221-79204
May 2017

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.

The following two manuals and Maintenance Help are supplied with this product.

Document name	Document No.	Format	Description
GC-2030 Instruction Manual (this document)	221-79204	DVD-ROM *1	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.
GC-2030 Operation Guide	221-79201	Booklet	The descriptions about daily operations are excerpted from Instruction Manual and Maintenance Help. Store this booklet near the system, and use it for reference.
GC-2030 Maintenance Help	-	DVD-ROM *1	This Help document describes maintenance operation of GC-2030. Use this for the maintenance of the product.

*1 For the usage of DVD-ROM, see "How to Use the DVD-ROM" P.iii.

Keep this manual for future reference.

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

This manual describes how to use the system and accessories and peripherals associated with the system. Please read this manual carefully and use the system 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 "Electromagnetic Compatibility" 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.

Original version is approved in English.

Notice

- Information in this manual is subject to change without notice and does not represent a commitment on the part of the vendor.
- Any errors or omissions which may have occurred in this manual despite the utmost care taken in its production will be corrected as soon as possible, although not necessarily immediately after detection.
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Indications Used in This Manual

Warnings, cautions, and notes are indicated using the following conventions:

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

The following symbols are used in this manual:

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

The DVD-ROM contains "Instruction Manual" and "Maintenance Help".

Use the DVD-ROM according to the following procedure.

NOTE

- Log in to the PC as a user with administrator permissions before running the DVD-ROM.
- System requirements to see Instruction Manual and Maintenance Help are shown below:
  Internet Explorer 10, Internet Explorer 11, Microsoft Edge, Chrome 45, Safari 8

1 **Insert the DVD-ROM into your PC.**

2 **Click [GC2030Manual.msi].**

3 **Click [Next].**

4 **Click [Install].**

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

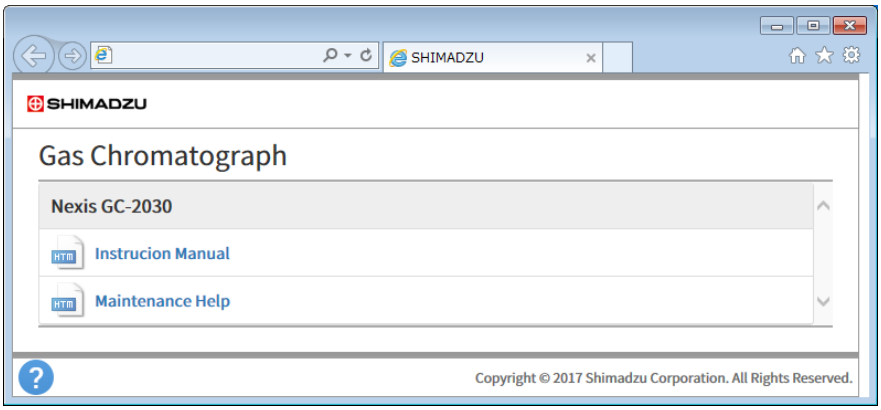
5 **Click [Complete].**

An icon is created on Desktop, and installation is completed.

6 **Double-click** 

on Desktop.

The following screen appears.



7 **Click an item to see it.**

HTML manual opens.

Safety Instructions

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

The gas cylinders used with this system 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.

■ Precautions for Use

⚠ WARNING

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.

Do NOT use the system for other than intended use.

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

■ Precautions for Installation Site

⚠ WARNING

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

May cause fire or explosion.

Do NOT install the system in the vicinity of combustibles.

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

Install the system in a well-ventilated area.

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

⚠ CAUTION

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

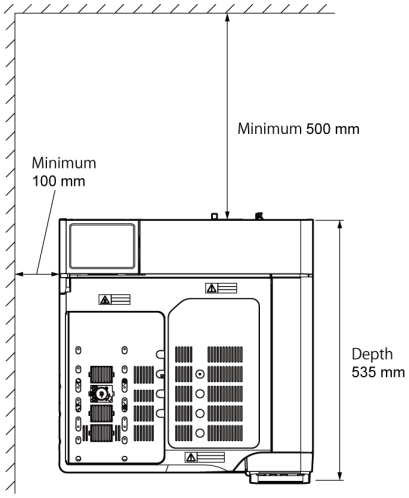
The weight of the main body of the system is 43.5 kg (for SPL/FID model). If the conditions are not satisfied, that may cause accident due to toppling over or drop.

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.

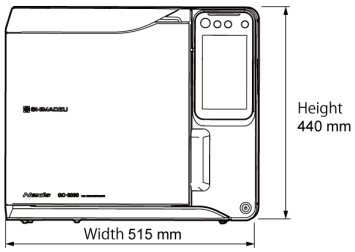
- Do NOT put combustibles near the rear of the product.
- Keep the rear of the product more than 500 mm away from the wall. (The distance from the wall should be more than 250 mm when optional exhaust duct (P/N: S221-80955-41) is installed.)
- Leave a space for maintenance and inspection of the rear.



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:

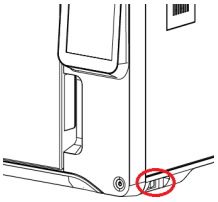
- Keep room temperature at 5 to 40 °C with small fluctuation
- Keep humidity from 5 to 90 % (no condensation)
- Prevent the air conditioner from blowing directly on the system
- Avoid direct sunlight
- Avoid strong vibration
- Avoid condensation
- Comply with standards for installation environment (IEC) (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 system

⚠ CAUTION

Instruction

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

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



■ Precautions for 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
AC100 V	18 A	26 A
AC115 V	15.7 A	22.6 A
AC230 V	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

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.

Comply with the rated current of the outlet.

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

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
AC100 V (100 V~)	1800 VA	50 Hz/60 Hz	80 A
AC115 V (115 V~)	1800 VA	50 Hz/60 Hz	80 A
AC230 V (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.

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.

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

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

Ground the system.

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

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

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

That may cause accident due to toppling over or drop.

Ventilate your room adequately after installation.

The system 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.

■ Precautions for Operation

⚠ WARNING

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.

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).

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 auto injector AOC-20i. It is also recommended to use sample cooling fan when using the other flammable solvent or sample.

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.

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

Do NOT use mobile phone near the detector (especially TCD and FTD).

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

Use specified gases.

If not, that may cause malfunction and accident.

If liquid such as water and organic solvent spills on the system, wipe it immediately.

May cause malfunction.

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.

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 code 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.

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.

■ Risk of Repair/Disassembling/Modification

⚠ CAUTION

Do NOT modify/disassemble the system without permission.

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

Ask your Shimadzu sales/service representative for repair.

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

■ Precautions for Inspection/Maintenance

⚠ WARNING

During cleaning of the system's exterior, do NOT keep the system wet and do NOT wipe the system 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 system with a soft cloth dampened with a small amount of water or mild detergent and wipe it dry with a dry cloth.

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

Ensure that the temperatures of the injector 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.113

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

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 system 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 system has several large-capacity heaters to control temperatures of column oven, injection port, and detector during analysis.

⚠ CAUTION

Wear safety glasses during maintenance and inspection.

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

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

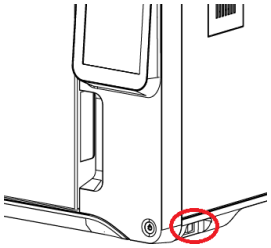
If insulation becomes deformed, heat in column oven is lost from the gap and you may not be able to obtain data as the specification. When insulation becomes deformed, stop using the system immediately and contact your Shimadzu sales/service representative.

■ Emergency Operating Procedure

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

Emergency stop

1 Turn off the main power of the system.



2 Turn off all of the associated devices.

3 Shut off the main valve of the cylinder of carrier gas, hydrogen, air, and makeup gas.

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 system.
- 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 system is installed for ventilation.

■ Operation After Power Failure

Operate the system according to the following procedure.

1. Shut off the hydrogen gas supply immediately.
2. Turn off the main power of the system.
3. Turn off all of the associated devices.
4. Open doors and windows of the room where the system is installed for ventilation.
5. After recovery, see "Precautions for Installation" P.vi and "Precautions for Operation" P.viii and start up the system 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.

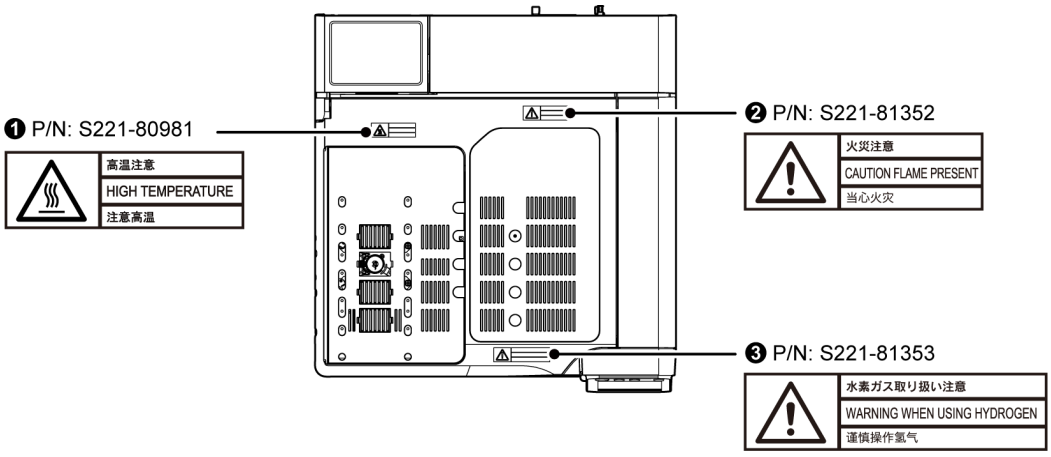
Warning Labels and Residual Risk Information

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.

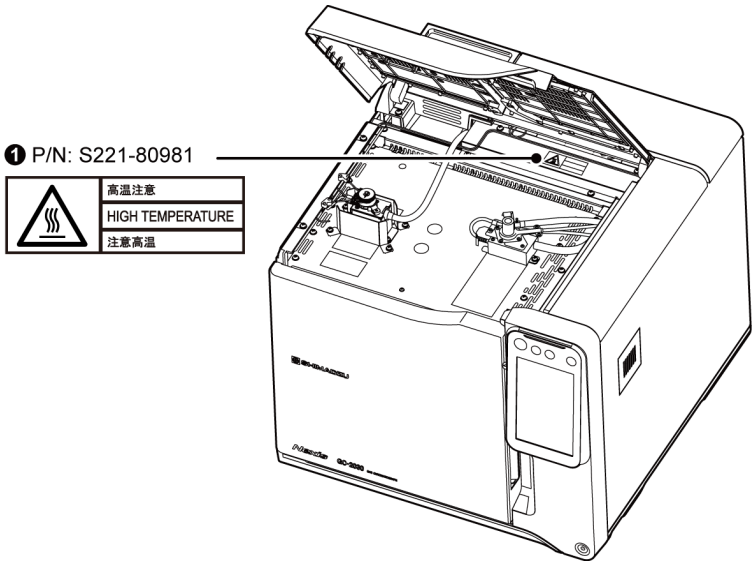
A residual risk indicates a risk that could not be reduced or eliminated in the process of design and manufacture. Read and understand "Description" before use.

■ Top Face



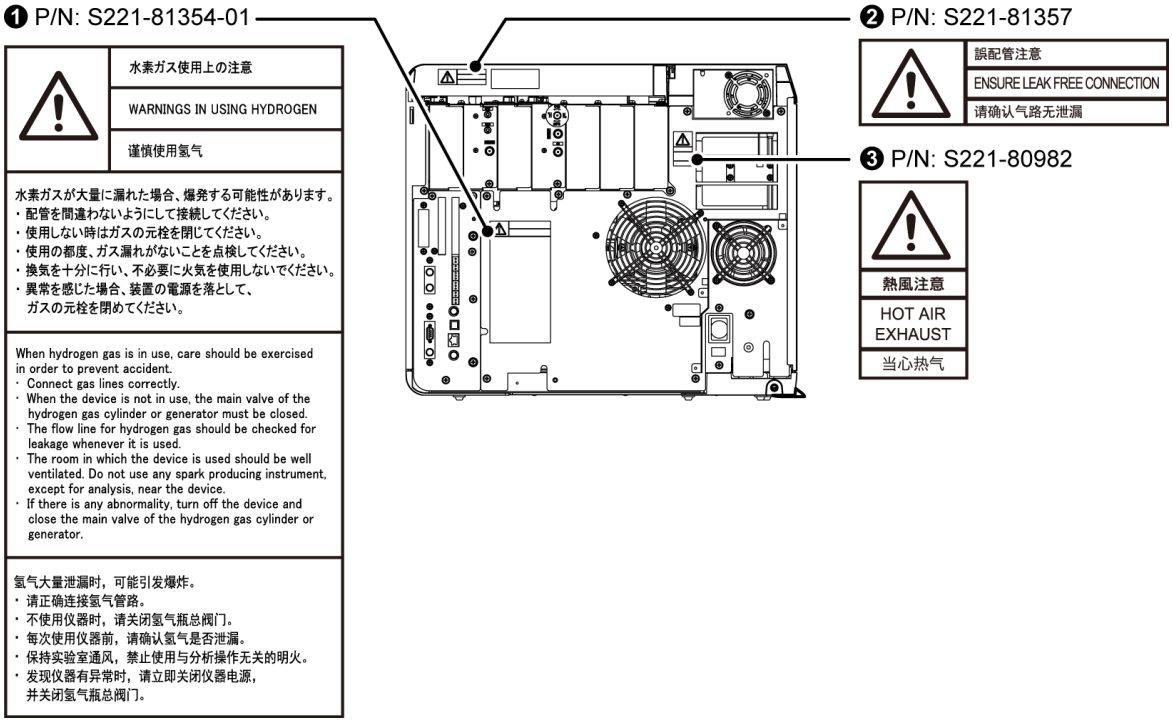
No.	Description
❶	**HIGH TEMPERATURE** Do NOT touch injection port, detector and INJ/DET cover during analysis. May cause burn.
❷	**CAUTION FLAME PRESENT** Do NOT put objects on INJ/DET cover. May cause fire.
❸	**WARNING WHEN USING HYDROGEN** Close all unused valves for hydrogen pressure control and seal the column fittings. If hydrogen fills the oven, it may cause explosion.

■ Inside of the System



No.	Description
❶	**HIGH TEMPERATURE** Do NOT touch injection port, detector and INJ/DET cover during analysis. May cause burn.

■ Rear



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.

Electromagnetic Compatibility

Descriptions in this section apply only to the following models:

- 221-77002-58 GC-2030 AF
- 221-77003-58 GC-2030 AT
- 221-77004-58 GC-2030 ATF
- 221-77005-58 GC-2030 N

This product complies with European standard EN61326-1, class A for electromagnetic interference (Emissions) and basic electromagnetic environment requirement (Table1) for electromagnetic susceptibility (Immunity).

■ EN61326-1 Emissions (Electromagnetic Interference)

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

■ EN61326-1 Immunity (Electromagnetic Susceptibility)

Compliance with this standard 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 in the standard may cause the product to malfunction.

When installing or using this product, especially 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.

Precautions on Handling Gases

The gas cylinders used with this system 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 system, see "8.3.1 Gas Type and Purity" P.300.

■ 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

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

If hydrogen fills the oven, it may cause explosion.

Make sure that the supply pressure to the flow controller does not exceed 500 kPa.

If the flow controller fails with a hydrogen gas supply pressure over 500 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 H_2 flow is set at the initial value (40.0 mL/min). It is enough for operation.

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

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.

Install the system 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.

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.

■ Caution in Gas Plumbing

⚠ WARNING

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.302

When the system 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 CO_2 or pressurized liquid N_2 as coolant. Prepare siphon type cylinder when using liquid CO_2.

Care should be taken when handling the coolant.

Be sure to follow the instructions below.

■ Precautions for Operation

⚠ WARNING

Ventilate the room adequately.

