Reference "8.6.3 Flow Line Diagram" P.428

Column flow rate

The column flow rate in the instrument indicates the volume flow rate inside the column converted at the atmospheric pressure and the room temperature. It corresponds to the flow rate measured at room temperature by a flow meter connected to the column outlet. The column flow rate can be calculated with the following equation:

$$F_c = \frac{60\pi d^4}{256\mu L T} \times (P^2 - P_0^2) \times \frac{T_s}{P_s} \times 10^3$$

F_c : Column flow rate (mL/min)

d : Column inner diameter (mm)

L : Column length (m)

P : Column inlet pressure (kPa)

T : Column Temperature

P_0 : Column outlet pressure (= atmospheric pressure) (kPa)

μ : Viscosity coefficient (19.4 μ Pas helium at 20 °C)

T_s : Standard temperature (25 °C)

P_s : Standard pressure (101.325 kPa)

The viscosity coefficient depends the column oven temperature according to Sutherland's formula.

Linear velocity

Linear velocity indicates how many cm the carrier gas moves inside the column.

The terms "VELOCITY", "linear velocity" in this instruction manual indicate the average linear velocity inside the column.

The average linear velocity can be obtained with the following equation:

$$V = \frac{0.75 \times d^2}{32 \mu L} \times \frac{(P^2 - P_0^2)^2}{(P^3 - P_0^3)} \times 10^5$$

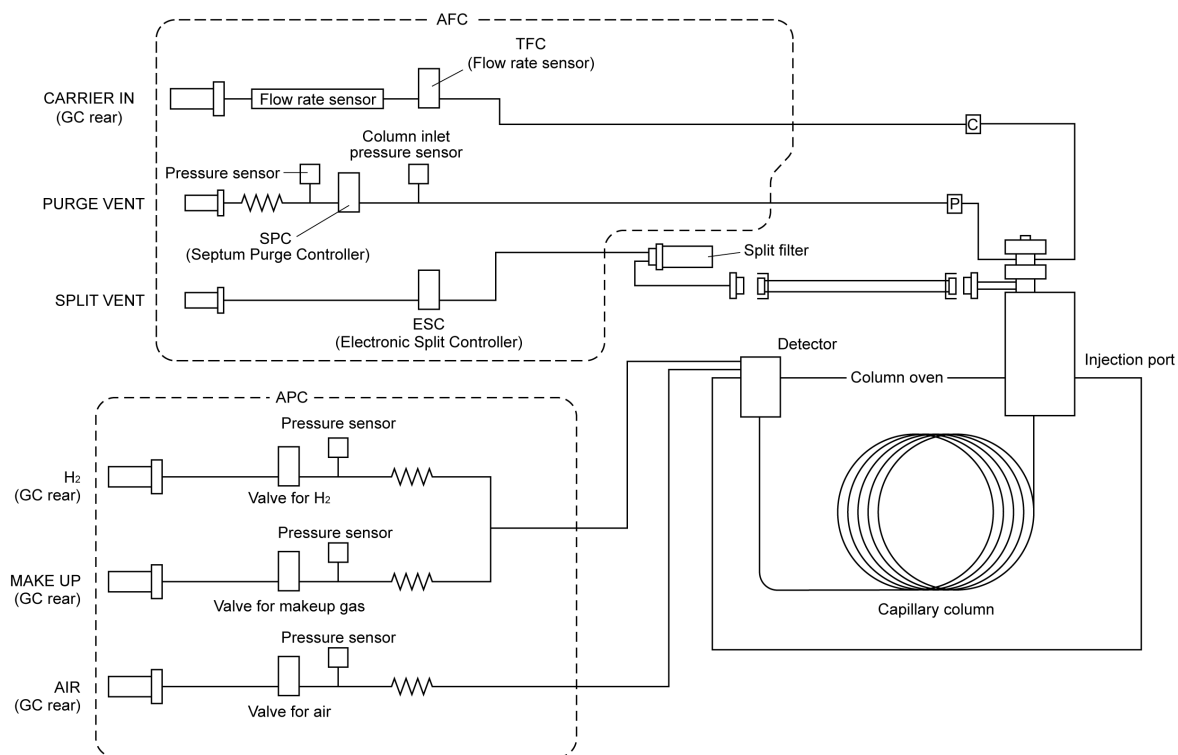
Split ratio

The split ratio in the instrument indicates "split flow / column flow".

The total flow is shown as "total flow = column flow + split flow + purge flow".

$$\text{Split ratio is shown as } \frac{\text{total flow} - \text{column flow} - \text{purge flow}}{\text{Column Flow}}$$

8.6.3 Flow Line Diagram



Note: This figure illustrates an FID or FTD detector example.
For ECD or TCD detectors, the APC controls only the makeup gas.
For FPD detector, the APC controls only hydrogen and air.

TFC: TOTAL FLOW CONTROLLER
SPC: SEPTUM PURGE CONTROLLER
ESC: ELECTRIC SPLIT CONTROLLER

8.6.4 Control by AFC

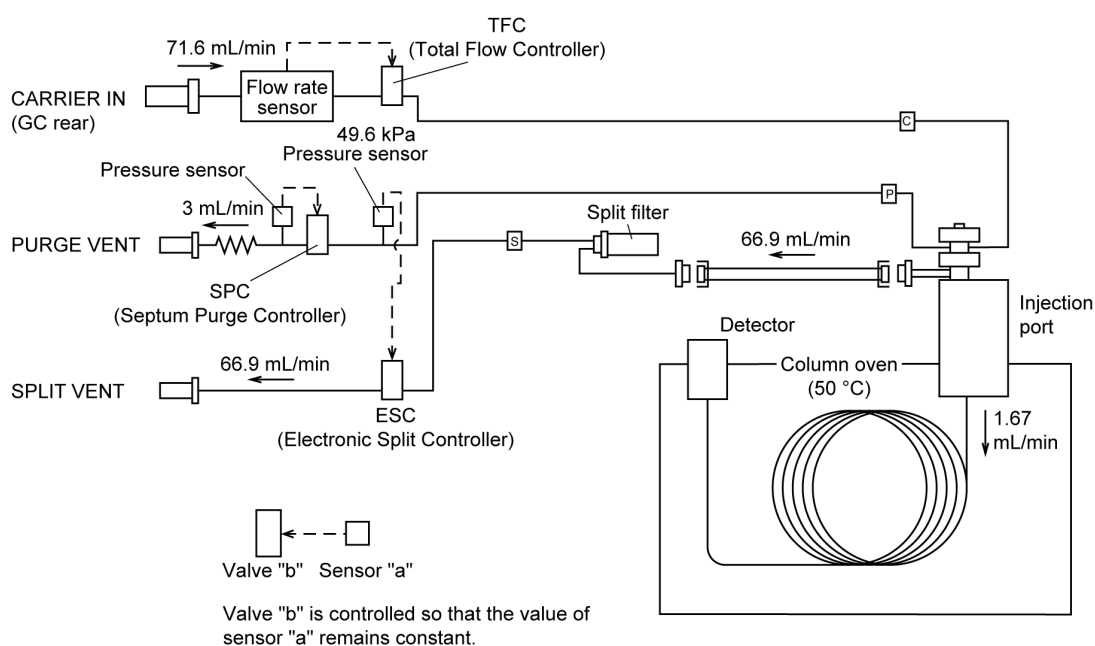
The combinations of injection unit and injection mode are shown below.

Injection Unit	Injection Mode		
	Split	Splitless	Direct
SPL	✓	✓	
PTV	✓	✓	
WBI			✓
OCI			✓

■ Split

The AFC controls the total flow rate to keep it at a constant value. The TFC (Total Flow Controller) inside the AFC feeds back output from the column inlet pressure sensor, which controls the ESC (Electronic Split Controller), which, in turn, controls the column inlet pressure.

The following figure shows the control status with a split ratio of 1 : 40, a linear velocity of 30 cm/sec, a purge flow rate of 3 mL/min, and a column oven temperature of 50 °C.



Column inner diameter : 0.32 mm
 Column length : 25.0 m
 Film thickness : 0.50 μm
 Carrier gas : He
 Split ratio : 40 = 66.9 mL/min / 1.67 mL/min
 (split flow rate)(column flow rate)

The column inlet pressure is calculated based on the linear velocity, the oven temperature, the column inner diameter, the column length, and the column film thickness, and is automatically set to 49.6 kPa. In the same way, the column flow rate is automatically set to 1.67 mL/min, and the total flow rate is set to 71.6 mL/min ($\div 1.67 \text{ mL/min} + 1.67 \text{ mL/min} \times 40 + 3 \text{ mL/min}$ (= purge flow rate)).

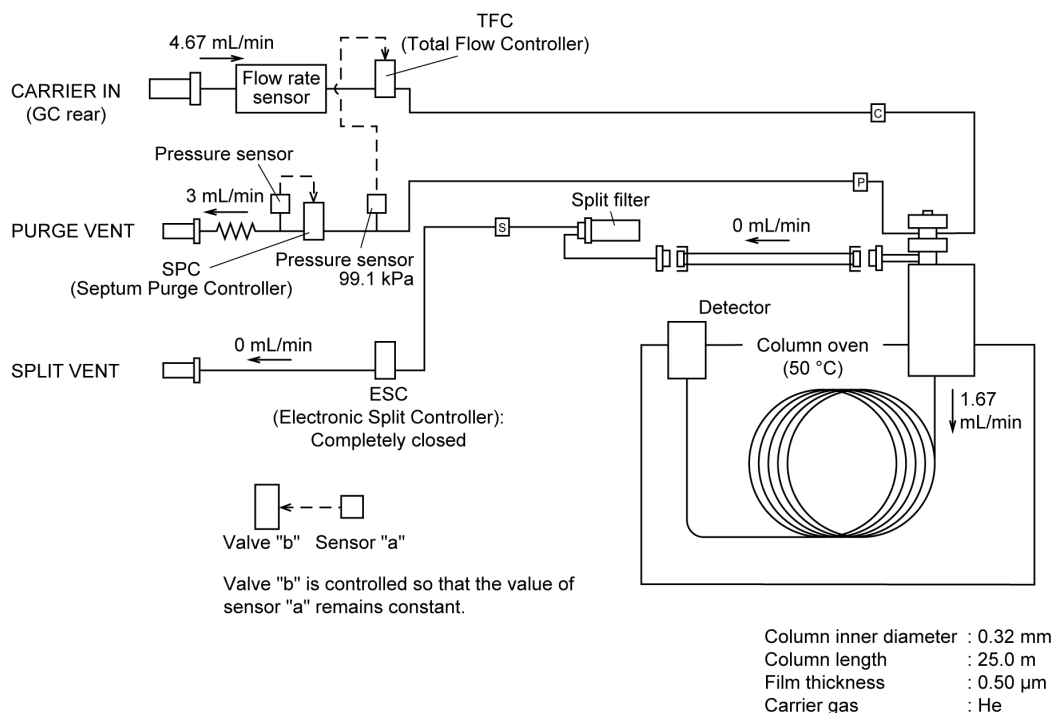
- When [Flow Control Mode] is set at [Press]
The column inlet pressure is controlled to remain at 49.6 kPa regardless of the column oven temperature.
- When [Flow Control Mode] is set at [Velocity]
The pressure is set to a value which keeps the linear velocity constant despite changes in the column oven temperature. Even if the column oven temperature changes, as in programmed temperature analysis, the linear velocity is always kept constant. Generally, when the column oven temperature increases, the viscosity of the carrier gas also increases, and does not flow easily, resulting in increased pressure.
- When [Flow Control Mode] is set at [Col Flow]
The pressure is set to a value which keeps the column flow rate constant despite changes in the column oven temperature. Even if the column oven temperature changes, as in programmed temperature analysis, the column flow is always kept constant. Generally, when the column oven temperature increases, the viscosity of the carrier gas also increases, and does not flow easily, resulting in increased pressure.