The device releases large amount of CO_2 or N_2. Oxygen deficiency may occur in a closed room.

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.

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 "7.6.2 [CRG] Screen" P.210

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.

NOTE When you perform low-temperature analysis on highly humid day, condensation may occur on the system surface or inside the column oven. In this case, set the column oven temperature at about 200 °C and dry out the system.

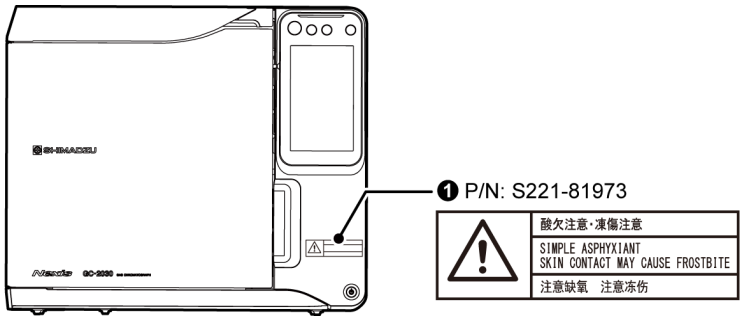
Reference "Drying out of the system" P.299

When the humidity is too high in the atmosphere, adjust the humidity using air conditioner etc.

■ 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
❶	**SIMPLE ASPHYXIANT** **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.

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

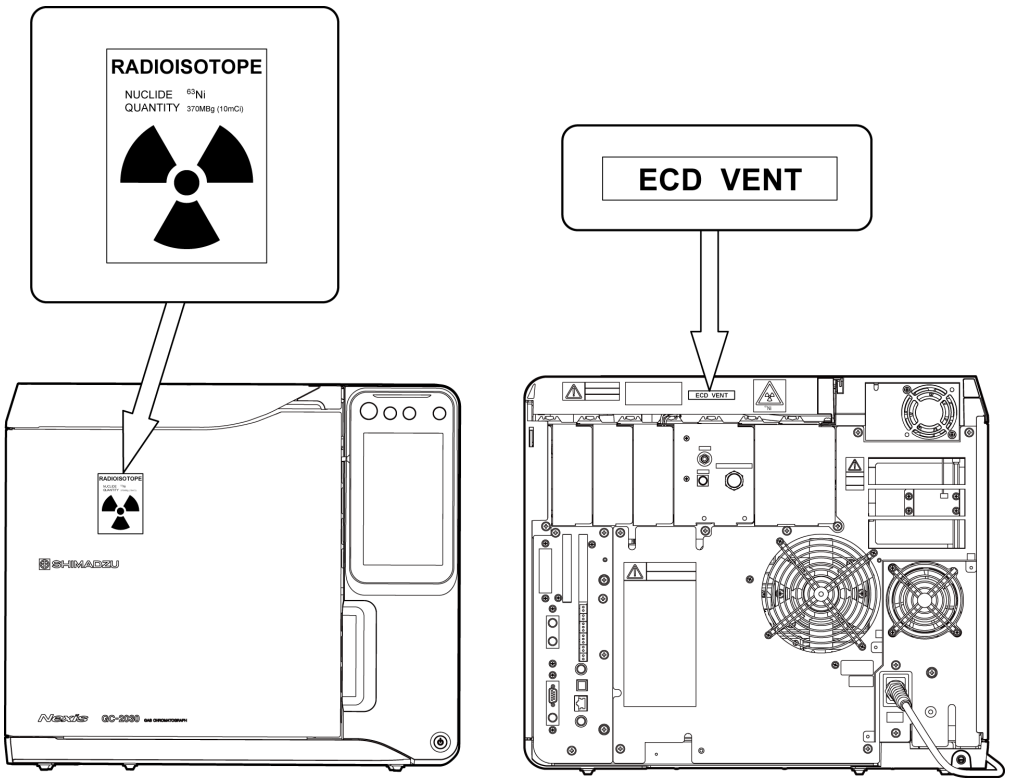
Connect a vinyl or PTFE tube to the exhaust port (VENT) when using the detector, and set the other end of the tube on the roof of the building or other place where no person is likely to come within 1 m from the tube end.

■ 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.

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) Consumable 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 the troubleshooting section 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/calibration are necessary.

- For daily maintenance, inspection, and replacement parts, see "4 Maintenance and Inspection" of this manual.
- Periodic inspection/calibration 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.

■ 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

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

Contents

4 Maintenance and Inspection

5 Trouble Shooting

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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 January 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 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 system 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 4 kinds of injection units and 6 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
Manuals	Operation Guide		S221-79201	1
	Instruction Manual (DVD-ROM)		S221-79206-41	1
Parts	Branch tube		S221-72658-91	1
	Column nut (without split)		S221-16325-01	1
	Column nut (with split)		S221-32705	1
	Graphite jig, SPL (SPL Column insertion jig)		S221-41532-91	1
	Column hanger *1		S221-47159	1
	Radiating fin cover *2		S221-43597-01	1
	Cable tie (red) *3		S072-60606-01	2
Consumables *4	Standard Accessory Kit for GC-2030		S227-35003-01	1
	Contents	Premium Green Septa *5	-	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
Other	Declaration of conformity		S221-30991-22	1
	Declaration of conformity: Descriptions		S228-30164	1

*1 Installed in the inside of the column oven.

*2 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.)

*3 Attach the cable ties to the hydrogen gas line for making a distinction from other gas lines.

*4 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

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

■ 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)	S221-48610-07	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

■ AOC-20 series standard accessories

Accessories for AOC-20i/AOC-20s are shown below.

AOC-20i Autoinjector standard accessories

Name	Part number	Qty
4 mL vial rack (for solvent/waste liquid)	S221-32949-01	3
1.5 mL vial rack	S221-45609-92	1
Syringe (10 µL)	S221-34618	1
Needle guide	S221-44584	2
Plunger holder	S221-44790	5
Barrel holder	S221-44780	2
Large vial (4 mL)	S221-34267-91	1 (5 pcs.)
Large cap (4 mL)	S221-34268-91	1 (5 pcs.)
Large septum (4 mL)	S221-34266-91	1 (15 pcs.)
Small vial (1.5 mL)	S221-34272-91	1 (20 pcs.)
Small cap (1.5 mL)	S221-34273-91	1 (20 pcs.)
Small septum (1.5 mL)	S221-34239-92	1 (40 pcs.)
1.5 mL vial rack for autosampler	S221-45181	1
4 mL vial rack for autosampler	S221-45182	1
Wrench, 7 × 8	S086-03047-04	1
Wrench, 5.5 × 7	S086-03047-03	1

AOC-20s Autosampler standard accessories

Name	Part number	Qty
1.5 mL vial rack	S221-44709-91	6
1.5 mL vial rack for autosampler	S221-45181	1
4 mL vial rack	S221-32949-01	2
Large septum, 4 mL, 10 pcs.	S221-34266-93	1
4 mL vial, 10 pcs.	S221-34267-93	1
Large cap, 10 pcs.	S221-34268-93	1
Small septum	S221-41233	20
1.5 mL vial, 20 pcs.	S221-34272-91	1
Small cap, 20 pcs.	S221-34273-91	1

2.2 Names and Functions of Parts

2.2.1 General View

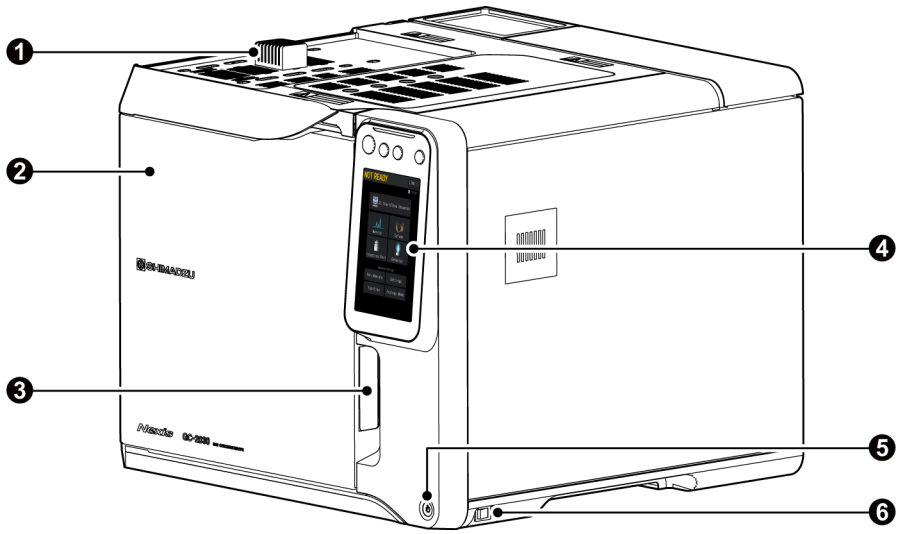
⚠ WARNING

Instruction

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

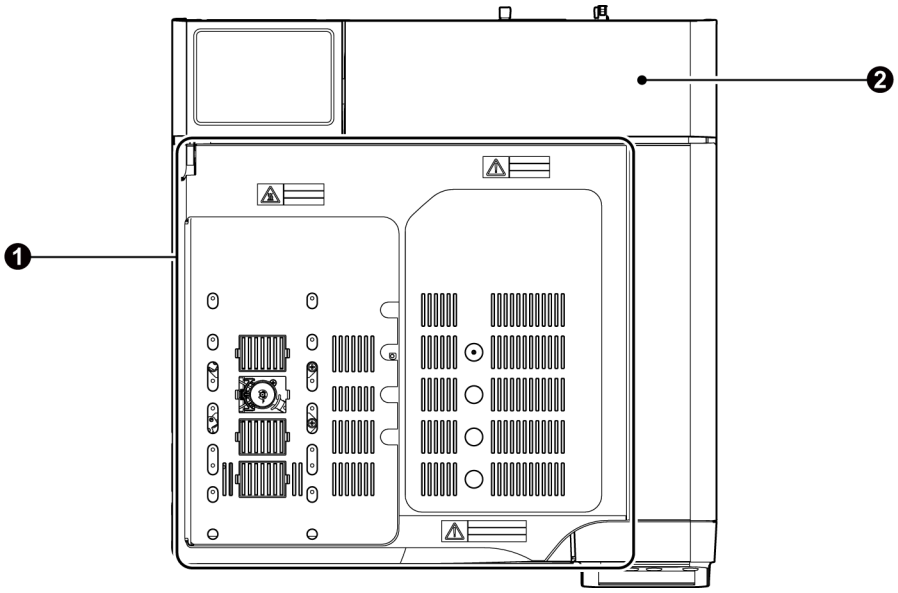
Operation at a high temperature may cause burns. Tightening the nut at a high temperature may cause the seizing (galling) of the sliding part.

Reference "7.2.3 [Temp Monitor] Screen" P.113



No.	Name		Description
❶	Radiating fin cover		Attach it to INJ/DET cover in the case of manual injection. This cover protects you from burns.
❷	Column oven door		Column is installed in the inside of the column oven door.
❸	Column oven door latch		Pull the column oven door latch toward you to open the door.
❹	Control panel		Sets analytical conditions and starts analysis. Reference "2.2.6 Control Panel" P.13
❺	(Power button)		Turns ON/OFF the system.
		Not Illuminating	The main power of the system is turned off.
		Orange	The main power of the system is turned on.
		White	The system is turned on.
❻	Main power switch		Turns ON/OFF the main power of the system. Normally, you do not need to use the main power switch.
		○	The main power of the system is turned off.
		|	The main power of the system 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 system.

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

2.2.3 Inside of the System

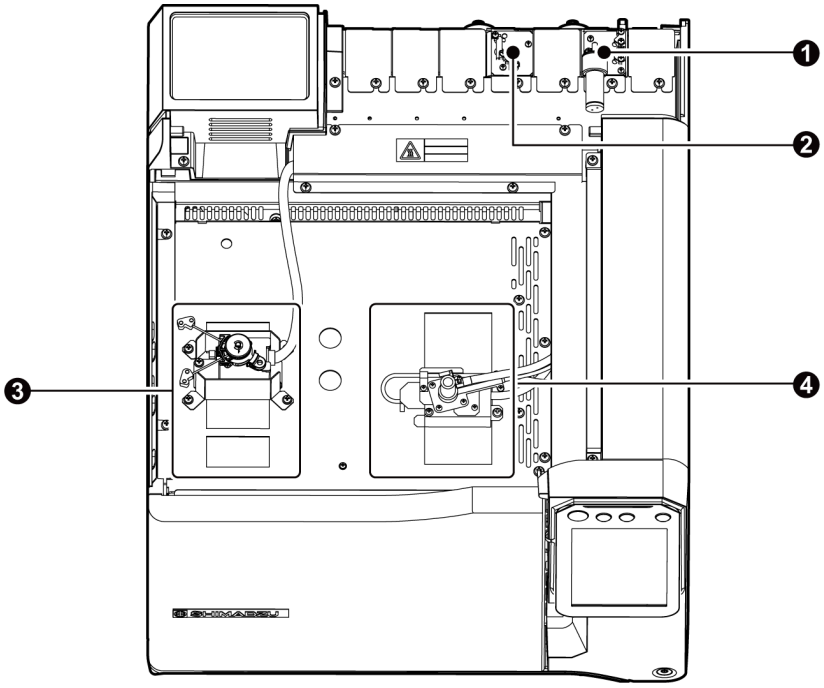
⚠ WARNING

Instruction

Before you touch the inside of the system, ensure that the temperatures of the injector 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.113



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

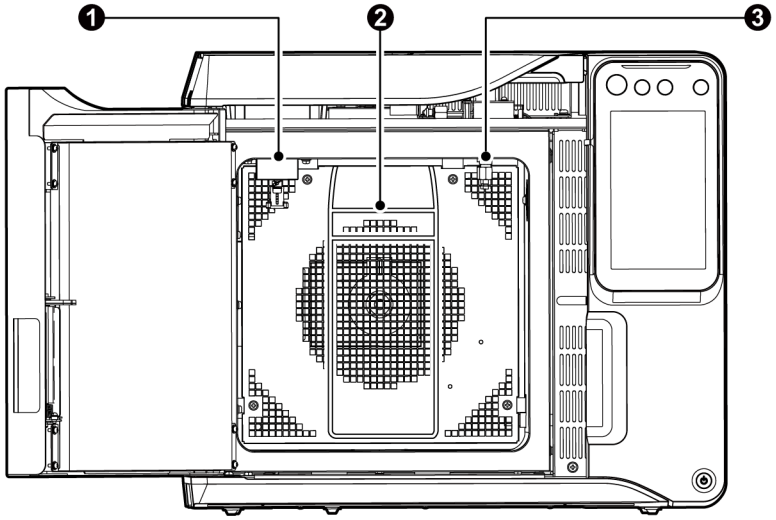
⚠ WARNING

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.

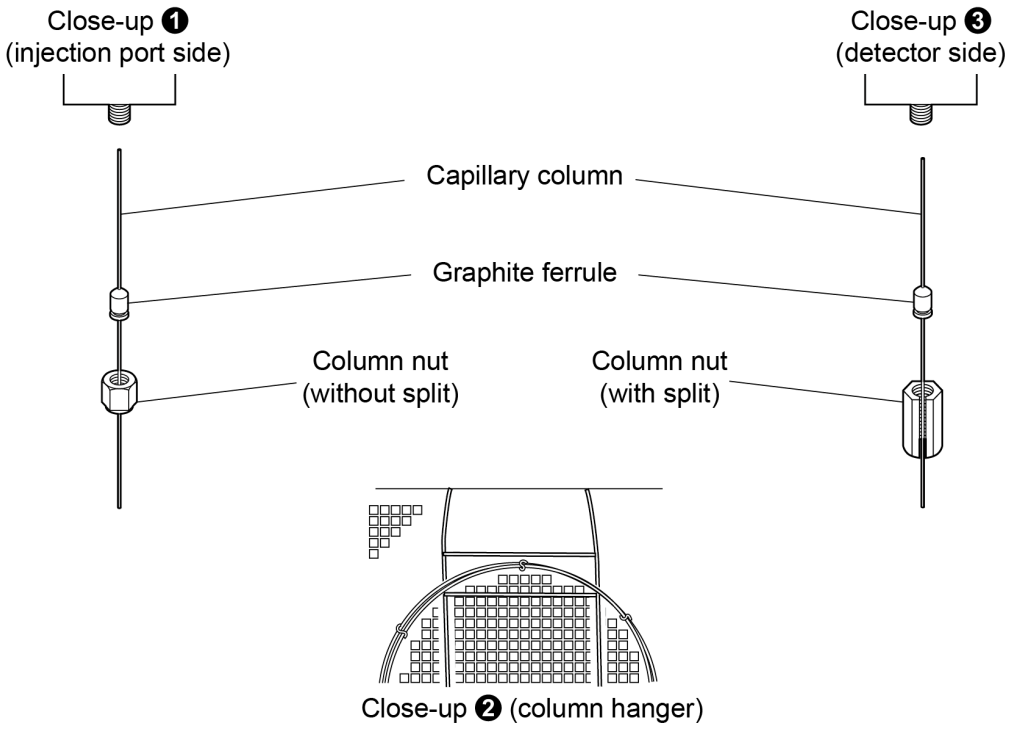
Reference "7.2.3 [Temp Monitor] Screen" P.113



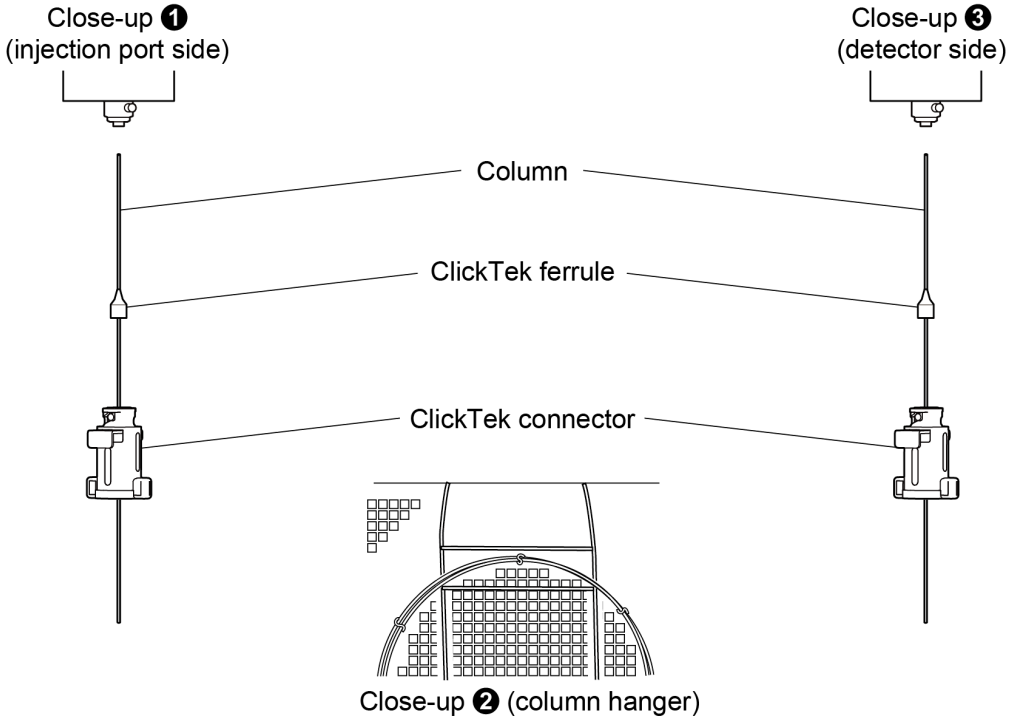
No.	Name	Description
❶	Column connection (injection port side)	Attaches the column to the injection port. (close-up ❶)
❷	Column hanger	Install the capillary column here. (close-up ❷)
❸	Column connection (detector side)	Attaches the column to the detector. (close-up ❸)

■ Close-ups of the inside of the column oven

For graphite ferrule



For ClickTek ferrule (Option)



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 system.

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

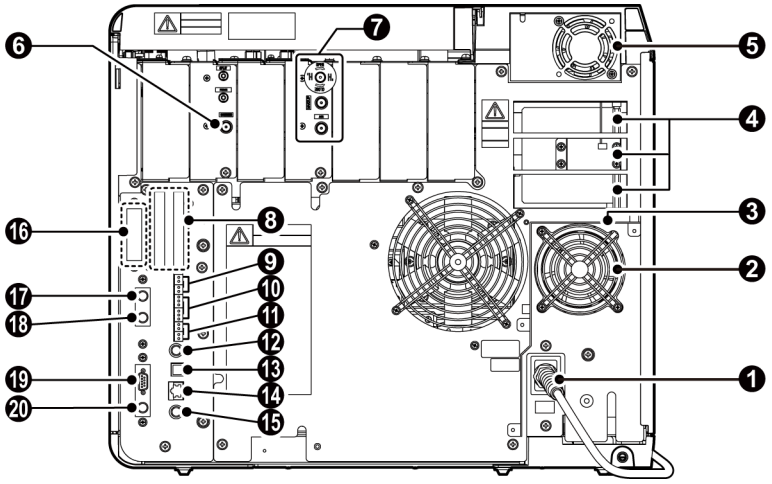
Check gas flow lines for leaks.

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.



No.	Name	Description
❶	Power cable	Supplies power to the system.
❷	Air inlet fan	Sends air to the column oven to cool it down.
❸	Partition plate	Prevents the air from flowing back into the column oven.
❹	Exhaust vent	This vents the column oven during cooling.
❺	INJ/DET fan	Used to cool the injection port and the detector.
❻	Carrier gas inlet	Supplies carrier gas.
❼	Detector gas inlet	Supplies detector gas.
❽	PRG connector *1	Connect optional PRG-2030 or valve.

No.	Name	Description
❾	Relay output connector (1 Relay)	Connect an external device to output the signal set on [Relay Control] screen.
❿	Relay output connector (2 Relay)	Connect an external device to output the signal set on [Relay Control] screen.
⓫	Relay input connector	Connect an external device to input the signal set on [Relay Control] screen.
⓬	INJECTOR1 connector for AOC-20i	Connect Auto injector AOC-20i. When using auto injectors in dual configuration, connect the main auto injector.
⓭	USB connector	Connect USB cable. For communications with PC.
⓮	Ethernet connector	Connect LAN cable. For communications with PC.
⓯	Detector signal output terminal for Ch1 (analog)	Outputs detector signal to analogue inputs including CHROMATOPAC.
⓰	External input connector for A/D board *1	Inputs external analog signal.
⓱	SAMPLER connector for AOC-20s *1	Connect Autosampler AOC-20s.
⓲	INJECTOR2 connector for AOC-20i *1	When using auto injector AOC-20i in dual configuration, connect the secondary auto injector.
⓳	RS-232C connector *1	Connect RS-232C cable. For communications with CHROMATOPAC.
⓴	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.

2.2.6 Control Panel

No.	Name		Description
❶	Status light		Indicates the system status by the color of the light.
		Not Illuminating	Indicates the following system status. • The system is turned off. • The system is waiting in sleep mode. • The system is turned on, however the GC has not started yet.
		Yellow	The GC started and the system is getting ready.
		Green	The GC started and the system is ready.
		Blue	During analysis or diagnosis.
		Red	An error occurs.
❷	Operation buttons		Use to start/stop analysis or analytical programs and display HOME screen.
		START (START)	Analysis will start. Use for manual sample injection. When pre-run program is set, pre-run program will start.
		PREP RUN (PREP RUN)	Use it while PREP RUN function is active (the system status on the touch panel flashes). The system enters the status where the system can start analysis. ▶▶ Reference "7.8.10 [PREP RUN] Screen" P.284
		STOP (STOP)	Stops analysis or analytical programs.
		⌂ (HOME)	Displays HOME screen. ▶▶ Reference "HOME" P.93
❸	Touch Panel		Use it to set analytical conditions and check system status. ▶▶ Reference • "Displayed items on the touch panel" P.15 • "7 Screens Displayed on Touch Panel and Their Functions" P.93

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.

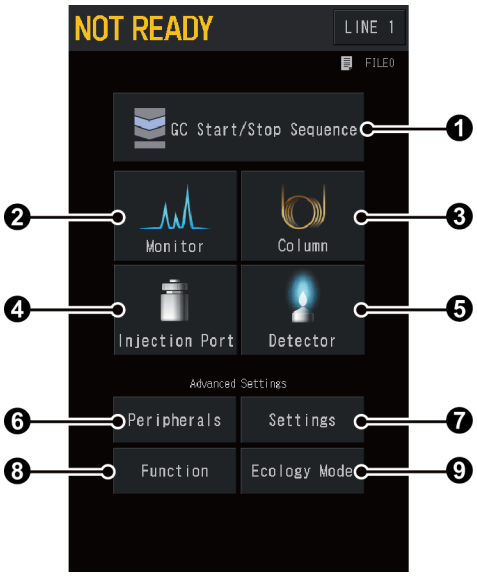
Reference See "7 Screens Displayed on Touch Panel and Their Functions" P.93 for details about each screen.

> **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 system.

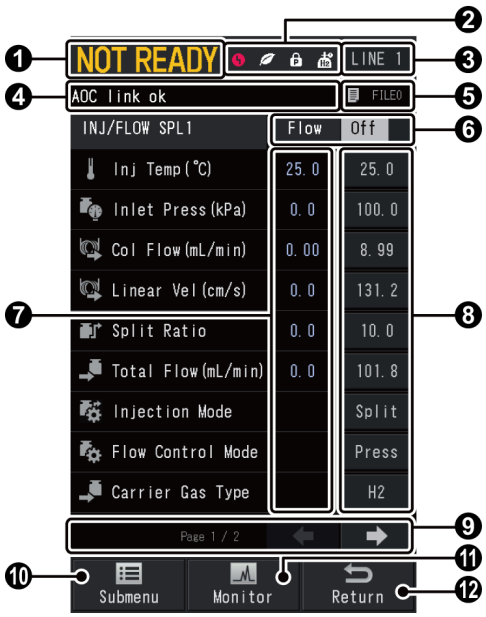
HOME screen is also displayed when you press (HOME) on the control panel while the system is turned on.



No.	Item	Description	See also
❶	GC Start/Stop Sequence	Sets parameters related to the GC start and stop.	P.94
❷	Monitor	You can check conditions of injection ports, columns, and detectors and the baseline.	P.107
❸	Column	Sets column temperature, column information (inner diameter, length, etc.), and temperature program.	P.115

No.	Item	Description	See also
❹	Injection Port	Sets inlets temperature and various conditions for the carrier gas.	P.125
❺	Detector	Sets detector temperature, conditions for the detector gas, and signal output.	P.161
❻	Peripherals	Sets optional devices (AOC-20, CRG, etc.).	P.200
❼	Settings	Sets line settings and frequently changed conditions (various temperatures, the carrier gas, detectors, etc.) by batch.	P.219
❽	Function	Sets configuration and time program.	P.223
❾	Ecology Mode	Sets carrier gas saver and auto stop/start of the system.	P.286

■ Displayed items on the touch panel



No.	Item		Description
❶	System Status		Displays the current status of the system.
		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
		Highlight	The background of the system status is highlighted while the system is working.

No.	Item		Description
❶		Flashing	The system status on the touch panel will flash when the system is set in waiting state by PREP RUN function. PREP RUN function can be active when the system 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 system is in waiting status for analysis and cannot perform analysis. Press PREP RUN (PREP RUN) on the control panel to change the system from waiting status for analysis to the status which enables analysis (READY). Reference "7.8.10 [PREP RUN] Screen" P.284
❷	Status Icons		Displays icons depending on the system status.
		(Error)	Displayed when an error occurs. Press the icon to check the current error. Reference "6 Error Messages" P.69
		(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 "7.9.1 [Eco Setting] Screen" P.287
		(Screen Lock)	Displayed when Screen Lock function is active. Reference "[Screen Lock] Screen" P.266
		(Parameter Lock)	Displayed when Parameter Lock function is active. Reference "[Parameter Lock] Screen" P.267
		(Hydrogen is used)	Displayed when the carrier gas is hydrogen.
		(Hydrogen Leak Check)	Displayed when optional Hydrogen Leak Check function is active. Reference "7.6.4 [Hydrogen Leak Check] Screen" P.214
❸	Line		Displays the analytical line number. When several analytical line are configured, switch the line number to set parameters for each line. Reference "7.7.2 [Line Configuration] Screen" P.220

No.	Item	Description
❹	Message Display	Displays messages depending on the system status.
❺	Used File	Displays the name of the loaded file. Reference "7.1.3 [File Select] Screen" P.101
❻	Control Status	Displays the current control status. Press [Off] or [On] to switch the control status.
❼	Value	Displays the actual values in blue text.
❽	Setup Button	Press the button to change the settings.
❾	Page Switching	Displayed when items are continued to the next page. Switch pages to set items.
❿	Submenu	Press to display Submenu for each screen.
⓫	Monitor	Press to display the monitor screen. Reference "7.2 Monitor" P.107
⓬	Return	Press to display the previous screen.

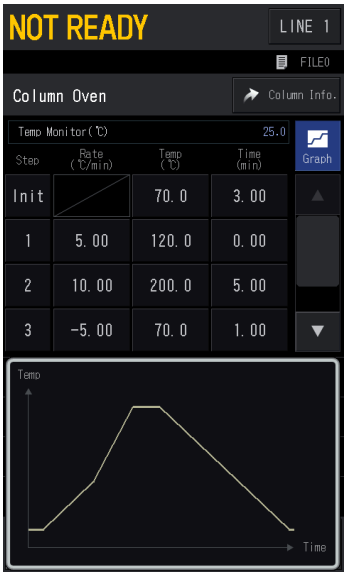
Graph window

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.93 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 injector 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.113

1 Prepare the injector 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 [Inj Maintenance] screen after you turn on the system.

Reference "7.2.2 [Inj Maintenance] Screen" P.112

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 system.
2. Set up the system.

Reference "8.9.1 Connecting to LabSolutions" P.348

When using CHROMATOPAC

1 Connect the cable of CHROMATOPAC to "Detector signal output terminal for Ch1 (analog)" on the back of the system.

2 Set up the system.

Reference "8.9.2 Connecting to CHROMATOPAC" P.349

4 Press the power button on the front of the system to turn on the system.

[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 "7.7.2 [Line Configuration] Screen" P.220

2 Configure units to be used in analytical lines.

3 Press (HOME) - [Column] - [Column Info.].

[Column Information] screen appears.

Reference "7.3.2 [Column Information] Screen" P.122

4 Set the column oven temperature.

6 Set analytical conditions and start up the GC.

When the detector is FID, TCD, FPD, ECD, or BID

1 Press (HOME) - [Settings].

[SET (Analysis Settings)] screen appears.

Reference "7.7.1 [Analysis Settings] Screen" P.219

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 injector port, detector, and column, and then set the details.

3 When the detector is TCD or ECD, press (HOME) - [Detector].

[Detector] screen appears.

Reference
- "7.5.2 [Detector] Screen (TCD Tab)" P.167
- "7.5.5 [Detector] Screen (ECD Tab)" P.182

4 Set the current value.

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.

5 Set analytical programs such as temperature program.

6 Press (HOME) - [Function] - [Diagnosis] - [Carrier Gas Leak Check].

[Carrier Gas Leak Check] screen appears.

7 Press [Start].
Carrier Gas Leak Check starts.

Reference "8.6.8 Carrier Gas Leak Check Function" P.333

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.

8 Press (HOME) - [GC Start/Stop Sequence].

[GC Start Sequence] screen appears.

Reference "7.1.1 [GC Start Sequence] Screen" P.94

9 Set [Start Temp/Det] to [Enable].

10 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.