Regardless of the control mode, the ESC controls the column inlet pressure and the TFC controls total flow as shown in above figure.

■ Splitless

The control status is different during and after sampling time. During sampling time, the AFC controls the TFC (Total Flow Controller) so that the output from the column inlet pressure sensor becomes constant, and then controls the column inlet pressure.

The following figure shows the control status during the sampling time with a split ratio of 1:40, a linear velocity of 30 cm/sec, a purge flow rate of 3 mL/min, and a column oven temperature of 50 °C.



The column inlet pressure is calculated based on the linear velocity, the oven temperature, the column inner diameter, the column length, and the column film thickness, and is automatically set to 49.6 kPa. In the same way, the column flow rate is automatically set to 1.67 mL/min.

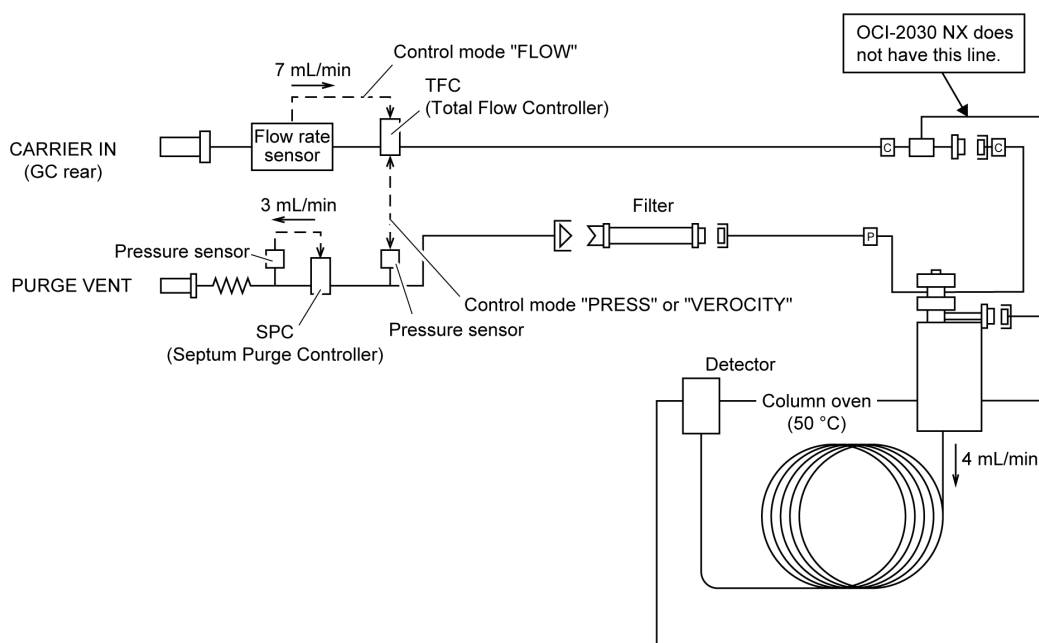
After the sampling time, the AFC controls the total flow rate to keep it at a constant value using the TFC (Total Flow Controller) inside the AFC. As in split mode, the ESC (Electronic Split Controller) is controlled to maintain the column inlet pressure constant. Control status after sampling time is shown in the same figure as split mode.

- When [Flow Control Mode] is set at [Press]
The column inlet pressure is controlled to remain at 49.6 kPa regardless of the column oven temperature.
- When [Flow Control Mode] is set at [Velocity]
The pressure is set to a value which keeps the linear velocity constant despite changes in the column oven temperature. Even if the column oven temperature changes, as in programmed temperature analysis, the linear velocity is always kept constant. Generally, when the column oven temperature increases, the viscosity of the carrier gas also increases, and does not flow easily, resulting in increased pressure.
- When [Flow Control Mode] is set at [Col Flow]
The pressure is set to a value which keeps the column flow rate constant despite changes in the column oven temperature. Even if the column oven temperature changes, as in programmed temperature analysis, the column flow is always kept constant. Generally, when the column oven temperature increases, the viscosity of the carrier gas also increases, and does not flow easily, resulting in increased pressure.

Regardless of the control mode, the TFC controls the pressure and the ESC closes during sampling time. After sampling time, the ESC controls the column inlet pressure and the TFC controls the total flow rate as in split mode.

■ Direct

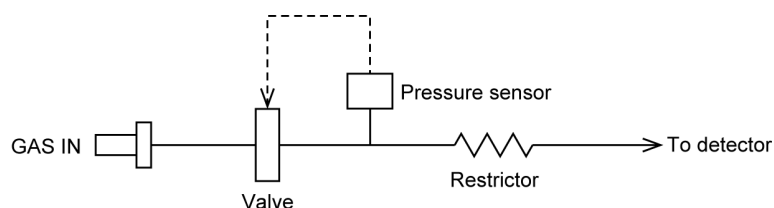
When the injection unit is WBI or OCI, direct mode is selected automatically.



- When [Flow Control Mode] is set at [Press]
The AFC controls the TFC (Total Flow Controller) so that the output from the column inlet pressure sensor becomes constant, and then controls the column inlet pressure. Column inlet pressure is different depending on the total flow, the column flow, the column oven temperature, the column inner diameter, and the column length.
- When [Flow Control Mode] is set at [Velocity]
Just as [Flow Control Mode] is set to [Press], the AFC controls the TFC (Total Flow Controller) so that the output from the column inlet pressure sensor becomes constant, and then controls the column inlet pressure. The pressure is set to a value which keeps the linear velocity constant despite changes in the column oven temperature.
- When [Flow Control Mode] is set at [Column Flow]
The AFC controls the TFC (Total Flow Controller) so that the total flow is kept at the sum of column flow and purge flow.
Above figure shows control diagram with a total flow of 7 mL/min and a purge flow rate of 3 mL/min. The column inlet pressure is different depending on the used column, purge flow rate, and the column oven temperature.

8.6.5 Control by APC

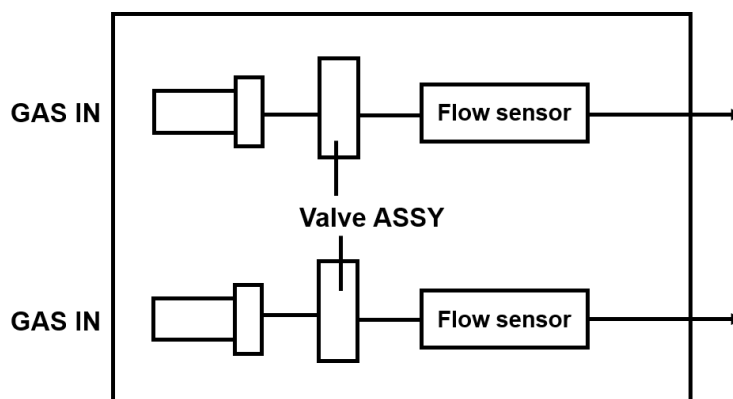
The APC performs its control as illustrated in the figure below.



The APC controls only the pressure.

The flow is calculated based on resistance and pressure.

8.6.6 Dual AFC (DAFC): AUX-AMC



The dual AFC controls only the flow.

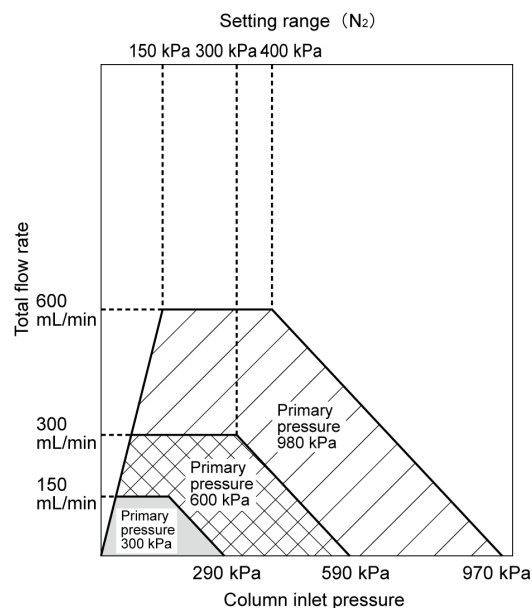
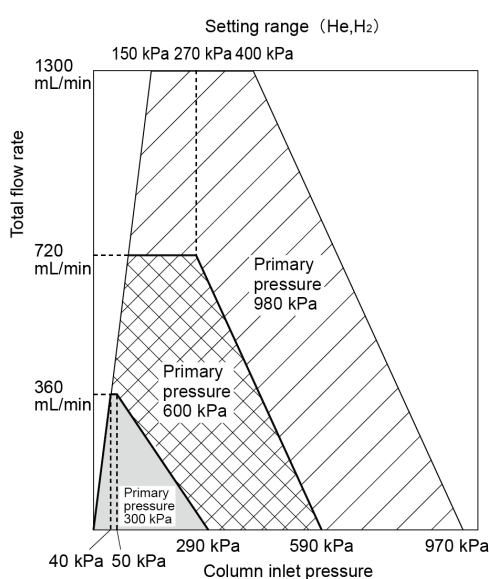
The upper limit of controllable flow differs depending on gas supply pressure and flow line resistance of downstream tubing.

8.6.7 AFC and APC Control Ranges

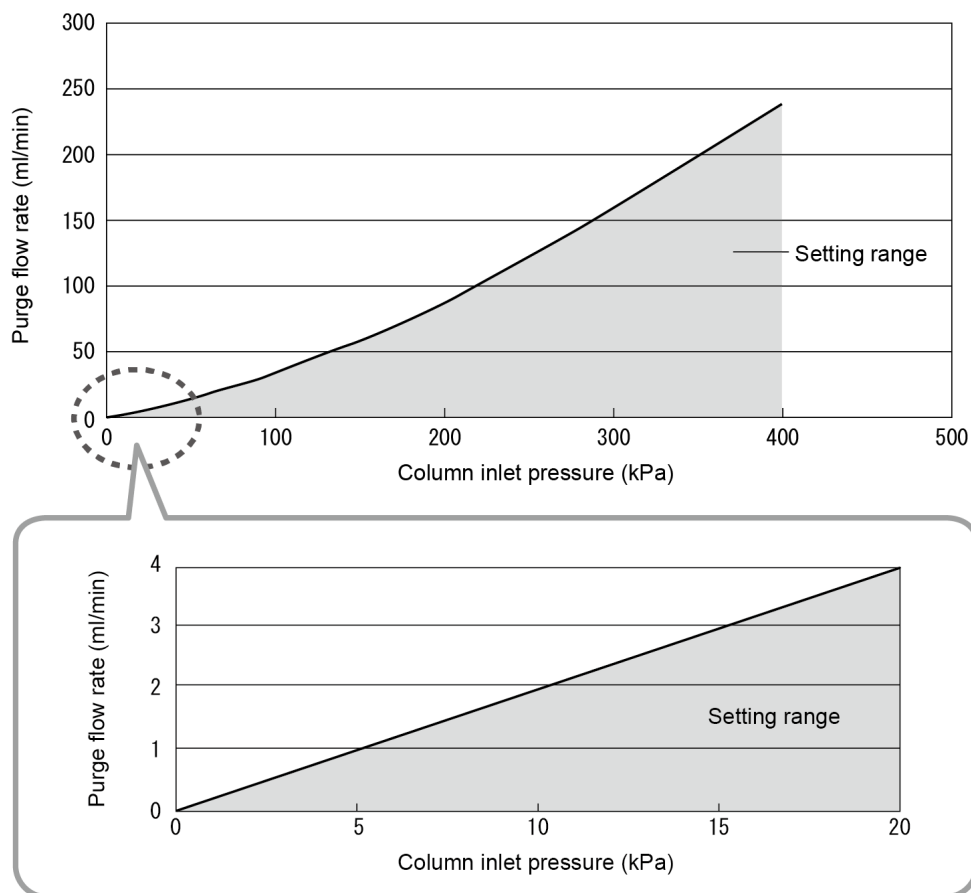
For the AFC, the column inlet pressure can be set from 0 to 970 kPa, and the total flow rate can be set from 0 to 1,300 mL/min.

However, these values are instrument specifications, valid when the primary pressure supplied to the instrument is 980 kPa.

The allowable pressure and flow rate settings are limited by the primary pressure, as shown below. In addition, the pressure settings are limited by the column type and the purge flow (it is recommended to set values higher than 1 mL/min and 1 kPa).



The allowable purge flow setting depends on the column inlet pressure. The following figure shows the range of purge flow permitted.



Allowable APC settings are shown below.

AIR (Detector = FID)	:	0 to 1000 mL/min
H ₂ (Detector =FID)	:	0 to 100 mL/min
Makeup (Detector =FID)	:	0 to 100 mL/min
Makeup (Detector =TCD)	:	0 to 20 mL/min

When the set value is more than the set range, displayed values may not be accurate, or APC cannot control the flow.

NOTE When flow line restrictors or buffers other than optional devices are installed on the flow line, the control range may become narrow.

For each detector, the supply pressure required for each set flow is shown below.

Hydrogen

Detector	Set flow	Required source pressure	Note
FID	32 mL/min	150 kPa	Standard flow
	100 mL/min	250 kPa	Maximum flow
FPD	40 mL/min	150 kPa	S standard flow
	62.5 mL/min	200 kPa	P standard flow
	150 mL/min	300 kPa	-
	250 mL/min	450 kPa	Maximum flow
FTD	3 mL/min	100 kPa	Standard flow
	30 mL/min	300 kPa	Maximum flow
TCD (H ₂ makeup)	8 mL/min	100 kPa	Standard flow
	20 mL/min	150 kPa	Maximum flow
SCD	100 mL/min	200 kPa	Maximum flow

-  **NOTE**
- Do not increase the source pressure higher than necessary.
 - To set hydrogen flow higher than 150 mL/min for FPD, set the supply pressure of hydrogen higher than 300 kPa. When using hydrogen carrier or the FID detector together, use H₂ option kit (for AFC: S221-83785-41, for APC: S221-83780-41) to decrease the supply pressure of hydrogen applied to the AFC and APC for FID.

Makeup gas

Detector	Set flow	Required source pressure	Note
FID	24 mL/min	150 kPa	Standard flow
	100 mL/min	300 kPa	Maximum flow
FTD	30 mL/min	150 kPa	Standard flow
	100 mL/min	300 kPa	Maximum flow
TCD (excluding H ₂)	8 mL/min	150 kPa	Standard flow
	20 mL/min	200 kPa	Maximum flow
ECD-Exceed	15 mL/min (flow path A)	100 kPa	Standard flow ^{*1}
	30 mL/min (flow path B)	150 kPa	Standard flow ^{*1}
	100 mL/min	300 kPa	Maximum flow
BID	50 mL/min	100 kPa	Standard flow
	100 mL/min	200 kPa	Maximum flow
SCD	100 mL/min	200 kPa	Maximum flow

*1 The standard flow for ECD varies depending on the ECD detector configuration. See ["2.2.8 How to Differentiate ECD-2010 Exceed Flow Paths"](#) P.20.

Air

Detector	Set flow	Required source pressure	Note
FID	200 mL/min	100 kPa	Standard flow
	1000 mL/min	300 kPa	Maximum flow
FPD	60 mL/min	100 kPa	S standard flow
	90 mL/min	150 kPa	P standard flow
	200 mL/min	300 kPa	Maximum flow
FTD	145 mL/min	250 kPa	Standard flow
	300 mL/min	400 kPa	Maximum flow

Oxygen

Detector	Set flow	Required source pressure	Note
SCD	50 mL/min	100 kPa	Maximum flow

8.6.8 Offset Calibration

The AFC and APC pressure and flow sensors can be calibrated (zeroed).

This calibration is required to correct minute deviations of the sensor values which may occur after long periods of use. If the sensor values deviate, 0.5 kPa (mL/min) could be displayed, for example, even though there is no actual pressure or flow.

When data repeatability is important, perform the offset calibration.

For the AFC, perform the offset calibration using the following procedure.

In the case of WBI analysis, remove the WBI column from the injection port before the following procedure. After the procedure, attach the column to injection port as before.

■ AFC offset calibration

1

Press [GC Start/Stop Sequence] on HOME screen.

[GC Start Sequence] screen appears.

2

Set [GC Start Setting] at [Manual Start].

▶▶ Reference "7.1.1 [GC Start Sequence] Screen" P.143

3

Press  (Monitor).

Monitor screen appears.

4

Wait until the temperatures of the injection port and the detector drops below 50 °C.

5

Ensure that the column oven temperature drops below 40 °C, and then, press the power button on the front of the instrument to turn off the instrument.

6

Turn ON the instrument and wait for a minute.

7

Press [Injection Port] on HOME screen.

[INJ/FLOW] screen appears.

8

Press [Submenu], and then press [Run] in [Calibration Offset].

"Zero calibration start" appears in the message display.

After about 10 seconds, "Zero calibration completed" appears and AFC offset calibration is completed.

9

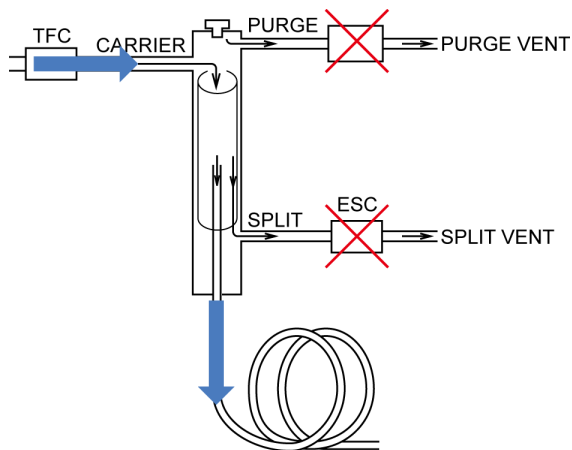
Return [GC Start Setting], which is changed in step 2, to an original setting.

■ APC offset calibration

- 1 Press **[GC Start/Stop Sequence]** on HOME screen.
[GC Start Sequence] screen appears.
- 2 Set **[GC Start Setting]** at **[Manual Start]**.
▶▶ Reference "7.1.1 [GC Start Sequence] Screen" P.143
- 3 Press  **(Monitor)**.
Monitor screen appears.
- 4 Wait until the temperatures of the injection port and the detector drops below 50 °C.
- 5 Ensure that the column oven temperature drops below 40 °C, and then, press the power button on the front of the instrument to turn off the instrument.
- 6 Turn ON the instrument and wait for a minute.
- 7 Press **[Detector]** on HOME screen.
[Detector] screen appears.
- 8 Press the detector tab for which offset calibration should be performed.
- 9 Ensure that the actual value of the detector gas is not fluctuating.
If fluctuating, wait for a moment.
- 10 Press **[Submenu]**, and then press **[Run]** in **[Calibration Offset]**.
"Zero calibration start" appears in the message display.
After about 10 seconds, "Zero calibration completed" appears and APC offset calibration is completed.
- 11 Return **[GC Start Setting]**, which is changed in step 2, to an original setting.

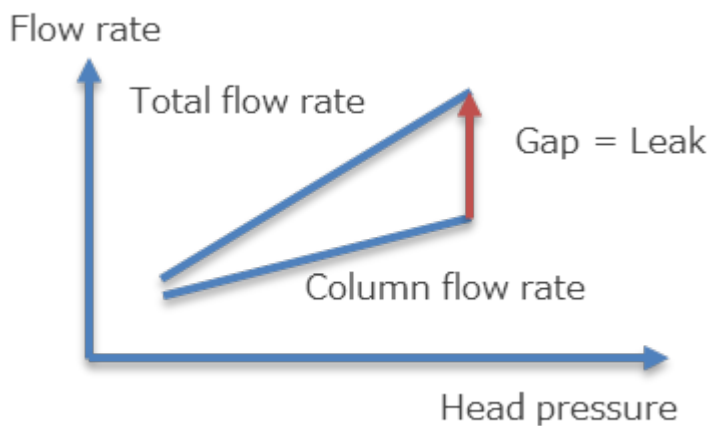
8.6.9 Carrier Gas Leak Check Function

Carrier Gas Leak Check function controls only total flow and compares the amount of change in total flow and that of column flow to check carrier gas leak.