11 Set other parameters related to the GC start.

12 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 "7.7.1 [Analysis Settings] Screen" P.219

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 injector port, detector, and column, and then set the details.

3 Press (HOME) - [Detector].

[Detector] screen appears.

Reference "7.5.3 [Detector] Screen (FTD Tab) " P.171

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 "8.6.8 Carrier Gas Leak Check Function" P.333

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.94

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.175

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 "7.3.1 [Column Oven] Screen" P.115

13 Set the column oven temperature for analysis.

7 Check the system 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-20i/AOC-20s, refer to the User's Manual for AOC-20i/AOC-20s and the User's Manual for AOC-20 Dual Injection System.

1 Check the syringe, etc. of AOC and set the sample.

2 Set parameters related to AOC.

Reference "7.6.1 [Auto Injector] Screen" P.201

3 Press [Start AOC].
AOC starts and the system performs the analysis according to the set analysis conditions.
After the analysis is completed, the system goes into waiting mode.

For manual injection

Reference "3.4 Sample Injection" P.28

⚠ CAUTION

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 (START).

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

9 Stop the GC.

1. Display [GC Stop Sequence] screen.

   Reference "7.1.2 [GC Stop Sequence] Screen" P.97

2. Set the period of time after [Stop GC] is pressed until the system 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.

10 Press the power button on the front of the system to turn off the system.

NOTE

- When you set [Sleep] at [Enable], the system 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 the position of the filled glass wool in Maintenance Guide.

■ 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 oxidization. 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.

■ Column installation

- Secure the ferrule to the capillary column using adjuster and nuts or Pre-Fix Tool (Option). Before securing the ferrule, ensure that there are no clogging in the column end and the edge of the cut is completely straight.
- For graphite ferrule, use a nut without split on the injection port side, and use a nut with split on the detector side. Before securing the ferrule on the injection port side, slide the column through a nut without split.
  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.)

■ 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 [Column Flow Rate + Split Flow Rate] ≥ 30 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

[Column Flow Rate + Split Flow Rate] < 20 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 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 system counts the number of reception of the start signal), a message appears on the screen and AOC-20i stops injection. When [Batch Behavior at Threshold] is set at [Stop], AOC-20i 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 system starts to control parts of the system 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 system 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 system automatically starts the temperature control. The system 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 system 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 system. This may cause a malfunction.

■ For good repeatability

- Auto injector AOC-20i is recommended for liquid samples.
- If several injector port are installed but you do not perform dual injection, do not control the temperature of the unused injector port (by not configuring the unused injector port in the analytical line for example).
- Use the system 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 system, repeatability may become poor.

3.4 Sample Injection

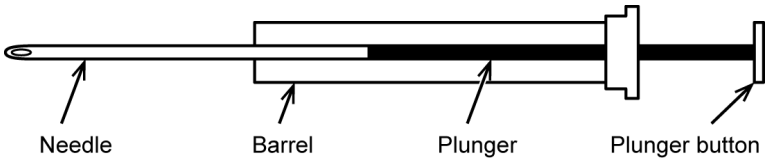
This section describes the procedure of analysis with manual injection.

Reference For auto sample injection with auto injector AOC-20i, refer to the User's Manual for AOC-20i/AOC-20s and the User's Manual for AOC-20 Dual Injection System.

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.

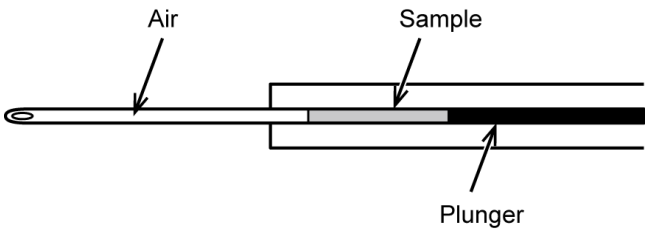
1 With the needle in the sample vial, pump the plunger to eliminate air bubbles inside the syringe (pumping).

Hint Aspirate slowly and discharge quickly for higher effectiveness.

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.



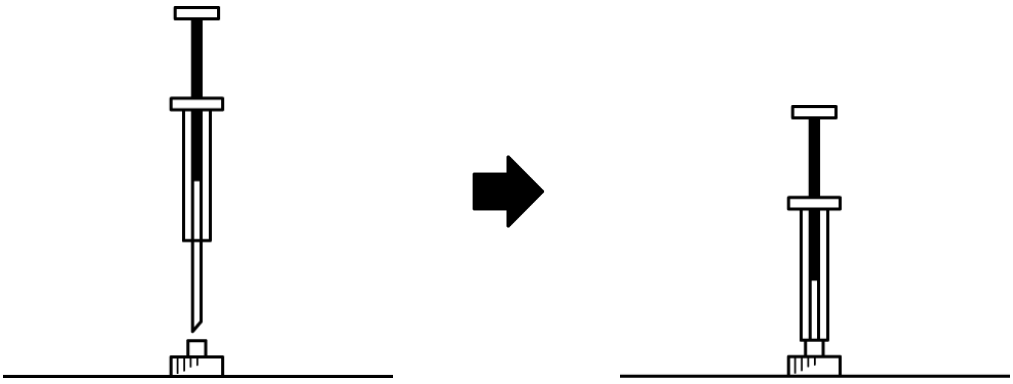
4 Inject the sample.

⚠ WARNING

Instruction

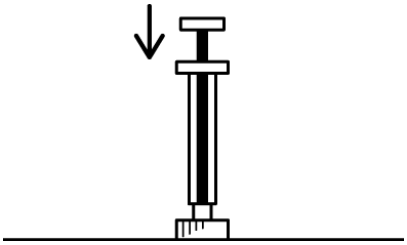
Wear safety glasses during sample injection.
The sample may squirt and be got in your eyes causing damage of your eyes.

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

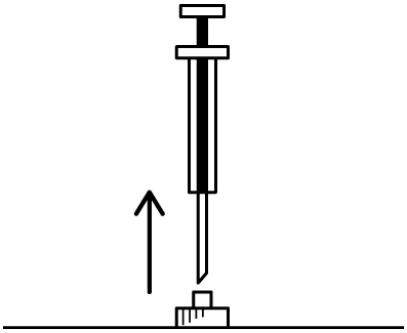


Hint When you insert the syringe unit, the plunger may project due to the inlet pressure. Support the plunger button with fingers during injection to avoid plunger projection.

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



3 Promptly pull out the syringe.



3.5 Starting and Stopping Analysis

■ Starting analysis

When the status light illuminates in green and the system status is [READY], you can start analysis. Press START (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 system starts to obtain data. When you set pre-run program, the system 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 system automatically goes into waiting mode. Press STOP (STOP) to force the analysis or programs to terminate. When you press STOP (STOP), the system returns to the initial state and the system 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 system.

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

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

However, STOP (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.253 screen, you can set the channel of the analogue terminal which sends signals to CHROMATOPAC when START (START) is pressed.

4 Maintenance and Inspection

Periodic inspection and replacement are required to maintain the system 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 system, 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 injector 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.113

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.37

⚠ CAUTION

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.

Place removed parts on a clear tray or sheet.

Pay attention not to lose or contaminate them.

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

Septum and O-ring may project. And, rapid change of the injector port 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 system usage and the samples to be analyzed. Inspect the system according to the situation.
- Contact your Shimadzu sales/service representative for inspection of detectors (TCD, 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 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.
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.
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 every 3 years.
ClickTek connector						✓	Replace it 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.
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.

Inspection items	Inspection/replacement cycle						Corrective action
	1 month	3 months	6 months	1 year	2 years	Other	
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.
Gas 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 system 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.

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.

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.

■ 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" P.41

4.4 Replacement Procedure of the Parts

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

4.5 Consumables

For the standard accessories of the system, see the standard accessory list.

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.

http://www.shimadzu.com/an/gc/column_consumable/feature8.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 replacement cycle depends on the installation environment and usage conditions of the system.
- 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 system 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)

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

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.33
- "4.3 Important Points for Inspection" P.35
- 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/injector port control. • Turn [On] the detector gas control.	P.125 P.161 P.192
Supply pressure is low.	Change the supply pressure of the gas. • Carrier gas: 300 to 980 kPa • Detector gas: 300 to 980 kPa • Hydrogen: 300 to 500 kPa • Air: 300 to 500 kPa	P.302
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.41
Set value is incorrect.	Set pressure at a proper value.	P.323
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.125 P.122
Total flow is too low, and pressure cannot increase.	Increase the total flow.	P.323
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 system and contact your Shimadzu sales/service representative.	-

■ Carrier gas leak check

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

1 **Prepare the system.**

• 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 injector 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 injector port.**

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	:	300 kPa
Total Flow	:	100 mL/min

13 **Turn [On] the flow controller control.**

14 **Wait until [Inlet Press] increases to around carrier gas primary pressure, and then turn [Off] the flow controller control.**

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 300 kPa	The decrease is more than 2.5 kPa
300 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.43

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.

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

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

This may cause electric shock.

⚠ CAUTION

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 system 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.94
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.94
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.242 P.122
Detector temperature is lower than the set value of column temperature.	Set detector temperature larger than column temperature.	P.161

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.161
Signal cable of the data processing unit is connected incorrectly.	Connect signal cable correctly.	P.348
There is a leak at the connection of the detector with the column.	Check for gas leaks, and tighten leaking connections.	P.41
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.161
Zero level is far below "0".	Check the signal level on Monitor screen and perform Auto Zero.	P.107
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 injector port. • Increase sample concentration.	-
Split ratio is too high. (For split analysis)	Reduce split ratio.	P.125 P.138
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.194
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 system, 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 system 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.194
Detector gas controller (APC) fails.	Turn off the main power of the system, 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 system 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.41
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 system and contact your Shimadzu sales/service representative.	P.113
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 system and contact your Shimadzu sales/service representative.	P.114
The air conditioner blows on the system.	Change the system 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 system 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.348
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.162 P.177

5.4 Detector (FID)

WARNING

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.45

Cause	Solution	See also
Hydrogen flame does not ignite.	Check flows of hydrogen, air and detector gas and ignite it again.	P.162
High pressure brush is installed incorrectly.	Install high pressure brush correctly.	Maintenance Help
Detector sensitivity is low.	Set [Signal Range] at [x1].	P.194
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.162
Detector temperature is low.	Set detector temperature at a higher value.	P.162
The air in the tubing is not adequately replaced with hydrogen gas.	Repeat ignition sequence several times to replace the air completely.	P.165

5.4.3 Baseline Noise Is High (FID)

Reference "5.3.2 Baseline Noise Is High (for all detectors)" P.46

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.46

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.165

5.5 Detector (TCD)

5.5.1 No Peaks or Extremely Small Peaks (TCD)

Reference "5.3.1 No Peaks or Extremely Small Peaks (for all detectors)" P.45

Cause	Solution	See also
Current set value is too low.	• Increase current setting. • Decrease TCD temperature, and increase maximum working current.	P.167
Detector sensitivity is low.	Set [Signal Range] at [x1].	P.194

Cause	Solution	See also
Detector gas flow is high.	Set it at a proper value (about 8.0 mL/min).	P.167

5.5.2 Baseline Noise Is High (TCD)

Reference "5.3.2 Baseline Noise Is High (for all detectors)" P.46

Cause	Solution	See also
Current set value is too high.*1	Decrease current setting.	P.167
Detector gas flow is low.	Increase the flow.	P.167
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 system and contact your Shimadzu sales/service representative.

5.5.3 Baseline Drift or Long-term Fluctuation (TCD)

Reference "5.3.3 Baseline Drift or Long-term Fluctuation (for all detectors)" P.46

Cause	Solution	See also
Current set value is too high.	Decrease current setting.	P.167
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)

Reference "5.3.4 Zero Adjustment Error (for all detectors)" P.47

Cause	Solution	See also
Current does not pass through filament.	Set the current value properly.	P.167
Current set value is too high.	Decrease current setting.	P.167
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)

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.167
The air in TCD cell is not adequately replaced.	• Supply carrier gas and detector gas for more than 1 minute and then turn [On] TCD control or set TCD current. • Set [Start Time] at more than 1 minute and press [Start GC].	P.94 P.167
Carrier gas or detector gas leaks.	• Check for gas leaks, and tighten leaking connections. • Replace tubing or septum.	P.41 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.167

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.45

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.115 P.171

Cause	Solution	See also
Detector temperature or detector gas flow is changed after background current adjustment.	Adjust background current again.	P.171
Set value for background current is too low.	Set background current at a higher value.	P.171
Detector sensitivity is low.	Set [Signal Range] at [x1].	P.194
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.46

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.46

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.

5.7.1 No Peaks or Extremely Small Peaks (FPD)

Reference "5.3.1 No Peaks or Extremely Small Peaks (for all detectors)" P.45

Cause	Solution	See also
Hydrogen flame does not ignite.	Check flows of hydrogen and air and ignite again.	P.177
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.194
Light leaks in.	Cover the system 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.177
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.177
The air in the tubing is not adequately replaced with hydrogen gas.	Repeat ignition sequence several times to replace the air completely.	P.180

5.7.3 Baseline Noise Is High (FPD)

Reference "5.3.2 Baseline Noise Is High (for all detectors)" P.46

Cause	Solution	See also
Light leaks in.	Cover the system 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.	-
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.46

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.180
Light leaks in.	Cover the system with a blackout curtain, etc. to determine where light leaks in, and correct it.	-

5.7.5 Zero Adjustment Error (FPD)

Reference "5.3.4 Zero Adjustment Error (for all detectors)" P.47

Cause	Solution	See also
Light leaks in.	Cover the system 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.45

Cause	Solution	See also
ECD current set value is too low.	Increase ECD current setting.	P.182
Detector gas is improper.	• Use nitrogen (argon + methane). • Optimize detector gas flow.	Maintenance Help
Detector sensitivity is low.	Set [Signal Range] at [x1].	P.194
Cell is contaminated.	Check for cell contamination and request cleaning as needed.	P.58
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.46

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.58

5.8.3 Baseline Drift or Long-term Fluctuation (ECD)

Reference "5.3.3 Baseline Drift or Long-term Fluctuation (for all detectors)" P.46

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.47

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.182
Cell is contaminated.	Check for cell contamination and request cleaning as needed.	P.58
ECD current set value is too high.	Decrease ECD current setting.	P.182

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.182
Detector gas is improper.	• Use nitrogen (argon + methane). • Optimize detector gas flow.	Maintenance Help

Cause	Solution	See also
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.58
Detector gas flow is low.	Increase detector gas flow. NOTE It is noted that the sensitivity will decrease.	P.182
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.59.

1 **Configure ECD in the analytical line.**

Reference "7.7.2 [Line Configuration] Screen" P.220

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 higher than 0.3 nA	:	Set value of current (nA) × 90000 μV (For example, less than 90000 μV when set value is 1 nA)
When ECD current is lower than 0.3 nA	:	27000 μV

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.58.

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 system 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.275.