Flow during carrier gas leak check

When carrier gas leaks, the amount of change in total flow is larger than that of column flow. When the amount exceeds a certain value, a message to warn carrier gas leak appears.



Column Flow vs. Total Flow

■ Inspection method using the carrier gas leak check function

It is possible to perform a simple leak check by using the carrier gas leak check function. Gas leak causes poor repeatability. It also wastes the carrier gas. Check that there is no carrier gas leak.

NOTE For the analytical line using AFT switching element, gas leak check cannot be performed from [Carrier Gas Leak Check] screen. When using AFT, see "[Carrier gas leak check \(Capillary\)](#)" P.54.

1

Ensure that the GC stops.

When the GC operates, stop the GC according to the following procedure.

- 1 Press  (HOME) - [GC Start/Stop Sequence] to display [GC Stop Sequence] screen.
- 2 Set [Flow Control] at [Off].
- 3 Set [Flow Off Time] at more than 30 minutes.

 **Hint** Set [Flow Off Time] so that the column temperature reaches about 40 °C.
 ▶▶ Reference "[7.1.2 \[GC Stop Sequence\] Screen](#)" P.146

- 4 Set [Sleep] at [Disable].
- 5 Set [Restart] at [Disable].
- 6 Press [Stop GC].

2

Press  (Monitor).

Monitor screen appears.

3

Ensure that the column oven temperature drops below 40 °C.

4

Press  (HOME) - [Function] - [Diagnosis] - [Carrier Gas Leak Check].

[Carrier Gas Leak Check] screen appears.

▶▶ Reference "[\[Carrier Gas Leak Check\] Screen](#)" P.374

If the previous check result is displayed, press [Clear] to delete it.

5

Ensure that all items on [Column Information] are set correctly.

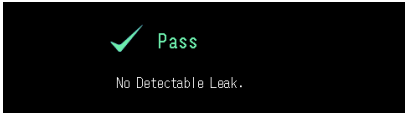
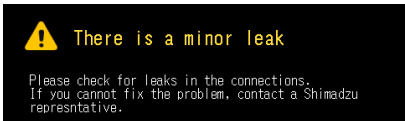
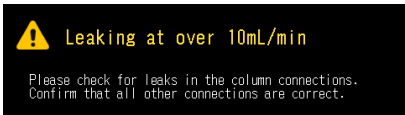
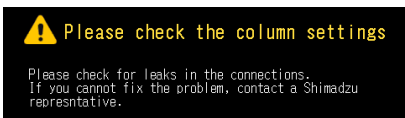
6

Press [Start].

NOTE When the check starts, column oven temperature automatically increases to 40 °C. After the check is completed and temp control stops, the temperature drops.

Carrier gas leak check starts.

After the check is completed, the result appears.

	Result screen	Solution
OK		-
NG		See "Carrier gas leak check (Capillary)" P.54 and check connections for leaks.
		Check column connection and piping connection, and install them correctly.
		Ensure that the column information is entered correctly. ▶▶ Reference "7.6.2 [Column Information] Screen" P.292

8.7 Peripherals

8.7.1 CRG CO₂/CRG N₂

CRG is a device to cool the column oven with coolant to perform analysis at low temperatures.

- ▶▶ Reference • "Precautions on Using CRG" P.xliii
 • "7.7.1 [CRG] Screen" P.296

■ How to use

- 1 Press  (HOME) - [Peripherals] - [CRG].
[CRG] screen appears.
- 2 Set coolant to be used in [Coolant].
- 3 Set [CRG] to [Usable].
- 4 Set [Valve] to [On].
- 5 Press  (HOME) - [Column].
[Column Oven] screen appears.
- 6 Set the column temperature at lower values.
- 7 Press [Start GC] on [GC Start Sequence] screen to start the GC.

8

Press  (PREP RUN), or start analysis from LabSolutions.

CO₂ gas or N₂ gas blows into the column oven and the instrument starts to keep the temperature at low.

 NOTE

- If [Turn the CRG on once other temperature parameters (aside from the oven) become READY] is checked on [CRG] tab on [Eco Setting] screen, CRG will not be used until the actual temperatures of parts other than column oven (injection port etc.) reach near the set value.
- After the column oven temperature reaches the set temperature, blowing of the coolant will stop if analysis is not started by the time set in [Prep Run Wait Time] on [PREP RUN] screen elapses. To restart blowing of the coolant, press  (PREP RUN) again.

9

After analysis, turn off the GC and shut off the main valve of the cylinder.

■ To open the column oven door

Procedures to stop the CRG for column replacement etc. are shown below.

 CAUTION

Instruction

Set [Valve] to [Off] on [CRG] screen and ensure that the column temperature reaches near room temperature before opening the column oven door.

- 1 Set [CRG] to [N/A] on [CRG] screen or turn off the GC.
- 2 Ensure that the column temperature reaches near room temperature on the monitor screen.
- 3 Open the column oven door.

8.7.2 PRG

PRG is an optional unit to control solenoid valve or sample cock to perform auto sample injection or signal switching using GC-2030 function.

When PRG-2030 is integrated into GC-2030, parts with 24 V of rated voltage (such as solenoid valve) can be controlled.

When PRG box is installed, parts with 100V/200V of rated voltage also can be controlled.

■ To change relay type and polarity

They can be changed on [Relay Control] screen.

▶▶ Reference ["7.7.5 \[Relay Control\] Screen" P.302](#)

■ To switch event

1

Press  (HOME) - [Function] - [Direct Operation].

[Direct Operation] screen appears.

▶▶ Reference ["7.9.5 \[Direct Operation\] Screen" P.333](#)

2

Set event No. to be used in [Event].

▶▶ Reference ["8.10 Event No." P.467](#)

3

Press [Run].

Set event is executed.

■ PCB for PRG-2030

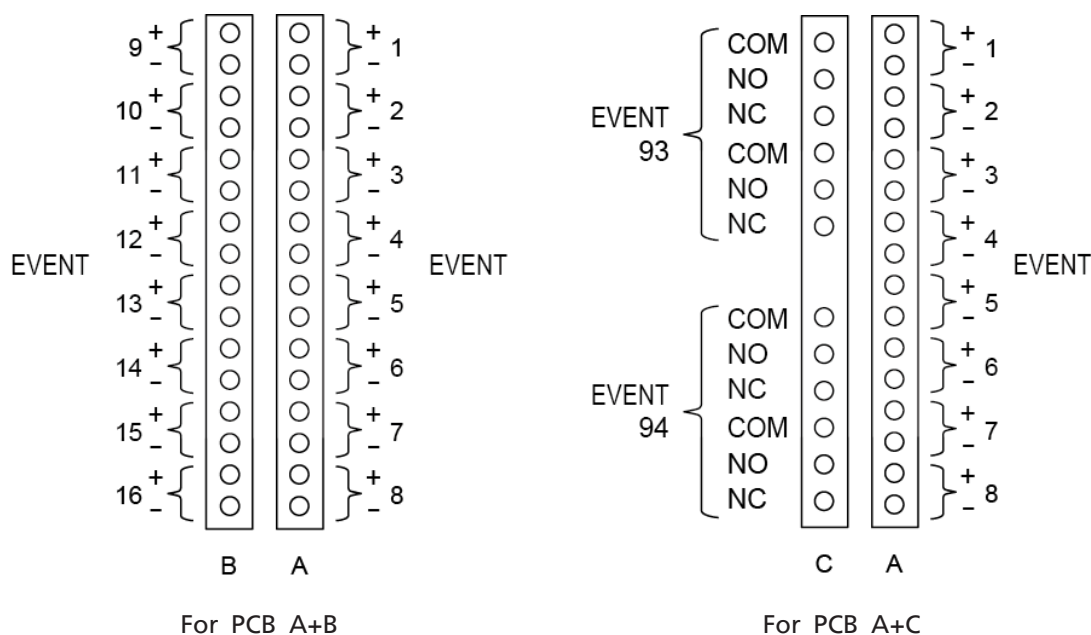
PRG-2030 should be incorporated into GC-2030 to use.

Three types of PCB for PRG-2030 are available:

- PCB A : Outputs 24 V (the maximum: 100 mA) in EVENT1 to 8.
- PCB B : Outputs 24 V (the maximum: 100 mA) in EVENT9 to 16.
- PCB C : Turn on the relay in EVENT93 and EVENT94.

Choose from PCB A+B or PCB A+C.

Insert cables of the devices to be used in the order of Event No.



■ PRG box

PRG box can output 100 V AC or 230 V AC using 24 V relay on PRG-2030.

Connect between PRG-2030 and PRG box using supplied cable (P/N: S221-49338) to use PRG box.

One PCB of PRG-2030 becomes available when connecting one PRG box.

Connect the PRG box to PCB A of PRG-2030 (EVENT 1 to 8). When connecting ports are not enough, you can add one more PRG box. Connect the second PRG box to PCB B of PRG-2030 (EVENT 9 to 16). When connecting two PRG boxes, you cannot use PCB C of PRG-2030.

As with PRG-2030, insert PRG box in the order of Event No.

8.7.3 Hydrogen Sensor

Hydrogen sensor (P/N: S221-78910-41/S221-88999-41) is an optional unit to detect concentration of hydrogen gas in the column oven.

The pump installed on the rear of the instrument aspirates atmosphere in the column oven and the sensor detects the concentration of hydrogen.

When the concentration of hydrogen in the column oven reaches 0.4 %, an error message appears, and the instrument stops all temperature control and fully opens the oven flap.

When the concentration of hydrogen in the column oven reaches 2 %, the instrument will be forcibly turned off.

■ Switching active views button

1

Press  (HOME) - [Peripherals] - [Hydrogen Leak Check Function].

[Hydrogen Leak Check Function] screen appears.

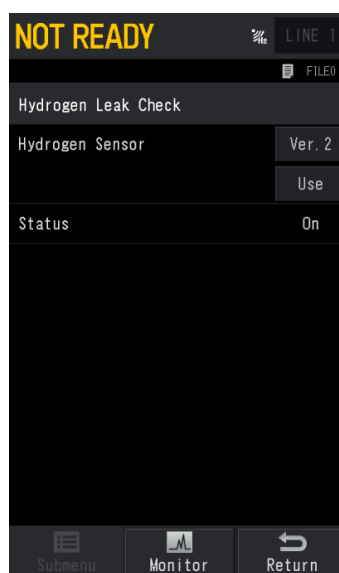
▶▶ Reference "7.7.3 [Hydrogen Leak Check] Screen" P.300

2

Set [Hydrogen Sensor] to [Ver.1] or [Ver.2].



(hydrogen sensor) icon is displayed on the screen, and hydrogen sensor function becomes available.



■ Daily inspection

Ensure that the pump on the rear of the gas chromatograph does not cause an unusual noise.

The pump repeatedly operates/stops every 15 seconds.

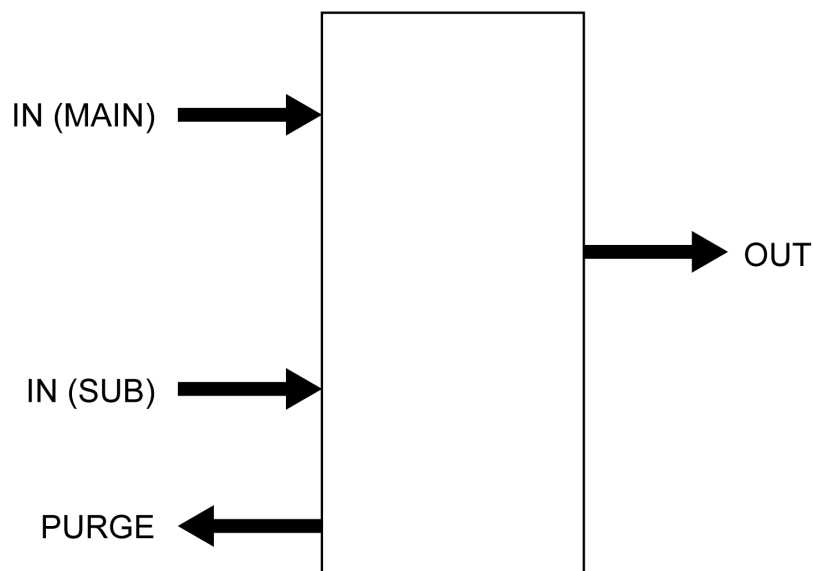
8.7.4 Gas Selector

The gas selector is an electronic flow controller. It supplies one gas of two types of gases to other flow controller connected to the gas selector.

Examples of usage are shown below.

- General
Analysis is performed switching the carrier gas depending on the purposes.
- When using helium and nitrogen
Helium is used as carrier gas, however, it is switched to nitrogen while analysis is not performed to reduce helium consumption.
- When using hydrogen and nitrogen
Hydrogen is used as carrier gas, however, it is switched to nitrogen while analysis is not performed for safety.

■ Flow diagram of the gas selector



8.8 AFT (Advanced Flow Technology)

AFT (Advanced Flow Technology) series is a capillary analysis system using a new flow line control technology. It provides great separation capacity and productivity. For example, it can separate the target component from complex matrix with high precision, and it can reduce the analysis time significantly.

►► **Reference** For settings of AFT method, refer to the User's Manual for LabSolutions.

8.8.1 Back Flush System

Back flush is a function to discharge a component remaining in the column from the inlet side (split vent) by blowing the carrier gas backward after the target component is detected.

It can eject high-boiling point contaminants after the target compounds from the split vent effectively. Therefore, it can improve productivity by reducing analysis time, prevent contamination of the column, and improve repeatability of the retention time.

Back flush is effective when the eluting time of the other components is longer than the target component. However, when the time required to discharge the contaminants after the target component is not so long under normal conditions, back flush function may not be able to reduce the analysis time.

For using the Back Flush mode, an optional package for back flush (P/N: S221-78811-41) is required.

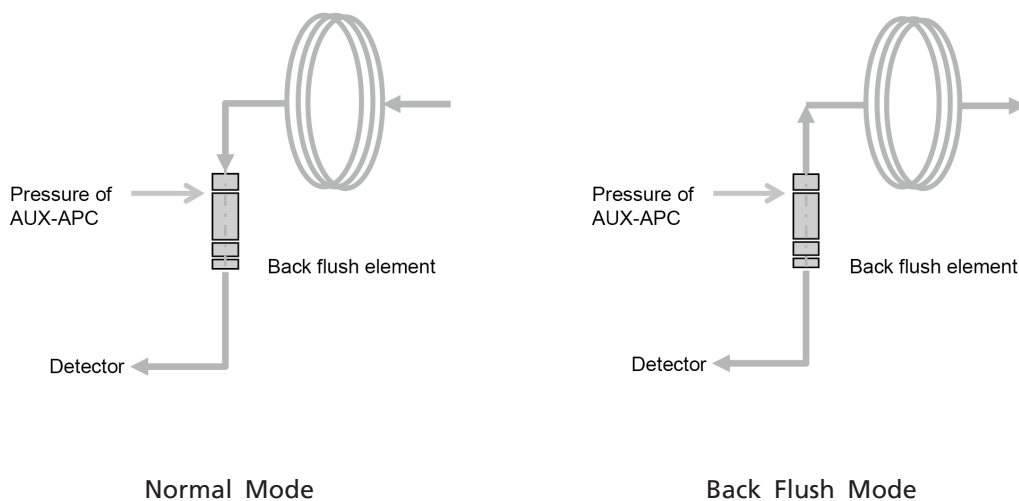
For back flush analysis, pressure program in GC-2030 is used.

In normal mode to detect the target component, the instrument sets the pressure of AUX-APC connected to back flush element at a value lower than injection port pressure.

In back flush mode after the target component is detected, the instrument increases the pressure of AUX-APC connected to back flush element, and at the same time, decreases the injection port pressure to blow the carrier gas backward.

Increasing the column temperature in back flush mode is effective to elute high-boiling point components.

Perform blank analysis after sample analysis to check whether the contaminants are eluted in back flush mode.



►► Reference "7.5.10 [Back Flush Settings] Screen" P.275

8.8.2 Heart-Cut/Detector Switching System

Heart-Cut is a system to separate and quantify the target component from complex matrix using two columns with different separation characteristics.

There are two types of heart-cut.

- Single open type : Uses two types of column for one column oven.
- Dual open type : Connects two columns to two column ovens (2 GCs, GC and GCMS, etc.), respectively.

Detector switching is a system to analyze components eluted from the column with two detectors depending on your purpose.

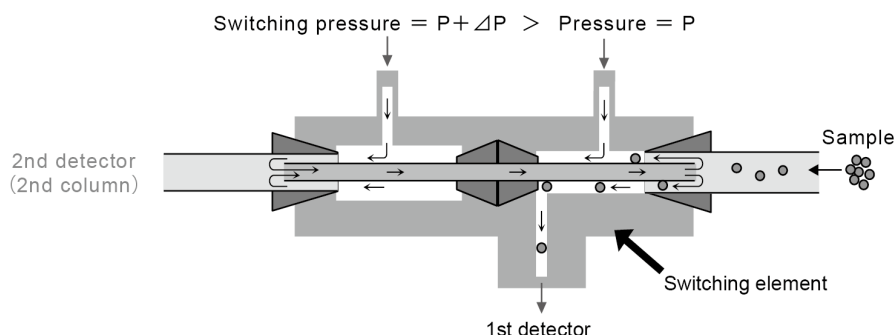
Optional switching units (flow line switching unit) (P/N: S221-78890-41, including switching element and AUX-APC, for 100 V, 115 V and 230 V) are required to use Heart-Cut/Detector Switching function.

For switching element, multi-Deans type is adopted. By using this, several heart-cuts can be performed precisely because retention time after heart-cut fluctuates very little.

For heart-cut/detector switching, the system uses switching program.

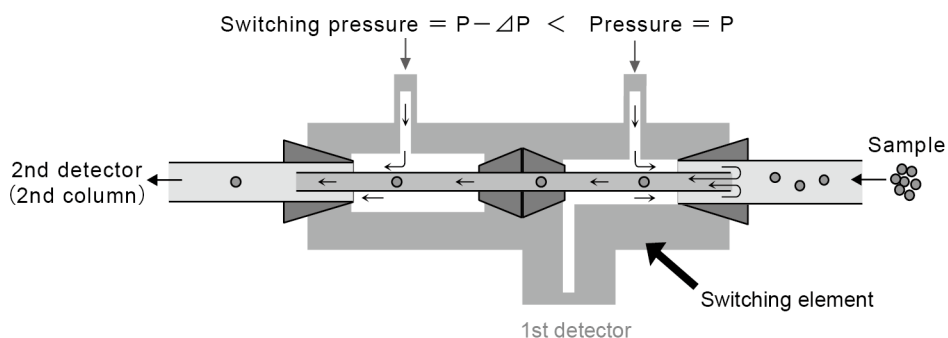
- Standby mode

The sample component flows in the order of the 1st column, switching element, and monitor detector.



- Switching mode

The sample component flows in the order of the 1st column, switching element, the 2nd column, and the 2nd detector.



NOTE To switch detectors, connect restrictor instead of the 2nd column.

■ Settings when not using switching unit

When not using switching unit, perform the followings to prevent degradation of the switching unit.

- Remove all column metal restrictors.
- Set switching pressure at 5 kPa.

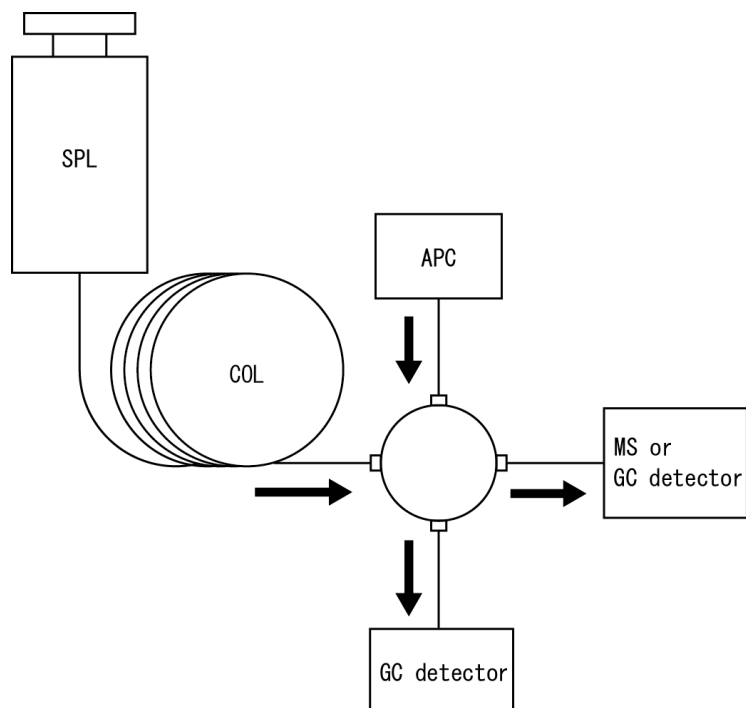
8.8.3 Detector Splitting System

Detector splitting is a system to split the column outlet to obtain information from several detectors in one sample injection.