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 system.
ECD frequency is proportional to detector signal level. 40 kHz of output frequency corresponds to 2,500,000 μV 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.45

Cause	Solution	See also
Plasma is turned off.	Check detector gas flow and turn on plasma again.	P.187
Detector gas is improper.	Optimize detector gas flow.	Maintenance Help
Detector sensitivity is low.	Set [Signal Range] at [x1].	P.194
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 system 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.187
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.187
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 to 300 °C)	P.187
Detector temperature is high.	Set detector temperature at a lower value. (Recommended value: 150 to 300 °C)	P.187
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.187

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 system 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 system and contact your Shimadzu sales/service representative.	-
APC fails.	Turn off the main power of the system and contact your Shimadzu sales/service representative.	-
Plasma ON/OFF and BID controller have a problem.	Turn off the main power of the system and contact your Shimadzu sales/service representative.	-
Plasma generator fails.	Turn off the main power of the system 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.46

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 system 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.46

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 system 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 system 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 system 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.47

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.331
Trap ASSY has a problem.	Replace trap ASSY and calibrate APC. To replace trap ASSY, contact your Shimadzu sales/service representative.	P.331
APC fails.	Turn off the main power of the system 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.125
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.187

5.10 Chromatogram

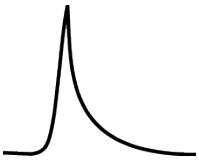
5.10.1 Presence of Ghost Peaks

Cause	Solution	See also
Septum purge is not flowing.	Flow septum purge.	P.125
Components which did not elute during previous analysis is detected.	Increase column oven temperature and column flow to eliminate sample remaining inside column.	P.115
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
Injector 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
The graphite ferrule is not fixed.	Additionally tighten the graphite ferrule. If it cannot be fixed even after additional tightening, replace it.	Maintenance Help

5.10.2 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.325
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.125
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.125 Maintenance Help
Column temperature is low.	Increase column temperature.	P.115
Injection port temperature is low.	Increase injection port temperature.	P.125

■ Peak splitting

Cause	Solution	See also
Several peaks are not separated and appear as one peak.	• Change conditions to improve separation. • Replace column.	P.125
Injection volume is high.	Decrease injection volume.	-
Sample is injected in two steps (twice).	Inject sample correctly.	-

5.10.3 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.41 Maintenance Help
Column is overloaded.	• Decrease injection volume. • Dilute sample. • Increase split ratio. • Use a column with a greater film thickness.	P.125 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.

5.10.4 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) in 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.

5.11 LCD

5.11.1 Touch Screen Responds Inaccurate

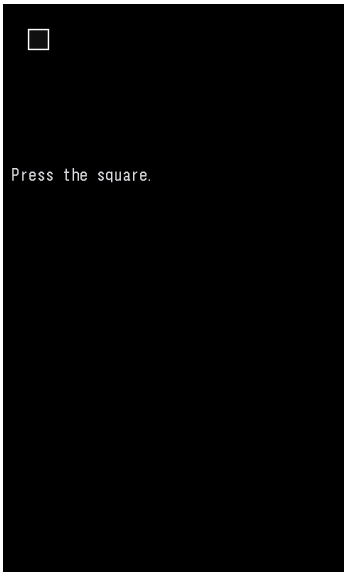
Cause	Solution	See also
Your touches are detected inaccurately.	Calibrate the screen.	P.67

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.

6 Error Messages

The system 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 system control. If the cause of the error is removed, the error screen will not appear again.
Ignore	Select this action to keep the system 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.255

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 system and contact your Shimadzu sales/service representative.

6.1 System Errors

Code	Message	Cause	Solution	Note
1	DC5V is out of range	The power source may fail.	Turn off the main power of the system 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 system may fail.	Turn off the main power of the system and contact your Shimadzu sales/service representative.	-
6	Atm. press is out of range			

Code	Message	Cause	Solution	Note
7 8 9 10	DET#n PCB error	PCB may fail.	Turn off the main power of the system 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 system and contact your Shimadzu sales/service representative.	-
30	COL A/D converter error	A/D converter may fail.	Turn off the main power of the system 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 system and contact your Shimadzu sales/service representative.	-
38	CPU register error	Electronics may have a problem.	Turn off the main power of the system and contact your Shimadzu sales/service representative.	-
39	PRG current error	PCB may fail.		
40	Power controller board error	PCB may fail.		
51	Detected hydrogen leak	Hydrogen gas leaks.	Check whether the tubing and column connections have no leak.	-

Code	Message	Cause	Solution	Note
59 62 65 68 71 74	Flow# DC24V was out of range	PCB may fail.	Turn off the main power of the system and contact your Shimadzu sales/service representative.	#=1 to 6
60 63 66 69 72 75	Flow# DC12V was out of range	PCB may fail.	Turn off the main power of the system and contact your Shimadzu sales/service representative.	#=1 to 6
61 64 67 70 73 76	Flow# DC5V was out of range	PCB may fail.	Turn off the main power of the system and contact your Shimadzu sales/service representative.	#=1 to 6
77	Hydrogen sensor init error	Hydrogen sensor may fail.	Turn off the main power of the system and contact your Shimadzu sales/service representative.	-
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.214 • When using hydrogen sensor, the hardware fails. Turn off the main power of the system and contact your Shimadzu sales/service representative.	-
79	TC was broken	Thermocouple for heat protection may be broken.	Turn off the main power of the system and contact your Shimadzu sales/service representative.	-

6.2 Operation Errors

Code	Message	Cause	Solution	Note
5001	Input parameter out of range	Parameter out of range was inputted.	Input a correct value.	In some cases, input range is displayed.
5002	Invalid file no	An incorrect operation was attempted.	Operate the system correctly.	-
5003	This file is now used			
5004	File initialize failure			
5005	File can't be copied			
5006 5007 5008 5070 5071 5072 5101 5105	CARx calc. prss out of range	The carrier gas pressure calculated from inputted linear velocity, flow, split ratio, column temperature, and APC flow for BID is outside the set range.	Change the value so that the pressure is within the set range.	x=1 to 4
5009 5010 5011 5073 5074 5077 5078 5102 5106 5107 5110 5111	CARx calc. flow out of range	The carrier gas total flow or column flow calculated from inputted split ratio, pressure, column temperature, column conditions and APC flow for BID is outside the set range.	Change the value so that the carrier gas total flow or column flow is within the set range.	x=1 to 4
5012 5015 5018 5021 5045 5046 5047 5048	MUPn calc. prss out of range	The pressure calculated from inputted flow is outside the set range.	Change the value so that the pressure is within the set range.	n=1 to 4
5013 5016 5019 5022	HGNn calc. prss out of range			
5014 5017 5020 5023	AIRn calc. prss out of range			

Code	Message	Cause	Solution	Note
5024 5025 5026 5027 5028 5029 5030 5031 5032 5033 5034 5035 5036 5037 5038 5039 5040 5041 5049 5050 5051 5052	APCy calc. prss out of range	The pressure calculated from inputted flow is outside the set range.	Change the value so that the pressure is within the set range.	y=1 to 18
5053 5054 5055 5056 5057 5058 5059 5060 5061 5062 5063 5064 5065 5066				
5042 5043 5044 5067 5068 5069 5103 5104	PURn calc. prss out of range			n=1 to 4
5075 5076 5108 5109	CARm calc. ratio out of range	The carrier gas total flow calculated from split ratio program, etc. is outside the set range.	Change the value so that the carrier gas total flow is within the set range.	m=1 to 4
5079 5080 5081 5082	DCGn calc. prss out of range	The pressure calculated from inputted flow is outside the set range.	Change the detector gas flow so that the pressure is within the set range.	n=1 to 4

Code	Message	Cause	Solution	Note
5083 5084 5085 5086	ECDGn calc. prss out of range	The pressure calculated from inputted flow is outside the set range.	Change the value so that the pressure is within the set range.	n=1 to 4

6.3 Optional Device Errors (AOC-20i/AOC-20s)

One of the following messages appears when an error has occurred in the AOC-20i auto injector or the AOC-20s auto sampler.

Reference For solutions, refer to User's Manual for AOC-20i/AOC-20s.

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	

6.4 Transmission Errors

Code	Message	Cause	Solution	Note
4001	Transmission time out	An error occurred during communication with external devices (such as PC) or transmission.	Check the connection status and retry the communication.	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	An error occurred during communication with AOC or transmission.	Check the connection status and retry the communication.	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			
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.	Solve the error of the flow controller.	#=1 to 6
4045	Power controller board com. failed	POWER PCB may fail.	Turn off the main power of the system 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 system. Possible reasons are described below. • 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 (for TCD). Remove the cause of the error, then turn on the system. If the error cannot be resolved, contact your Shimadzu sales/service representative.	n=1 to 4
4105 4106 4107 4108	DET#n FTD overcurrent detected			
4109 4110 4111 4112	DET#n flame is out	Detector flame (FID, etc.) error.	Check the gas supply, and ignite the detector again. If the flame error occurs repeatedly, the hardware fails. Turn off the main power of the system and contact your Shimadzu sales/service representative.	n=1 to 4
4121 4122 4123 4124	DET#n FPD cooling fan error	FPD cooling fan has a problem.	Turn off the main power of the system and check the installation status of the cooling fan. If it is installed correctly, the hardware fails. Turn off the main power of the system and contact your Shimadzu sales/service representative.	n=1 to 4

Code	Message	Cause	Solution	Note
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 system 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 system again. If the error occurs repeatedly, cables may be damaged. Turn off the main power of the system and contact your Shimadzu sales/service representative.	n=1 to 4
4133 4134 4135 4136	DET#n DTCD overvoltage detected in cell power	Detector current is abnormal. If the resistance of the filament becomes abnormally high when the DTCD is in use, the protection circuit is actuated to prevent damage to the filament.	Turn off the main power of the system. Possible reasons are described below. • The set value of the current exceeds the maximum operating current. • 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 system. If the error cannot be resolved, contact your Shimadzu sales/service representative.	n=1 to 4

<table>
<tr><th>Code</th><th>Message</th><th>Cause</th><th>Solution</th><th>Note</th></tr>
<tr><td>4149
4150
4151
4152</td><td>DET#n FTD adjustment failed</td><td>It cannot be adjusted because FTD power (%) is [0] or [100].</td><td>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.</td><td>n=1 to 4</td></tr>
<tr><td>4201</td><td>TCD signal was out of range</td><td>Zero adjustment cannot be performed because the difference in filament resistance is high between the TCD cells. The detector controller unit may fail.</td><td>Turn off the main power of the system and contact your Shimadzu sales/service representative.</td><td>-</td></tr>
<tr><td>4203
4204
4205
4206</td><td>DET#n ignition failed</td><td>FID or FPD ignition failed.</td><td>Check the following items.
• Column is connected.
• Hydrogen is supplied at a proper flow.
• Air is supplied at a proper flow.
• Filament in igniter is intact.
• FID jet is not clogged.
• Unused FID control is not set at [On].
If the error is displayed after turning on the system or the cause cannot be identified after inspection, contact your Shimadzu sales/service representative.</td><td>n=1 to 4</td></tr>
</table>

⚠ CAUTION

Instruction

Shut off the hydrogen gas supply before inspection.

After the error message appears, manual flow controller does not stop hydrogen gas flow automatically. For safety, shut off the hydrogen gas supply before inspection.

Code	Message	Cause	Solution	Note
4207	H2, AIR APC are not ready	APC for H2 and AIR does not become ready during ignition.	Check whether the gas supply pressure is stable and whether gas does not leak. If there is no problem with the gas supply, the hardware fails. Turn off the main power of the system and contact your Shimadzu sales/service representative.	-
4208 4209 4210 4211	DET#n failed to start plasma	BID Plasma cannot be turned on.	Check detector temperature and detector gas flow and then turn on the plasma again. If the illumination fails after inspection, the hardware fails. Turn off the main power of the system and contact your Shimadzu sales/service representative.	n=1 to 4
4212	DCG APC are not ready	APC for detector gas (DCG) does not become ready during BID plasma illumination.	Check whether the gas supply pressure is stable and whether gas does not leak. If there is no problem with the gas supply, the hardware fails. Turn off the main power of the system and contact your Shimadzu sales/service representative.	-

Code	Message	Cause	Solution	Note
4213	DCG flow rate is not enough	This error appears if DCG flow is below 20 mL/min when BID illumination is started or after the start. Plasma is turned off forcibly.	Check the following items. • Set value of DCG flow. • Gas supply pressure. • The presence of gas leaks. If there is no problem with the gas supply, the hardware fails. Turn off the main power of the system 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 n=1 to 2
84 85 86 87	CARx insert counter error			
88 89	AOCn syringe counter error			
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 system and close the hole.	-
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

Code	Message	Cause	Solution	Note
1010 1011 1012 1013 1014 1015 1016 1017 1054	xxx sensor is short circuit	Temperature sensor fails.	Turn off the main power of the system and contact your Shimadzu sales/service representative.	xxx=COL, INJ1, DET1, INJ2, DET2, AUX3, AUX4, AUX5, SAT
1018 1019 1020 1021 1022 1023 1024 1025 1055	xxx sensor is down			
1026 1027 1028 1029 1030 1031 1032 1033 1056	xxx sensor error			
1034	COL CRG is out of control	• Oven door opens. • The system cannot cool column oven because coolant becomes empty.	• When oven door opens, close the door and press [Reset]. • When coolant becomes empty, turn off the main power of the system and replace coolant.	-
1036	Overheat is sensed	Temperature control circuit has a problem.	Turn off the main power of the system and contact your Shimadzu sales/service representative.	Overheat detected by thermocouple
1037 1038 1039 1040 1041 1042 1043 1044 1057	xxx temperature controller error			Overheat detected by software xxx=COL, INJ1, DET1, INJ2, DET2, AUX3, AUX4, AUX5, SAT
1045	COL relay error	Relay or heater control circuit has a problem.	Turn off the main power of the system and contact your Shimadzu sales/service representative.	-
1046	INJ1-DET2 relay error			
1047	AUX3-AUX5 relay error			

Code	Message	Cause	Solution	Note
1049 1050 1051 1052	DET#n set temperature is low	Detector temperature is set at a lower value than column temperature.	Change the set value for detector temperature. To set detector temperature at a lower value than column temperature, change the maximum value of detector temperature.	n=1 to 4
1061	Oven door is open	Column oven door opens.	Close column oven door and press [Reset].	-
2014 2017 2020 2023	DetAPCn makeup set point not reached	The pressure cannot reach the set value due to gas control error (leaks).	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). If the purge flow rate is too low, the message "Purge leaks" may appear. If the carrier gas is also leaking, the ESC or TFC error message may not be displayed first.	n=1 to 4
2015 2018 2021 2024	DetAPCn hydrogen set point not reached			
2016 2019 2022 2025	DetAPCn air set point not reached			
2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043	APCy set point not reached			y=1 to 18
2272 2273 2274 2275	DAMCn makeup set point not reached			n=1 to 4
2276 2277 2278 2279	DAMCn reference set point not reached			n=1 to 4

Code	Message	Cause	Solution	Note
2048 2049 2050 2202	CARx purge valve not completely closed	Gas control errors (valve leak errors).	Gas is flowing even though the pressure is set at 0 kPa (or 0 mL/min for flow). If there is no problem with gas supply, calibrate AFC/APC according to "8.6.7 Offset Calibration" P.331. If the error cannot be solved, AFC/APC valve, etc. may fail. Turn off the main power of the system and contact your Shimadzu sales/service representative.	x=1 to 4
2057 2060 2063 2066	DetAPCn makeup valve not completely closed			n=1 to 4
2058 2061 2064 2067	DetAPCn hydrogen valve not completely closed			
2059 2062 2065 2068	DetAPCn air valve not completely closed			
2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086	APCy valve not completely closed			y=1 to 18
2132 2133 2206 2207	CARm AFC valve not completely closed			m=1 to 4
2280 2281 2282 2283	DAMCn makeup valve not completely closed			n=1 to 4
2284 2285 2286 2287	DAMCn reference valve not completely closed			

Code	Message	Cause	Solution	Note
2087 2088 2089 2090	DAMCn makeup control irregularity	Component does not operate correctly.	Confirm that pressure gas supply is stable. If there is no problem with gas supply, control system such as APC may fail. Turn off the main power of the system and contact your Shimadzu sales/service representative.	n=1 to 4
2091 2092 2093 2203	CARn purge control irregularity			
2094 2095 2096 2097	DAMCn reference control irregularity			
2100 2103 2106 2109	DetAPCn makeup control irregularity			
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
2130 2131 2204 2205	CARm AFC set point not reached			m=1 to 4
2134 2135 2136 2137 2208 2209 2210 2211	CARm AFC control irregularity			