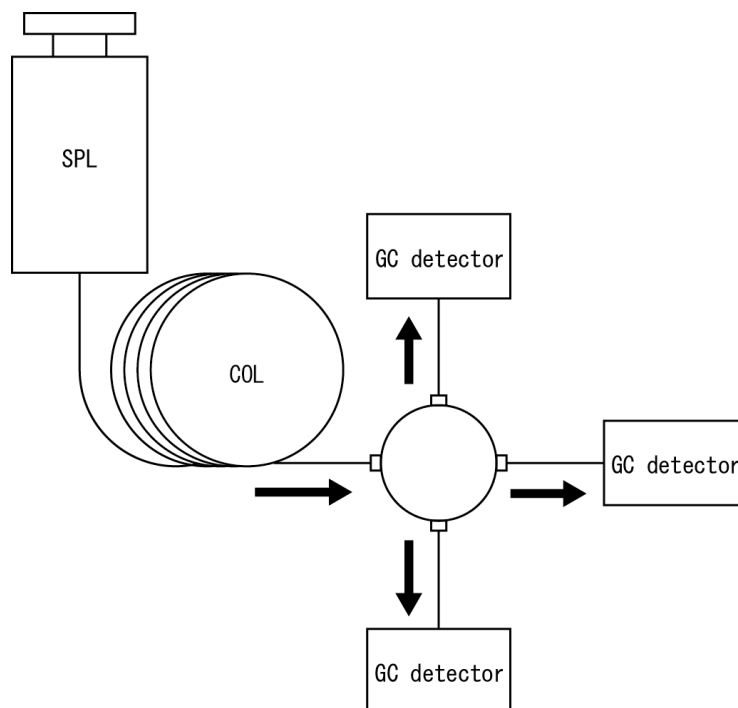
The amount of the sample introduced into the detectors is smaller than analysis using single detector because this system splits the sample component. You need to adjust split ratio so that each detector can detect the sample component. Split ratio can be adjusted by resistance ratio (inner diameter, length) of restrictor connected to each detector.

Optional splitting units are required to use detector splitting function.

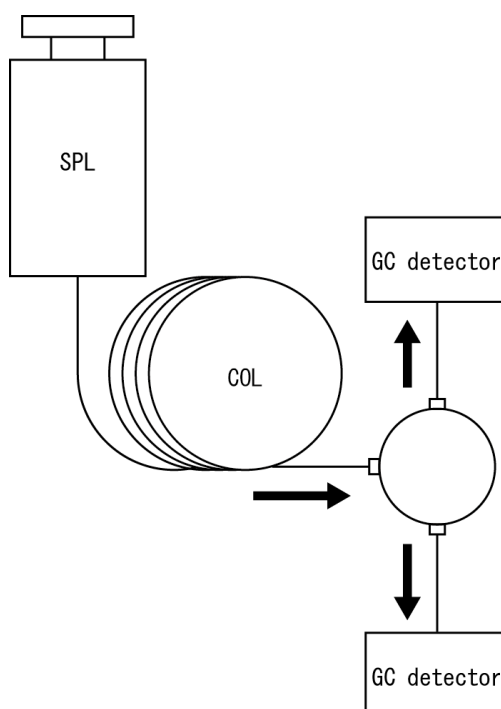
- 2-way splitting unit with AUX-APC (P/N: S221-78810-41 / S221-88100-41)



- 3-way splitting unit without AUX-APC (P/N: S221-73531-95)



- 2-way splitting unit without AUX-APC (P/N: S221-73531-96)



8.8.4 Trouble Shooting for AFT

This section describes possible problems when using AFT and their causes and solutions. Also see troubleshooting for the instrument.

▶▶ Reference "5 Trouble Shooting" P.53

If the problem is not solved by the recommended solutions, or if other problems occur, contact your Shimadzu sales/service representative.

■ Back flush system

Symptoms	Cause	Solution
No peaks	Injection port pressure for analysis (before back flush) is low.	Set the injection port pressure higher than AUX-APC (APC1) pressure.
Ghost peaks are detected during analysis after back flush.	High-boiling components do not elute during back flush.	Perform the following 3 procedures. • Set back flush time (the time to hold the final temperature for column temperature program) at larger value. • Increase the final temperature for column temperature program. • Increase AUX-APC pressure in back flush mode.
A problem with the detector occurs in back flush mode. (Example: FID or FPD detects extinguishment of the flame.)	Flow in back flush mode is large.	• Decrease AUX-APC pressure in back flush mode. • Change the restrictor to high-resistance type (with smaller inner diameter, longer).

■ Heart-cut/detector switching system

Symptoms	Cause	Solution
The 1st detector detects peaks, however, the 2nd detector does not detect peaks after switching.	There is a leak at the connection of the 2nd column or the 2nd detector restrictor.	• Find the leakage and stop it. • When there is a leak at the connection of the detector, additionally tighten it or replace the ferrule. ▼ NOTE SiLTite ferrule, which is used for connections on splitting element side, is reusable. However, it may cause a leak when it is tightened too much. If SiLTite ferrule causes a leak due to the excessive tightening, it should be replaced.

Symptoms	Cause	Solution
The 1st detector detects peaks, however, the 2nd detector does not detect peaks after switching.	The 2nd column or the 2nd detector restrictor is clogged.	Cut or replace the 2nd column or the 2nd detector restrictor to remove clogging.
	Switching element is not properly connected to the 1st column, the 2nd column, or the 1st detector restrictor.	Connect them to switching element properly.
	Calculated switching recovery rate is below 100 %.	Change pressure of switching unit on AFT setting screen of LabSolutions so that calculated switching recovery rate becomes more than 100 %.
The 1st detector and the 2nd detector do not detect peaks.	There is a leak at the connection of the 1st column.	Stop the leak at the connection of the 1st column.
	There is a leak at the connection of the 2nd column or the 2nd detector restrictor.	- Find the leakage and stop it. - When there is a leak at the connection of the detector, additionally tighten it or replace the ferrule. NOTE SiLTite ferrule, which is used for connections on splitting element side, is reusable. However, it may cause a leak when it is tightened too much. If SiLTite ferrule causes a leak due to the excessive tightening, it should be replaced.
	Switching element is not properly connected to the 1st column, the 2nd column, or the 1st detector restrictor.	Connect them to switching element properly.
The 1st detector and the 2nd detector detect peaks.	Calculated switching recovery rate is below 100 %.	Change pressure of switching unit on AFT setting screen of LabSolutions so that calculated switching recovery rate becomes more than 100 %.
A problem with the detector occurs. (Example: FID or FPD detects extinguishment of the flame.) ▶▶ Reference • FID: P.63 • FPD: P.70	The length of the inserted column is not correct.	Check the length of the column inserted in the detector.
	The flow of the 1st detector restrictor or the 2nd column is large.	- Decrease AUX-APC pressure. - Change the restrictor to high-resistance type (with smaller inner diameter, longer). - Change the 2nd column to high-resistance type (with smaller inner diameter, longer).

■ Detector splitting system

▼ **NOTE** When the sample is split and sent into different types of detectors, the relative sensitivity for the sample is different considerably, and therefore, the split ratio may not be the same as the area ratio. Even if the sample is split and sent into the same type detectors, the split ratio may not be the same as the area ratio depending on the column flow.

Symptoms	Cause	Solution
Split ratio is not the same as the value calculated by LabSolutions.	Dimensions (inner diameter, length, film thickness) of the 1st detector restrictor or the 2nd column inputted in LabSolutions are wrong.	Input correct dimensions (inner diameter, length, film thickness) of the 1st detector restrictor or the 2nd column.
	There is a leak at the connection of the 1st column.	Stop the leak at the connection of the 1st column.
	There is a leak at the connection of the 2nd column or the 2nd detector restrictor.	- Find the leakage and stop it. - When there is a leak at the connection of the detector, additionally tighten it or replace the ferrule. ▼ NOTE SiITite ferrule, which is used for connections on splitting element side, is reusable. However, it may cause a leak when it is tightened too much. If SiITite ferrule causes a leak due to the excessive tightening, it should be replaced.
	Switching element is not properly connected to the 1st column, the 2nd column, or the 1st detector restrictor.	Connect them to switching element properly.

8.9 Connecting to External Devices

8.9.1 Connecting to LabSolutions

To control the instrument with LabSolutions, connect the USB or Ethernet cable to the connector on the rear of the instrument.

▶▶ Reference ["2.2.5 Rear" P.11](#)

■ When using USB cable

1 Press  (HOME) - [Function].

[Function] screen appears.

2 Press [Configuration] - [Transmission Settings].
[Transmission Settings] screen appears.

3 Press [USB] tab and then press [Apply].

▶▶ Reference ["\[USB\] tab" P.338](#)

The settings are updated and the instrument is connected with LabSolutions.

■ When using Ethernet cable

1 Press  (HOME) - [Function].

[Function] screen appears.

2 Press [Configuration] - [Transmission Settings].
[Transmission Settings] screen appears.

3 Press [Ethernet] tab and set up [IP Address], [Subnet Mask], and [Default Gateway].

▶▶ Reference ["\[Ethernet\] tab" P.338](#)

4 Press [Apply].

The settings are updated and the instrument is connected with LabSolutions.

8.9.2 Connecting to CHROMATOPAC

After you connect the instrument with CHROMATOPAC (C-R8A, C-R7A/C-R7A plus), set the transmission settings at equivalent values between the instrument and CHROMATOPAC, and perform calibration.

▶▶ **Reference** For CHROMATOPAC operation, refer to the User's Manual for C-R8A and C-R7A/C-R7A plus.

1

Calibrate analogue wide range signal.

NOTE When you connect between the instrument and CHROMATOPAC using a signal cable for linear, calibration is not required. Set [Analog Signal Type] at [Linear] and proceed to step 2.

For C-R8A

- 1 Press  (HOME) - [Detector] - [Submenu] - [Signal Settings].
[Signal Settings] screen appears.
- 2 Set [Analog Signal Type] at [Wide].
- 3 Press  (Return) to return [Detector] screen, and set [Detector Control] at [Off].
- 4 Enter the following text on C-R8A.
LOAD "8:ZCALIB.BAS"
- 5 Press "RUN" key on C-R8A.
Wait until [CH No. (1:CH1, 2:CH2)] is displayed.
- 6 Enter channel No. of C-R8A.
Wait until [Save to the disk? (Y:save N:no)] is displayed.
- 7 Enter "Y".
Wait until [COMPLETED] is displayed.
- 8 Set [Detector Control] at [On] on [Detector] screen of the instrument.

For C-R7A/C-R7A plus

- 1 Press  (HOME) - [Detector] - [Submenu] - [Signal Settings].
[Signal Settings] screen appears.
- 2 Set [Analog Signal Type] at [Wide].
- 3 Press  (Return) to return [Detector] screen, and set [Detector Control] at [Off].
- 4 Press "Win3" key on C-R7A/C-R7A plus, and enter the following text.
LOAD "ZCALIB"
- 5 Press "RUN" key on C-R7A/C-R7A plus.
Wait until [CH No. (1:CH1, 2:CH2)] is displayed.
- 6 Enter channel No. of C-R7A/C-R7A plus.
Wait until [Save to the disk? (Y:save N:no)] is displayed.
- 7 Enter "Y".
- 8 Set [Detector Control] at [On] on [Detector] screen of the instrument.

2

Check the calibration.

Check whether the calibration has done correctly as the following procedure.

- 1 Press  (HOME) - [GC Start/Stop Sequence].
[GC Start Sequence] screen appears.
- 2 Press [GC Start].
- 3 Press  (HOME) - [Detector].
[Detector] screen appears.
- 4 Set [Detector Control] at [Off].
- 5 Press [Submenu] - [Signal Settings].
[Signal Settings] screen appears.
- 6 Set [Signal Range] at [x1].
- 7 Set zero level of CHROMATOPAC at "FREE".
 - For C-R8A
Press  , and then .
 - For C-R7A/C-R7A plus
Press "F" key on [Win1] screen.
- 8 Press  (Monitor).
Monitor screen appears.
- 9 Press  (Auto Zero).
The baseline moves to zero point (0 μ V).
▶▶ Reference ["7.2.1 Monitor Screen" P.156](#)
- 10 Check the displayed range on CHROMATOPAC.
 - When [Analog Signal Type] is [Wide]
The signal level is within " ± 50 μ Ve", the calibration has done correctly.
 - When [Analog Signal Type] is [Linear]
The signal level is " ± 0 μ Ve", CHROMATOPAC can be used.

**NOTE**

- If the calibration was failed, perform the above-mentioned calibration procedure again.
- When [Signal Attenuation] is set at [x1] on the instrument, the maximum difference of displayed values between the instrument and CHROMATOPAC (FREE) is ± 50 μ V or ± 5 %, whichever is greater.
- Perform this calibration when changing the detector or changing CHROMATOPAC channels which connect to the detector. If not, quantitation may fail.

8.9.3 Connecting to Auto Injector

►► **Reference** For details about AOC, refer to the AOC Instruction Manual.

Set up this equipment after connecting the auto injector.

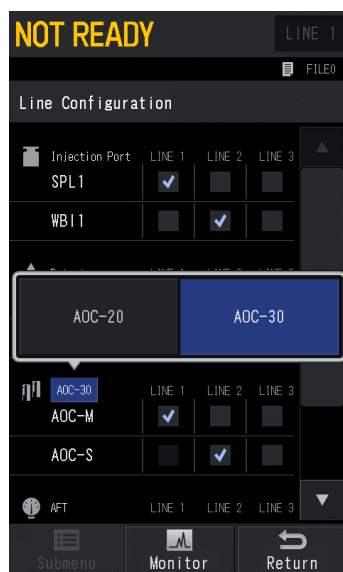
1

Press  (HOME) - [Settings] - [Submenu] - [Line Configuration].

[Line Configuration] screen appears.

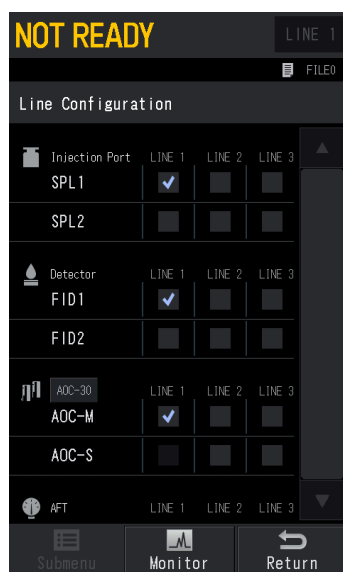
2

Select [AOC-20] or [AOC-30].



3

Configure [AOC-M] and injection port to be used in the same analytical line.



■ Setting according to the AOC configuration

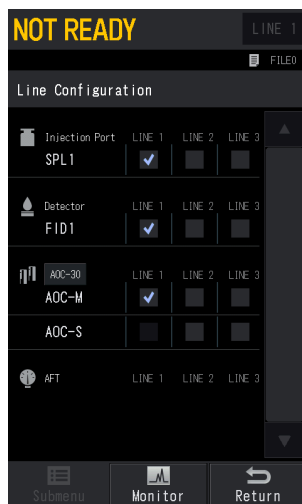
Make settings according to the AOC configuration on the [Line Configuration] screen.

▶▶ Reference "7.8.2 [Line Configuration] Screen" P.314

Auto Injector Setup

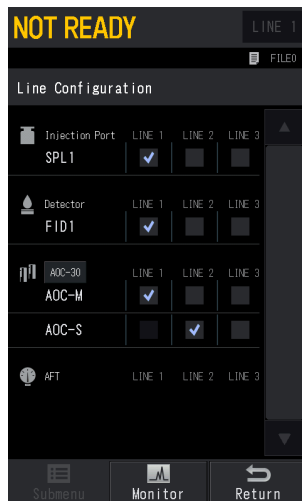
- Single configuration

Register AOC-M as the analytical line ([LINE 1] in the figure).



- Dual configuration

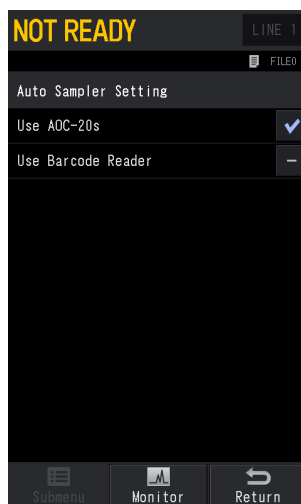
Register AOC-M and AOC-S as the analytical lines ([LINE 1] for AOC-M and [LINE 2] for AOC-S in the figure).



Auto Sampler Setup

- AOC-20

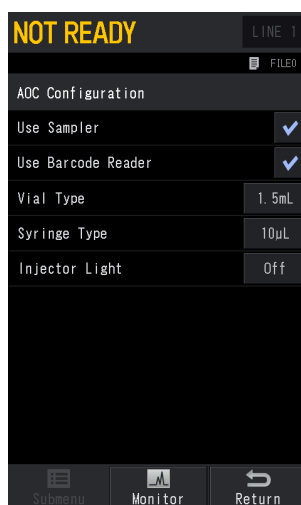
Check [Use AOC-20s] in the [Auto Sampler Setting] screen.



▶▶ Reference "[Auto Sampler Setting] Screen" P.173

- AOC-30

Check [Use Sampler] in the [AOC Configuration] screen.



▶▶ Reference "[AOC Configuration] Screen" P.180

8.9.4 Connecting to Relay Cable

Connect relay input/output connector (optional, P/N of 2P: S071-36136-01, P/N of 3P: S071-36136-02) on the rear of the instrument.

▶▶ Reference "2.2.5 Rear" P.11

■ Standard relay output/input

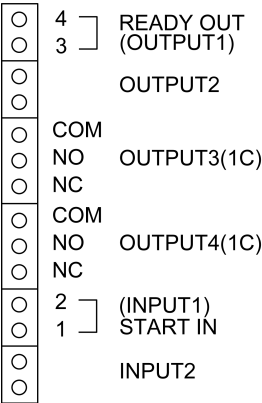
Signal type of relay output/input can be set on [Relay Control] screen.

▶▶ Reference "7.7.5 [Relay Control] Screen" P.302

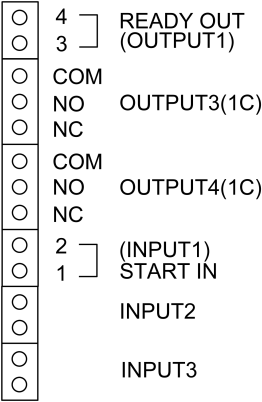
- OUTPUT1 and OUTPUT2 output signals by Open/Close.
- OUTPUT3 and OUTPUT4 output signals by NO/NC.
- INPUT1 and INPUT2 detect Open/Close of two contacts of connection destination.

Insert the connector to be used according to your purpose.

- When the CPU board firmware version is 1.XX or 2.XX (S221-77080-XX)



- When the CPU board firmware version is 4.XX (S221-89060-XX)



■ NOTE When the CPU board firmware version is 4.XX, OUTPUT2 is not located on the rear of the GC. If you wish to use OUTPUT2, prepare an additional part for using OUTPUT2 (S221-89777-41).

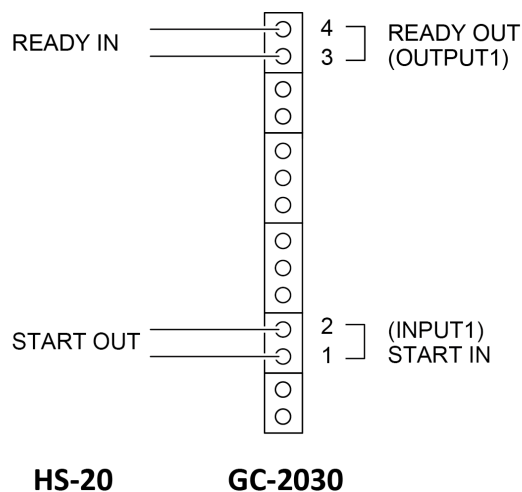
■ Connecting to HS-20

Make the following settings when using the HS-20.

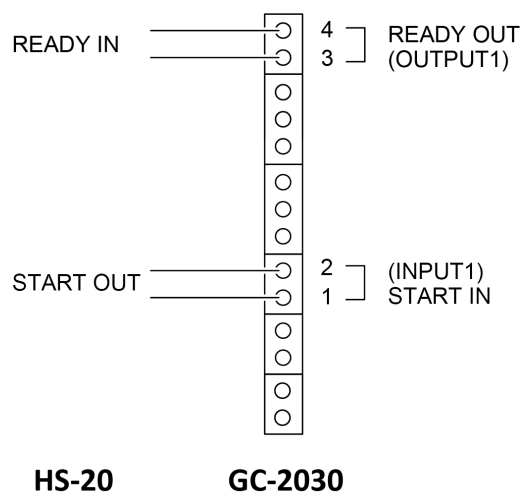
1

Connect between HS-20 and GC with start signal line.

- When the CPU board firmware version is 1.XX or 2.XX (S221-77080-XX)



- When the CPU board firmware version is 4.XX (S221-89060-XX)



2

Set items as below on [Relay Control] screen.