Code	Message	Cause	Solution	Note
2138 2139 2140 2212	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
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 DCG set point not reached	The DCG pressure cannot reach the set value.	Check whether gas is supplied and whether gas is not leaking from connections.	n=1 to 4
2148 2149 2150 2151	DetAPCn DCG valve not completely closed	Sweep gas flow supplied from bypass line is unstable.	If there is no problem with gas supply, perform the following adjustment. • Turn off sweep gas flow and then ensure that the actual flow is 0 mL/min. • If the actual flow is not 0 mL/min, calibrate APC according to "8.6.7 Offset Calibration" P.331. • Adjust sweep gas flow to about 5 to 10 mL/min. If the error cannot be solved after the adjustment, APC valve may fail. Turn off the main power of the system and contact your Shimadzu sales/service representative.	n=1 to 4

Code	Message	Cause	Solution	Note
2152 2153 2154 2155	DetAPCn DCG control irregularity	BID does not operate correctly.	Check the following items. • Necessary and sufficient gas is supplied stably. • Sweep gas flow is about 5 to 10 mL/min. If there is no problem with gas supply and sweep gas flow, control system such as APC may fail. Turn off the main power of the system and contact your Shimadzu sales/service representative.	n=1 to 4
2156 2157 2158 2159	DetAPCn ECDG set point not reached	The ECD gas pressure cannot reach the set value.	Check whether gas is supplied and whether gas is not leaking from connections.	n=1 to 4
2160 2161 2162 2163	DetAPCn ECDG valve not completely closed	Detector gas flow supplied from bypass line is unstable or leaks from the valve.	If there is no problem with gas supply, perform the following adjustment. • Turn off detector gas control and then ensure that the actual flow is 0 mL/min. • If the actual flow is not 0 mL/min, calibrate APC according to "8.6.7 Offset Calibration" P.331. If the error cannot be solved after the adjustment, APC valve may fail. Turn off the main power of the system and contact your Shimadzu sales/service representative.	n=1 to 4

Code	Message	Cause	Solution	Note
2164 2165 2166 2167	DetAPCn ECDG control irregularity	The ECD gas does not operate correctly.	Check the following items. • Supply pressure is set at a value required to achieve the detector gas flow. • Carrier gas flow is less than the set value. If there is no problem with gas pressure and flow, control system such as APC may fail. Turn off the main power of the system and contact your Shimadzu sales/service representative.	n=1 to 4
2214 2215 2216 2217	CARn was overpressure	Overpressure or clogging in the tubing may occur.	Check whether the tubing is not clogged. If the error is displayed although there is no clogging in the tubing, turn off the main power of the system and contact your Shimadzu sales/service representative.	n=1 to 4
2218 2219 2220 2221	PURn was overpressure			
2222 2225 2228 2231	DetAPCn makeup was overpressure			
2223 2226 2229 2232	DetAPCn hydrogen was overpressure			
2224 2227 2230 2233	DetAPCn air was overpressure			

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	Overpressure or clogging in the tubing may occur.	Check whether the tubing is not clogged. If the error is displayed although there is no clogging in the tubing, turn off the main power of the system and contact your Shimadzu sales/service representative.	x=1 to 18
2264 2265 2266 2267	DetAPCn DCG was overpressure			n=1 to 4
2268 2269 2270 2271	DetAPCn ECDG was overpressure			
2288 2289 2290 2291	DAMCn makeup was overpressure			
2292 2293 2294 2295	DAMCn reference was overpressure			
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 fail. Turn off the main power of the system 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	Component does not operate correctly.	The control system of the APC may fail. Turn off the main power of the system and contact your Shimadzu sales/service representative.	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	Component does not operate correctly.	The control system of the APC may fail. Turn off the main power of the system and contact your Shimadzu sales/service representative.	x=1 to 18
4301	Settings were changed	Setting is changed while program is running.	If you changed the part which is not executed, the system continues the analysis according to the changed program. Check the setting.	-
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.115	-

6.7 Warning Messages

Code	Message	Cause	Solution	Note
9000	COL CRG use time warning	Exceeded the set threshold.	Replace the parts and then reset the counter. Reference P.280	-
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 system and contact your Shimadzu sales/service representative to ask for part replacement. Reference P.271	-
9004 9005 9006 9052	CARx septum counter warning	Exceeded the set threshold.	Replace the parts and then reset the counter. Reference P.278	x=1 to 4
9007 9008 9009 9053	CARx insert counter warning			
9059 9060	AOCm syringe counter warning			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.	-

Code	Message	Cause	Solution	Note
9011	Ignition finished(retried)	Detector ignition sequence was re-attempted, because the ignition failed initially.	If this massage appears frequently, diagnose ignition pulse and ignition sequence by standard diagnosis. Reference P.271 Also check for gas leaks and verify the gas flows. If set values are correct, contact your Shimadzu sales/service representative.	-
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 system 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.94	-
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.161	-
9055 9056 9057 9058	PURn 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.155	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 • Inj Maintenance	Press [Start GC] on [GC Start/Stop Sequence] screen before executing the listed operations. Reference P.94	-
		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.94	
		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 system and AOC were not connected.	Connect the system and AOC.	

7 Screens Displayed on Touch Panel and Their Functions

HOME screen is displayed when you turned on the system.

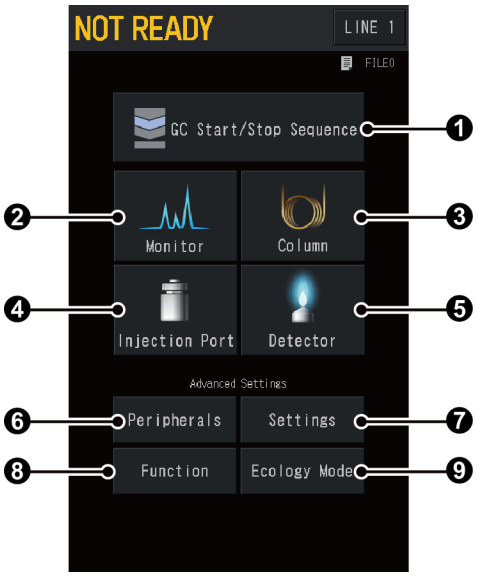
HOME screen is also displayed when you press (HOME) on the control panel while the system is turned on.

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.15 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
❶	GC Start/Stop Sequence	Sets parameters related to the GC start and stop.	P.94
❷	Monitor	You can check conditions of injection ports, columns, and detectors and the baseline.	P.107
❸	Column	Sets column temperature, column information (inner diameter, length, etc.), and temperature program.	P.115
❹	Injection Port	Sets inlets temperature and various conditions for the carrier gas.	P.125
❺	Detector	Sets detector temperature, conditions for the detector gas, and signal output.	P.161
❻	Peripherals	Sets optional devices (AOC-20, CRG, etc.).	P.200

No.	Item	Description	See also
❼	Settings	Sets line settings and frequently changed conditions (various temperatures, the carrier gas, detectors, etc.) by batch.	P.219
❽	Function	Sets configuration and time program.	P.223
❾	Ecology Mode	Sets carrier gas saver and auto stop/start of the system.	P.286

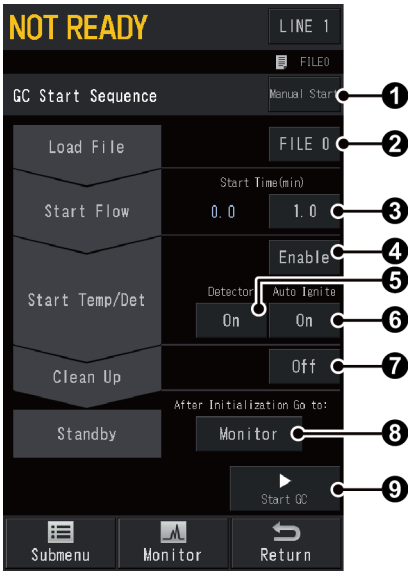
7.1 GC Start/Stop Sequence

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



<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">❶</td><td rowspan="3">GC Start Sequence</td><td colspan="2">Sets the GC start procedure after the system is turned on.</td></tr>
<tr><td>Items</td><td>• Manual Start
The GC does not start after the system is turned on. Press ❾ [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
Only carrier gas control starts automatically after the power is turned on. Press ❾ [Start GC] on [GC Start Sequence] screen to start the GC.</td></tr>
<tr><td>Default</td><td>Manual Start</td></tr>
<tr><td rowspan="3">❷</td><td rowspan="3">Load File</td><td colspan="2">Sets the file to be used. The GC will be controlled based on the parameters in the specified file.</td></tr>
<tr><td>Range</td><td>FILE 0 to FILE 9</td></tr>
<tr><td>Default</td><td>FILE 0</td></tr>
<tr><td rowspan="4">❸</td><td rowspan="4">Start Time</td><td colspan="2">Sets the period of time after flow control starts until temperature/detector control starts. This can be set when ❹ [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 system has been out of use for a time with no column connected : One to several hours
NOTE
• When the detector is ECD, set ❸ [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 ❸ [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.</td></tr>
<tr><td>Range</td><td>0.0 to 6000.0 min</td></tr>
<tr><td>Default</td><td>3.0 min</td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">❹</td><td rowspan="3">Start Temp/Det</td><td colspan="2">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.</td></tr>
<tr><td>Items</td><td>Enable, Disable</td></tr>
<tr><td>Default</td><td>Enable</td></tr>
<tr><td rowspan="3">❺</td><td rowspan="3">Detector</td><td colspan="2">Select [On] to prepare the detector configured in analytical line for analysis while the GC starts.</td></tr>
<tr><td>Items</td><td>Off, On</td></tr>
<tr><td>Default</td><td>On</td></tr>
<tr><td rowspan="3">❻</td><td rowspan="3">Auto Ignition</td><td colspan="2">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.165
"FPD ignition" P.180

NOTE • For BID, plasma will start to be produced while the GC starts regardless of the setting in ❻ [Auto Ignition].
• For TCD, ECD, and FTD, ignition will not start even the item is set at [On].</td></tr>
<tr><td>Items</td><td>Off, On</td></tr>
<tr><td>Default</td><td>On</td></tr>
<tr><td rowspan="3">❼</td><td rowspan="3">Clean Up</td><td colspan="2">Select whether to run the clean up program after the GC starts up.

Reference "7.1.4 [Clean Up] Screen" P.105</td></tr>
<tr><td>Items</td><td>• Off
The system does not perform clean up.
• On
The system performs clean up using the clean up program.</td></tr>
<tr><td>Default</td><td>Off</td></tr>
<tr><td rowspan="3">❽</td><td rowspan="3">After Initialization Go to:</td><td colspan="2">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.</td></tr>
<tr><td>Items</td><td>GC Stop Seq., HOME, Monitor</td></tr>
<tr><td>Default</td><td>Monitor</td></tr>
</table>

No.	Item	Description
❾	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 system 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.97

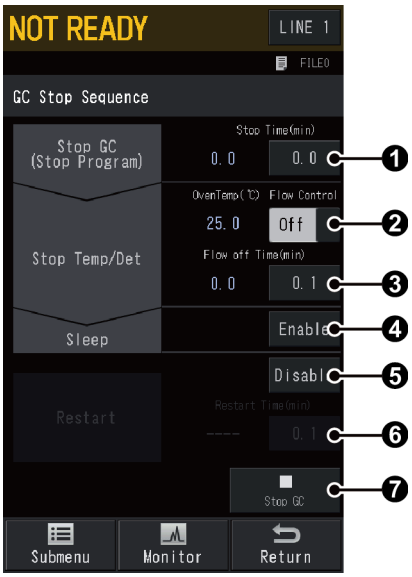
Submenu

Item	Description	See also
GC Stop Sequence	Displays [GC Stop Sequence] screen.	P.97
File	Displays [File Select] screen. You can change the file to be used.	P.101
Clean Up	Displays [Clean Up] screen. You can set parameters for clean up during the GC startup.	P.105

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.



<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">❶</td><td rowspan="3">Stop Time</td><td colspan="2">Sets the period of time after ❼ [Stop GC] is pressed until the system stops temperature/detector control.</td></tr>
<tr><td>Range</td><td>0.0 to 6000.0 min</td></tr>
<tr><td>Default</td><td>0.0 min</td></tr>
<tr><td rowspan="3">❷</td><td rowspan="3">Flow Control</td><td colspan="2">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.</td></tr>
<tr><td>Items</td><td>Off, On</td></tr>
<tr><td>Default</td><td>On</td></tr>
<tr><td rowspan="3">❸</td><td rowspan="3">Flow Off Time</td><td colspan="2">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.100
NOTE
• The system starts to count the flow off time after the temperature reaches the set value in [Make Up Gas Stop Temperature] for TCD and in [ECD Gas Stop Temperature] 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.</td></tr>
<tr><td>Range</td><td>0.0 to 6000.0 min</td></tr>
<tr><td>Default</td><td>0.0 min</td></tr>
<tr><td rowspan="3">❹</td><td rowspan="3">Sleep</td><td colspan="2">When [Enable] is selected, the system 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].</td></tr>
<tr><td>Items</td><td>Enable, Disable</td></tr>
<tr><td>Default</td><td>Disable</td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th>Description</th></tr>
<tr><td>❺</td><td>Restart</td><td>The action when [Disable] or [Enable] is selected are different depending on the settings in ❹ [Sleep].
<table>
<tr><th>Sleep</th><th>Restart</th><th>Operations after the GC shutdown</th></tr>
<tr><td>Disable</td><td>Disable</td><td>None</td></tr>
<tr><td>Enable</td><td>Disable</td><td>The system goes into sleep mode.</td></tr>
<tr><td>Disable</td><td>Enable</td><td>The GC will automatically start after the time set in ❻ [Restart Time] elapses.</td></tr>
<tr><td>Enable</td><td>Enable</td><td>The system will go into sleep mode after the time set in ❸ [Flow Off Time] elapses. After the time set in ❻ [Restart Time] elapses, the system will be automatically turned on and the GC will start.</td></tr>
</table>
This can be set when ❷ [Flow Control] is [Off].
<table>
<tr><th>Items</th><td>Enable, Disable</td></tr>
<tr><th>Default</th><td>Disable</td></tr>
</table></td></tr>
<tr><td>❻</td><td>Restart Time</td><td>Sets the time until the system 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 ❺ [Restart] is set at [Enable].
When the time is set at a value lower than ❸ [Flow Off Time], the system restarts instead of going into sleep mode even if ❹ [Sleep] is set at [Enable].
<table>
<tr><th>Range</th><td>0.1 to 6000.0 min</td></tr>
<tr><th>Default</th><td>0.1 min</td></tr>
</table></td></tr>
<tr><td>❼</td><td>Stop GC</td><td>When you press [Stop GC], the GC will stop according to [GC Stop Sequence] screen settings.
If you press [Stop GC] while the system 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.94</td></tr>
</table>

Submenu

Item	Description	See also
GC Start Sequence	Displays [GC Start Sequence] screen.	P.94
File	Displays [File Select] screen. You can change the file to be used.	P.101
Clean Up	Displays [Clean Up] screen. You can set parameters for clean up during the GC startup.	P.105
Inj Maintenance	Displays [Inj Maintenance] screen. Use this for the maintenance of the injection port.	P.112

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 system.

> **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 system 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.255

7.1.3 [File Select] Screen

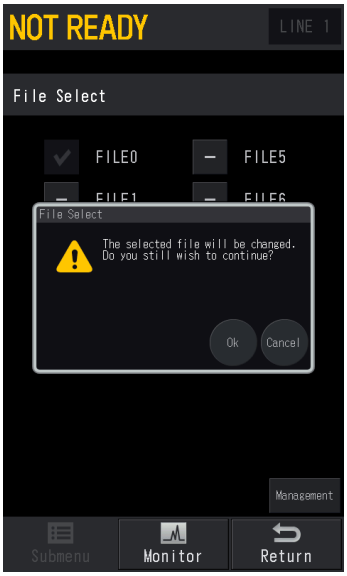
Press (HOME) - [GC Start/Stop Sequence] - [Submenu] - [File] to display [File Select] screen.

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.

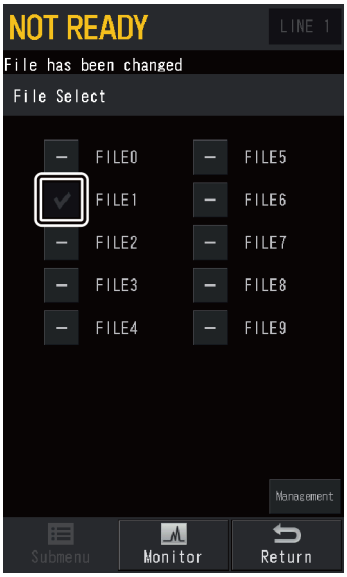
To change the file (Ex: Change the file from FILE0 to FILE1)

1 **Press [–] on the left of [FILE1].**

2 **Press [Ok].**

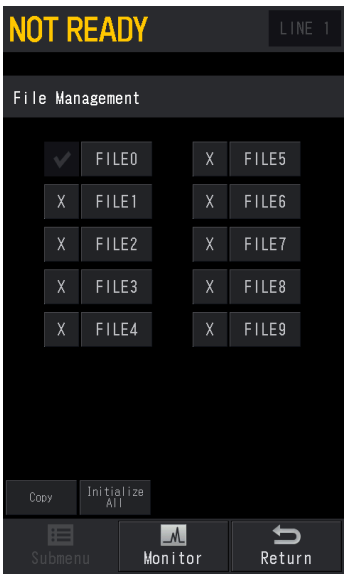


[FILE1] becomes check-marked and the change is confirmed.



■ [File Management] Screen

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



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

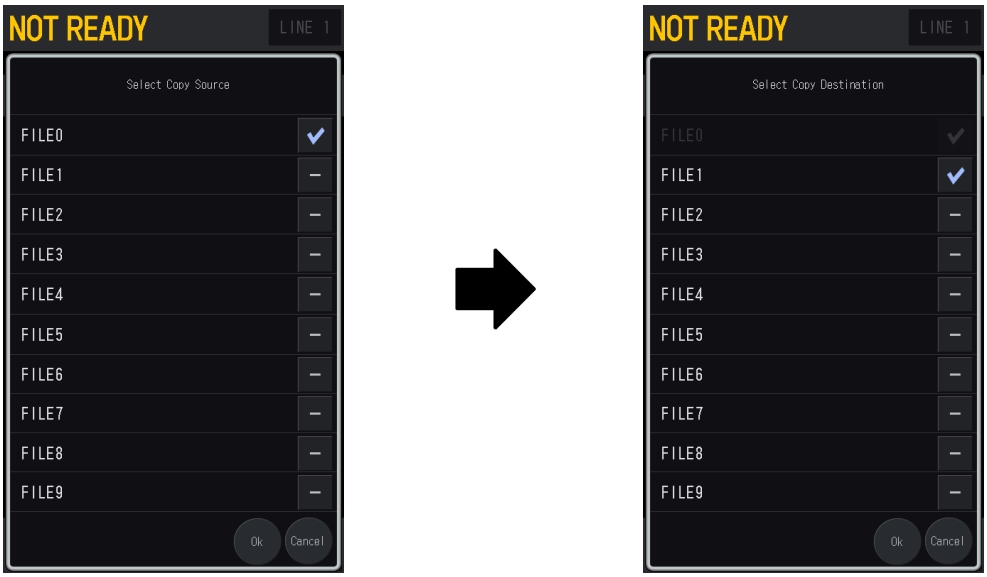
- "Change a file name"
- "Copy a file"
- "Initialization of a file"
- "Initialization of all files"

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 [×] 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

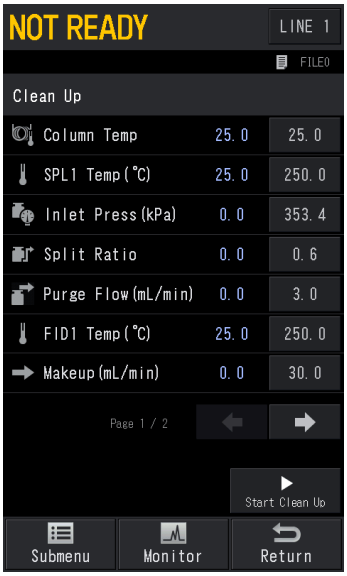
Press (HOME) - [GC Start/Stop Sequence] - [Submenu] - [Clean Up] to display [Clean Up] screen.

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 system 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 system and settings.



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

Reference
- "7.3.2 [Column Information] Screen" P.122
- "7.4 Injection Port" P.125

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 system 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.115
Pressure Program	Displays [Clean Up Pressure Program] screen. Displayed when [Flow Control Mode] in [INJ/FLOW] screen is set at [Press] or [Velocity].	P.143
Flow Program	Displays [Clean Up Column Flow Program] screen. Displayed when [Flow Control Mode] in [INJ/FLOW] screen is set at [Col Flow].	P.147

7.2 Monitor

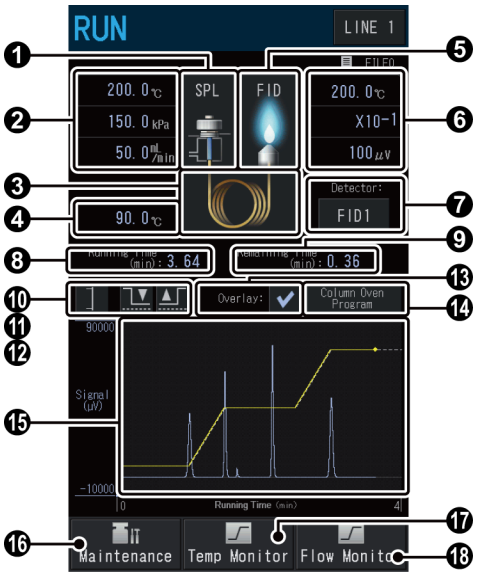
You can check conditions of injection port, column, and detector, chromatogram, and temperature program.

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
❶	Injection port	Displays the injection port configured in analytical line. Press the icon to set the injection port. ▶▶ Reference "7.4 Injection Port" P.125
❷	Actual values related to the injection port	Displays actual values of temperature of the injection port, inlet press, and total flow.
❸	Column	Press the icon to set the column oven. ▶▶ Reference "7.3 Column" P.115
❹	Actual value related to the column oven	Displays actual value of the column oven temperature.
❺	Detector	Displays detectors configured in analytical line. Press the icon to set the detector. ▶▶ Reference "7.5 Detector" P.161

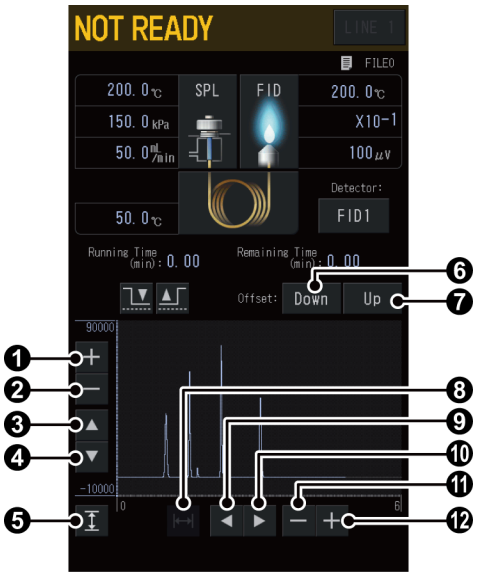
No.	Item	Description
❻	Actual value related to the detector	Displays actual values of the detector temperature, range, and signal. The system produces the voltage obtained by multiplying this value by range as an analogue output signal.
❼	Detector Switching	Displayed if several detectors are configured in one analytical line. You can change the detector to be displayed.
❽	Running Time	Displays the time elapsed after the analysis started.
❾	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.
❿	 (Vertical axis switching)	Switches the display mode of the vertical axis.
⓫	 (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 ❼ [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.
⓬	 (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 ❼ [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.
⓭	Overlay	Check this item to overlay program set in ⓮ [Display Program Setting] on the graph during analysis.
⓮	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. Items: Oven Temperature Program, Pressure Program, Linear Velocity Program, Flow Program, Inj Temp Program Default: Oven Temperature Program

No.	Item	Description
⓯	Graph	Displays the current status in graph form. Press the graph to enter Graph Edit mode. Reference "Graph edit mode" P.109
⓰	Maintenance (Maintenance)	Displays [Inj Maintenance] screen. Use this for the maintenance of the injection port. Reference "7.2.2 [Inj Maintenance] Screen" P.112
⓱	Temp Monitor (Temp Monitor)	Displays [Temp Monitor] screen. Reference "7.2.3 [Temp Monitor] Screen" P.113
⓲	Flow Monitor (Flow Monitor)	Displays [Flow Monitor] screen. Reference "7.2.4 [Flow Monitor] Screen" P.114

Graph edit mode

When the graph is pressed on Monitor screen, the system 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
❶	+ (Signal Axis Zoom)	Zooms the signal axis scale. Displayed area becomes narrow.
❷	− (Signal Axis Unzoom)	Unzooms the signal axis scale. Displayed area becomes wide.
❸	▲ (Signal Axis Up)	Moves the signal axis in the + direction.

No.	Item	Description
❹	 (Signal Axis Down)	Moves the signal axis in the - direction.
❺	 (Signal Axis Fitting)	Adjusts the signal axis according to the maximum value of the chromatogram displayed now.
❻	 (Decrease the baseline level)	Decrease the baseline level below the current level. The range of decrease depends on the scale of the vertical axis.
❼	 (Increase the baseline level)	Increase the baseline level over the current level. The range of increase depends on the scale of the vertical axis.
❽	 (Initialize the Time Axis Scale)	Initializes the time axis scale.
❾	 (Time Axis Left)	Moves the time axis in the - direction.
❿	 (Time Axis Right)	Moves the time axis in the + direction.
⓫	 (Time Axis Unzoom)	Unzooms the time axis scale. Displayed area becomes wide.
⓬	 (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
	

• 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

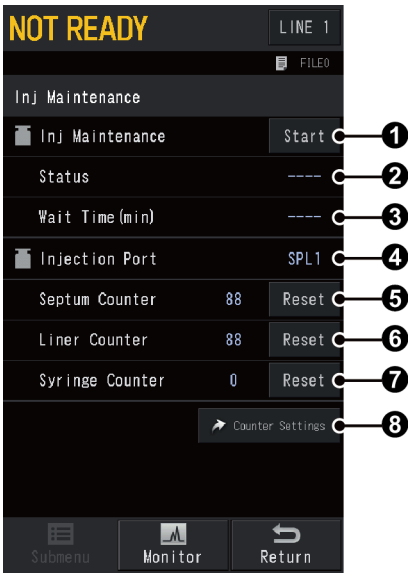
Not Illuminating	Illuminating
	

7.2.2 [Inj Maintenance] Screen

Press 

(Maintenance) on the monitor screen to display [Inj Maintenance] screen.

Use this for the maintenance of the injection port.



No.	Item	Description
❶	Inj Maintenance	When you press [Start] with the GC on, the system automatically lowers the temperature in the injection port and stops the supply of carrier gas to prepare the system for maintenance of the injection port. When the system is ready for maintenance, the message [GC is ready for maintenance] appears. Press [End] after the maintenance of the injection port is completed. Automatically supplies carrier gas, and starts temperature control of the injector and the column oven.
❷	Status	Displays the current status of the system.

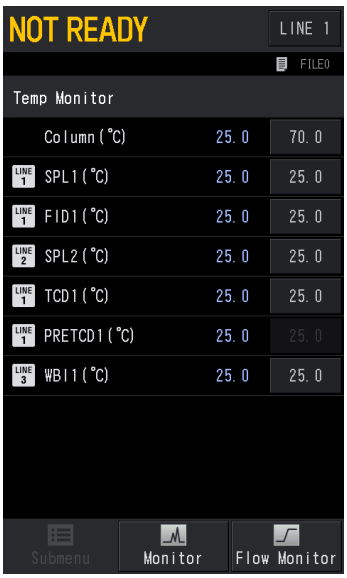
Screen display	Description
Cooling	The system is working to decrease the temperatures of the injection port and the column oven below 50 °C.
Purging	The system is shutting off the gas supply to the injection port. When AFT is used, the system also shut off the gas supply to AUX-APC.
Ready	The system is prepared for replacement of the parts in the injection port.
Preparing	The system starts the gas supply to the injection port again. After the time displayed in ❸ [Wait Time(min)] elapses, temperature control will start again.

No.	Item	Description
❸	Wait Time(min)	Displays the time after injection port maintenance is completed until heat control starts. The time until heat control starts is automatically calculated based on set values for the linear velocity and column length.
❹	Injection Port	Displays active injection port.
❺	Septum Counter	Displays the number of uses of the septum. Press [Reset] to reset the count.
❻	Liner Counter	Displays the number of uses of the insert. Press [Reset] to reset the count.
❼	Syringe Counter	Displays the number of uses of the syringe. Press [Reset] to reset the count. Displayed when AOC is configured in analytical line.
❽	Counter Settings	Displays [Analysis Counter] screen. ▶▶ Reference "[Analysis Counter] Screen" P.278

7.2.3 [Temp Monitor] Screen

Press Temp Monitor (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 system.



▶▶ Reference For details of displayed items, see sections describing column, injection port, and detector.

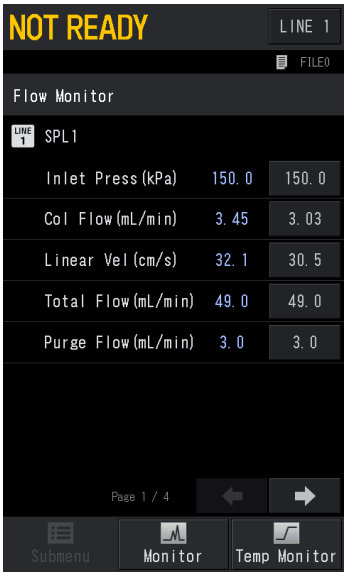
- "7.3 Column" P.115
- "7.4 Injection Port" P.125
- "7.5 Detector" P.161

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 system.



Reference For details of displayed items, see sections describing injection port and detector.

- "7.4 Injection Port" P.125
- "7.5 Detector" P.161

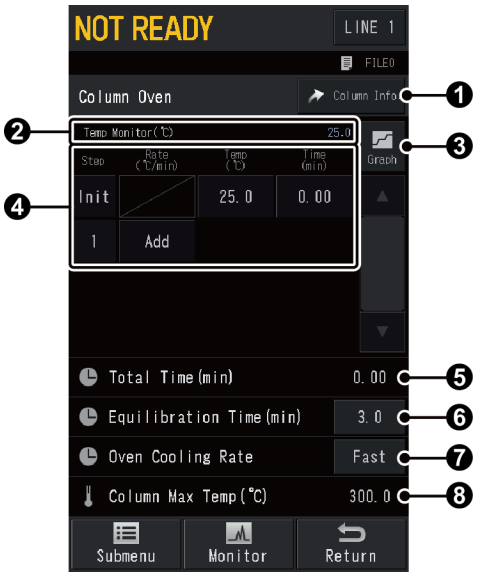
7.3 Column

You can set up the column and the column oven temperature program.

7.3.1 [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
❶	Column Info.	Displays [Column Information] screen. Reference "7.3.2 [Column Information] Screen" P.122
❷	Temp Monitor	Displays current temperature of the column oven.
❸	Graph (Graph)	You can see the set temperature program in graph form. Reference "Graph window" P.17

<table>
<tr><th>No.</th><th colspan="2">Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="6">❹</td><td colspan="2">Creating a temperature program</td><td colspan="2">You can create a temperature program (1 to 32 steps).</td></tr>
<tr><td rowspan="6"></td><td>Step</td><td colspan="2">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.</td></tr>
<tr><td rowspan="3">Rate</td><td colspan="2">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.</td></tr>
<tr><td>Range</td><td>0, -250.00 to 250.00 °C/min
Reference "Allowable settings and ranges for temperature program rates" P.120</td></tr>
<tr><td>Default</td><td>0.0 °C</td></tr>
<tr><td rowspan="3">Temp</td><td colspan="2">Sets the initial temperature and the final temperature of each step.