▶▶ Reference ["7.7.5 \[Relay Control\] Screen" P.302](#)

Item	Set Value
OUTPUT1	Ready
OUTPUT1 Polarity	Open
INPUT1	Start
INPUT1 Polarity	Close

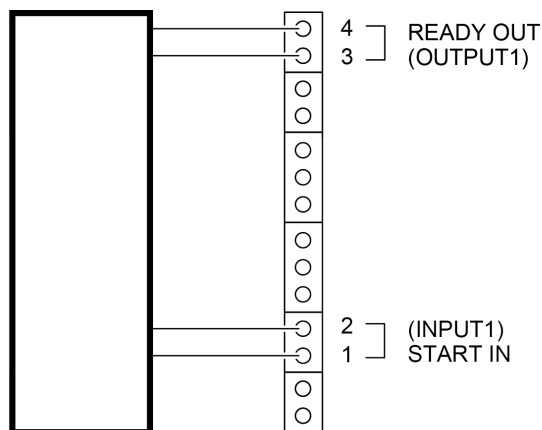
■ Connecting to HS-10

Make the following settings when using the HS-10.

1

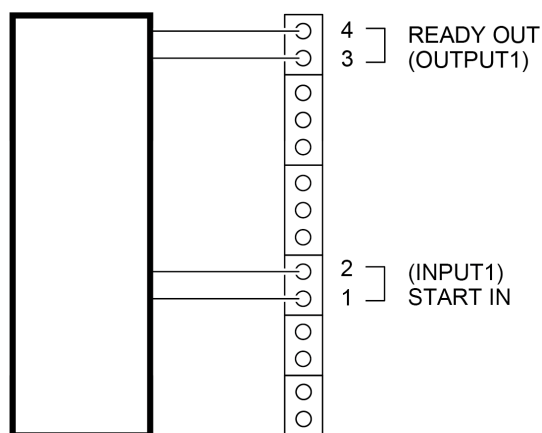
Connect between HS-10 and GC with start signal line.

- When the CPU board firmware version is 1.XX or 2.XX (S221-77080-XX)



HS-10 I/O Connector GC-2030

- When the CPU board firmware version is 4.XX (S221-89060-XX)



HS-10 I/O Connector GC-2030

2

Set items as below on [Relay Control] screen.

▶▶ Reference ["7.7.5 \[Relay Control\] Screen" P.302](#)

Item	Set Value
OUTPUT1	Ready
OUTPUT1 Polarity	Open
INPUT1	Start
INPUT1 Polarity	Open

8.10 Event No.

The list below shows the correspondence of event No. to functions.

No.	Function of Event xx (positive number)	Function of Event -xx (negative number)
0	Reverses contact status of Events 1 to 16 and Events 91 to 96	-
1	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
2	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
3	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
4	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
5	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
6	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
7	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
8	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
9	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
10	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
11	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
12	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
13	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
14	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
15	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
16	Turns on contact of one contact in one circuit (option PRG)	Turns off contact of one contact in one circuit (option PRG)
51	Performs zero adjustment of DET #1	Frees zero adjustment of DET #1
52	Performs zero adjustment of DET #2	Frees zero adjustment of DET #2
53	Performs zero adjustment of DET #3	Frees zero adjustment of DET #3
54	Performs zero adjustment of DET #4	Frees zero adjustment of DET #4
71	Ignites FID/FPD flame	Extinguishes FID/FPD flame
72	Turns on BID Plasma	Turns off BID Plasma

No.	Function of Event xx (positive number)	Function of Event -xx (negative number)
81	Turns on feedback of FTD 1	Turns off feedback of FTD 1
82	Turns on feedback of FTD 2	Turns off feedback of FTD 2
83	Turns on feedback of FTD 3	Turns off feedback of FTD 3
84	Turns on feedback of FTD 4	Turns off feedback of FTD 4
91	N/O contact between two contacts in one circuit	N/C contact between two contacts in one circuit
92	N/O contact between two contacts in one circuit	N/C contact between two contacts in one circuit
93	N/O contact between two contacts in one circuit (option PRG)	N/C contact between two contacts in one circuit (option PRG)
94	N/O contact between two contacts in one circuit (option PRG)	N/C contact between two contacts in one circuit (option PRG)
103	Closes CAR1 split flow line	Opens CAR1 split flow line
104	Closes CAR2 split flow line	Opens CAR2 split flow line
105	OCI/PTV Fan Port1 On	OCI/PTV Fan Port1 Off
109	INJ2 CRG Port On	INJ2 CRG Port Off
110	COL CRG Port On	COL CRG Port Off
115	Closes CAR3 split flow line	Opens CAR3 split flow line
116	Closes CAR4 split flow line	Opens CAR4 split flow line
131	Turns On DET #1 detector controller	Turns Off DET #1 detector controller
132	Turns On DET #2 detector controller	Turns Off DET #2 detector controller
133	Turns On DET #3 detector controller	Turns Off DET #3 detector controller
134	Turns On DET #4 detector controller	Turns Off DET #4 detector controller
141	Turns On CAR1 carrier gas	Turns Off CAR1 carrier gas
142	Turns On CAR1 septum purge	Turns Off CAR1 septum purge
143	Turns On CAR2 carrier gas	Turns Off CAR2 carrier gas
144	Turns On CAR2 septum purge	Turns Off CAR2 septum purge
145	Turns On CAR3 carrier gas	Turns Off CAR3 carrier gas
146	Turns On CAR3 septum purge	Turns Off CAR3 septum purge
147	Turns On DetAPC1 makeup gas	Turns Off DetAPC1 makeup gas
148	Turns On DetAPC1 H2	Turns Off DetAPC1 H2
149	Turns On DetAPC1 Air	Turns Off DetAPC1 Air
150	Turns On DetAPC2 makeup gas	Turns Off DetAPC2 makeup gas
151	Turns On DetAPC2 H2	Turns Off DetAPC2 H2
152	Turns On DetAPC2 Air	Turns Off DetAPC2 Air
153	Turns On DetAPC3 makeup gas	Turns Off DetAPC3 makeup gas
154	Turns On DetAPC3 H2	Turns Off DetAPC3 H2
155	Turns On DetAPC3 Air	Turns Off DetAPC3 Air
156	Turns On DetAPC4 makeup gas	Turns Off DetAPC4 makeup gas
157	Turns On DetAPC4 H2	Turns Off DetAPC4 H2

No.	Function of Event xx (positive number)	Function of Event -xx (negative number)
158	Turns On DetAPC4 Air	Turns Off DetAPC4 Air
159	Turns On CAR4 carrier gas	Turns Off CAR4 carrier gas
160	Turns On CAR4 septum purge	Turns Off CAR4 septum purge
161	CAR1 Carrier Gas Saver On Sets split ratio to value of CAR1 event split ratio 1. When GC becomes ready, split ratio returns to value of analysis parameter.	CAR1 Carrier Gas Saver Off Returns split ratio to value of analysis parameter.
162	CAR1 Carrier Gas Saver On Sets split ratio to value of CAR1 event split ratio 2. When GC becomes ready, split ratio returns to value of analysis parameter.	CAR1 Carrier Gas Saver Off Returns split ratio to value of analysis parameter.
163	CAR2 Carrier Gas Saver On Sets split ratio to value of CAR2 event split ratio 1. When GC becomes ready, split ratio returns to value of analysis parameter.	CAR1 Carrier Gas Saver Off Returns split ratio to value of analysis parameter.
164	CAR2 Carrier Gas Saver On Sets split ratio to value of CAR2 event split ratio 2. When GC becomes ready, split ratio returns to value of analysis parameter.	CAR1 Carrier Gas Saver Off Returns split ratio to value of analysis parameter.
165	CAR3 Carrier Gas Saver On Sets split ratio to value of CAR3 event split ratio 1. When GC becomes ready, split ratio returns to value of analysis parameter.	CAR3 Carrier Gas Saver Off Returns split ratio to value of analysis parameter.
166	CAR3 Carrier Gas Saver On Sets split ratio to value of CAR3 event split ratio 2. When GC becomes ready, split ratio returns to value of analysis parameter.	CAR3 Carrier Gas Saver Off Returns split ratio to value of analysis parameter.
167	CAR4 Carrier Gas Saver On Sets split ratio to value of CAR4 event split ratio 1. When GC becomes ready, split ratio returns to value of analysis parameter.	CAR4 Carrier Gas Saver Off Returns split ratio to value of analysis parameter.
168	CAR4 Carrier Gas Saver On Sets split ratio to value of CAR4 event split ratio 2. When GC becomes ready, split ratio returns to value of analysis parameter.	CAR4 Carrier Gas Saver Off Returns split ratio to value of analysis parameter.
171	Turns On CAR1 to CAR4 high pressure injection mode. Sets pressure to value of high pressure injection mode.	Turns Off CAR1 to CAR4 high pressure injection mode. Returns column input pressure to value of analysis parameter.
181	Turns On APC1 flow controller	Turns Off APC1 flow controller
182	Turns On APC2 flow controller	Turns Off APC2 flow controller
183	Turns On APC3 flow controller	Turns Off APC3 flow controller

No.	Function of Event xx (positive number)	Function of Event -xx (negative number)
184	Turns On APC4 flow controller	Turns Off APC4 flow controller
185	Turns On APC5 flow controller	Turns Off APC5 flow controller
186	Turns On APC6 flow controller	Turns Off APC6 flow controller
187	Turns On APC7 flow controller	Turns Off APC7 flow controller
188	Turns On APC8 flow controller	Turns Off APC8 flow controller
189	Turns On APC9 flow controller	Turns Off APC9 flow controller
190	Turns On APC10 flow controller	Turns Off APC10 flow controller
191	Turns On APC11 flow controller	Turns Off APC11 flow controller
192	Turns On APC12 flow controller	Turns Off APC12 flow controller
193	Turns On APC13 flow controller	Turns Off APC13 flow controller
194	Turns On APC14 flow controller	Turns Off APC14 flow controller
195	Turns On APC15 flow controller	Turns Off APC15 flow controller
196	Turns On APC16 flow controller	Turns Off APC16 flow controller
197	Turns On APC17 flow controller	Turns Off APC17 flow controller
198	Turns On APC18 flow controller	Turns Off APC18 flow controller
257	Turns On He Purifier Port1	Turns Off He Purifier Port1
258	Turns On He Purifier Port2	Turns Off He Purifier Port2
259	Turns On cold trap valve	Turns Off cold trap valve
260	Turns On the first GC valve	Turns Off the first GC valve
261	Turns On the second GC valve	Turns Off the second GC valve
262	OCI/PTV Fan Port2 On	OCI/PTV Fan Port2 Off

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