⚠ CAUTION

Instruction 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.

Instruction 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 "7.3.2 [Column Information] Screen" P.122</td></tr>
<tr><td>Range</td><td>0.0 °C to displayed value in [Column Max Temp]</td></tr>
<tr><td>Default</td><td>25.0 °C</td></tr>
</table>

<table>
<tr><th>No.</th><th colspan="2">Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">❹</td><td rowspan="3"></td><td rowspan="3">Time</td><td colspan="2">Sets the hold time for the initial temperature and the final temperature of each step.</td></tr>
<tr><td>Range</td><td>0.00 to 9999.99 min</td></tr>
<tr><td>Default</td><td>0.00 min</td></tr>
<tr><td>❺</td><td colspan="2">Total Time</td><td colspan="2">Displays the total time of the program.</td></tr>
<tr><td rowspan="3">❻</td><td colspan="2" rowspan="3">Equilibration Time</td><td colspan="2">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 system waits the equilibration time and then goes into Ready mode.</td></tr>
<tr><td>Range</td><td>0.0 to 9999.9 min</td></tr>
<tr><td>Default</td><td>3.0 min</td></tr>
<tr><td rowspan="4">❼</td><td colspan="2" rowspan="4">Oven Cooling Rate</td><td colspan="2">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 "7.3.3 [Colum Oven Temp Control Settings] Screen" P.124</td></tr>
<tr><td>Items</td><td>• 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.</td></tr>
<tr><td>Default</td><td>Fast</td></tr>
</table>

No.	Item	Description
❽	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 • "7.3.2 [Column Information] Screen" P.122 • "[Max Temperature] Screen" P.242

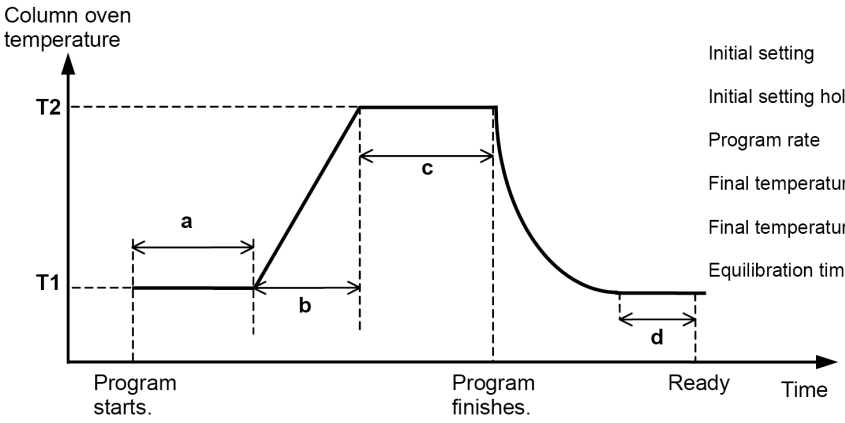
Submenu

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.124
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 then 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.255	-

Temperature program

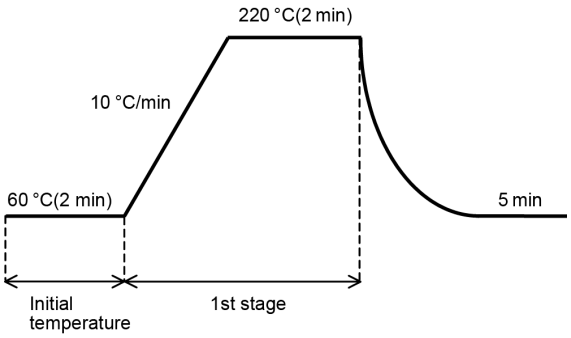
- Types of temperature program
  - Isothermal analysis
    The isothermal analysis technique keeps the column oven temperature at a constant value, which is optimal for separating compounds.
  - Programmed analysis
    Programmed analysis technique increases the column oven temperature gradually from 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.

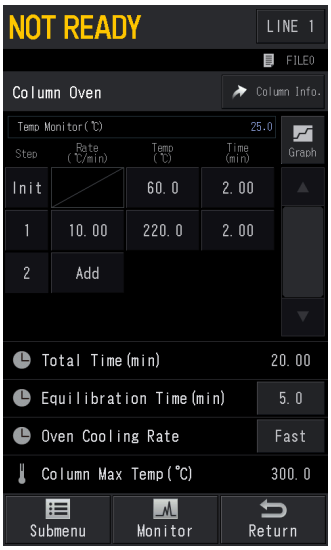
- Creating a temperature program
  Screen terminology (1-ramp temperature program)



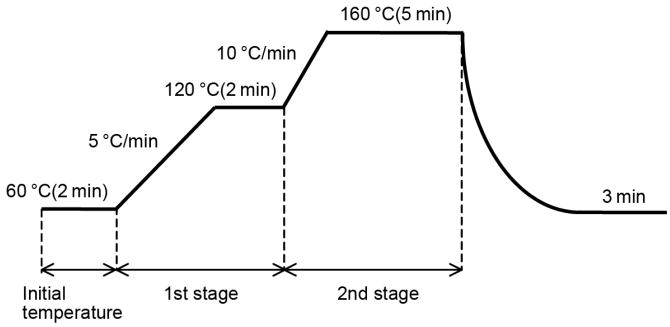
Initial setting (TEMP)····· T1
Initial setting hold time (TIME) ····· a
Program rate (RATE) ····· $\frac{T2-T1}{b}$
Final temperature (TMP) ····· T2
Final temperature hold time (TIM) ····· c
Equilibration time (ETIM) ····· d

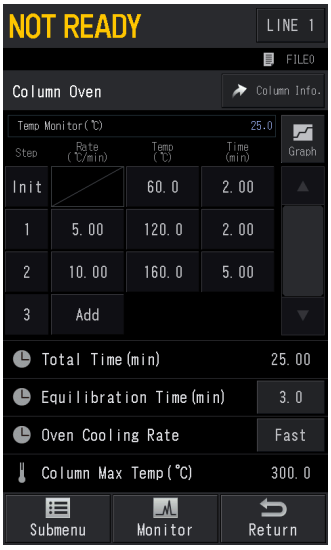
- Example for 1-ramp temperature program



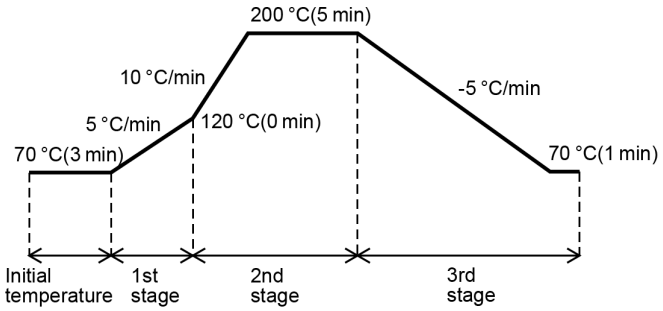


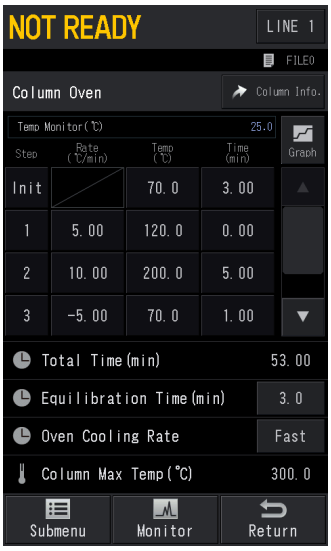
- Example for 2-ramp temperature program





• Example for multi-ramp temperature program (with temp increase /decrease)



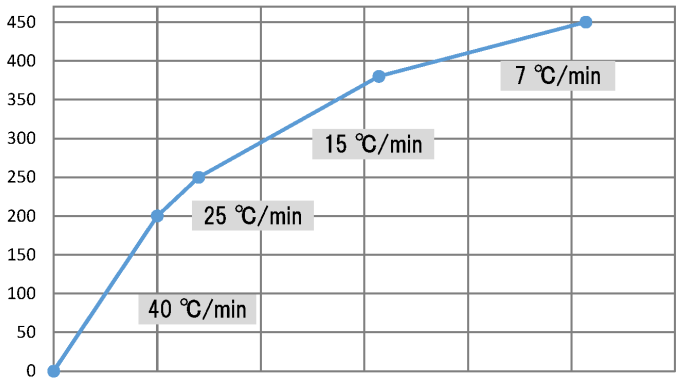


Allowable settings and ranges for temperature program rates

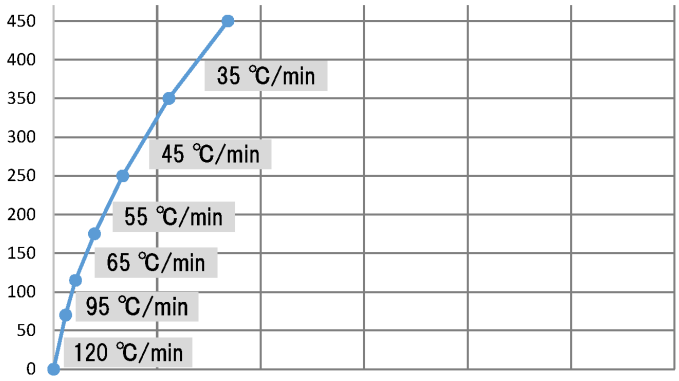
Item		Control range
Heating Normal oven	to 200 °C	0 °C to 40 °C/min
	to 250 °C	0 °C to 25 °C/min
	to 380 °C	0 °C to 15 °C/min
	to 450 °C	0 °C to 7 °C/min
Heating High power oven	to 70 °C	0 °C to 120 °C/min
	to 115 °C	0 °C to 95 °C/min
	to 175 °C	0 °C to 65 °C/min
	to 250 °C	0 °C to 55 °C/min
	to 350 °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.

Controllable ranges of temperature program rates

• Normal oven



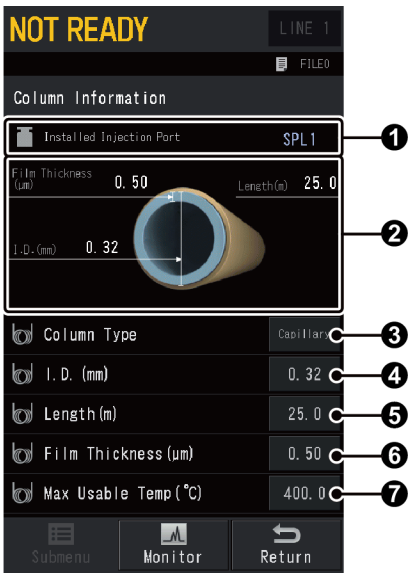
• High power oven



7.3.2 [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 system 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 system automatically calculates the column inlet pressure at column initial temperature.



No.	Item	Description	
❶	Installed Injection Port	Displays installed injection port.	
❷	Column Info.	Illustrates the column information.	
❸	Column Type	Sets the column type to be used.	
		Items	Capillary, Packed
		Default	Capillary
❹	I. D.	Sets the inner diameter of the column.	
		Range	0.01 to 6.00 mm
		Default	0.32 mm
❺	Length	Sets the length of the column.	
		Range	0.1 to 250 m
		Default	25.0 m

<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">❻</td><td rowspan="3">Film Thickness</td><td colspan="2">Sets the film thickness of the column. You cannot set this item when [Column Type] is set at [Packed].

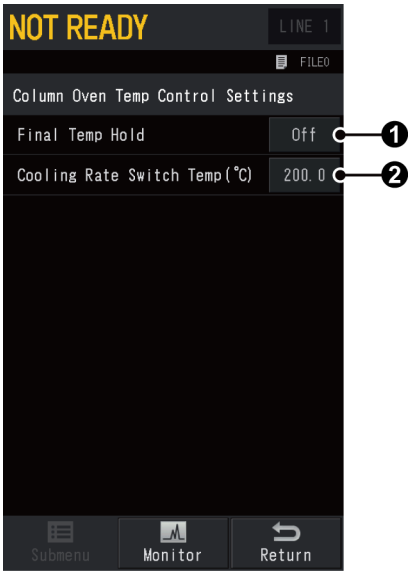
NOTE When you use columns with unknown film thickness (such as PLOT or WCOT), enter an arbitrary number or [0]. In these cases, pressure, flow rate, and linear velocity are not correct.</td></tr>
<tr><td>Range</td><td>0.00 to 300.00 µm</td></tr>
<tr><td>Default</td><td>0.50 µm</td></tr>
<tr><td rowspan="3">❼</td><td rowspan="3">Max Usable Temp</td><td colspan="2">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 temperature : Use it for short-time (about 30 min.) programmed analysis.
• Lower temperature : Use it for isothermal analysis or long-time (over 30 min.) programmed analysis.

Reference "[Max Temperature] Screen" P.242</td></tr>
<tr><td>Range</td><td>0.0 to 470.0 °C</td></tr>
<tr><td>Default</td><td>400.0 °C</td></tr>
</table>

7.3.3 [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	
❶	Final Temp Hold	Select [On] to maintain the temperature in the last step of column oven temperature program after analysis. Reference "7.3.1 [Column Oven] Screen" P.115	
		Items	Off, On
		Default	On
❷	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 "7.3.1 [Column Oven] Screen" P.115 NOTE It is available except when [Oven Cooling Rate] is set at [Fast].	
		Range	0.0 to 470.0 °C
		Default	200.0 °C

7.4 Injection Port

Sets temperature and flow rate, etc. of the injection port.

The injection units which can be used with the system are shown below:

- Split/Splitless injection unit (SPL)

Reference "7.4.1 [INJ/FLOW] Screen (SPL)" P.125

- Direct injection unit (WBI)

Reference "7.4.2 [INJ/FLOW] Screen (WBI)" P.130

- On-column injection unit (OCI)

Reference "7.4.3 [INJ/FLOW] Screen (OCI)" P.134

- Programmed Temperature Vaporizer (PTV)

Reference "7.4.4 [INJ/FLOW] Screen (PTV)" P.138

For details of sample injection, see "8.4 Sample Injection System" P.304.

Configure injection units in analytical line before using the system.

Reference "7.7.2 [Line Configuration] Screen" P.220

7.4.1 [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 system 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.

<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">❶</td><td rowspan="3">Control of Flow Controller</td><td colspan="2">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 system 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 system 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.</td></tr>
<tr><td>Items</td><td>Off, On</td></tr>
<tr><td>Default</td><td>On</td></tr>
<tr><td rowspan="3">❷</td><td rowspan="3">Inj Temp</td><td colspan="2">Sets the injection port temperature. Select a temperature suitable for each sample to instantly vaporize the sample in the injector.
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.</td></tr>
<tr><td>Range</td><td>0.0 to 450.0 °C</td></tr>
<tr><td>Default</td><td>25.0 °C</td></tr>
<tr><td rowspan="3">❸</td><td rowspan="3">Inlet Press</td><td colspan="2">Sets the inlet pressure of the column. Set initial pressure when you use Column Inlet Press Program.</td></tr>
<tr><td>Range</td><td>0.0 to 970.0 kPa</td></tr>
<tr><td>Default</td><td>100.0 kPa</td></tr>
<tr><td rowspan="3">❹</td><td rowspan="3">Col Flow</td><td colspan="2">Sets column flow. The system 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.</td></tr>
<tr><td>Range</td><td>• When ⓫ [Carrier Gas Type] is He, N2, or Ar
0.00 to 1300.00 mL/min
• When ⓫ [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>

No.	Item	Description	
❺	Linear Vel	Sets the average linear velocity of the carrier gas flowing in the capillary column. The system 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
❻	Split Ratio	The split ratio is "split flow / column flow". When you set a split ratio, the system 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
❼	Total Flow	Sets the total flow, which is the sum total of column flow, split flow, and septum purge flow. ▶▶ Reference "8.6.6 AFC and APC Control Ranges" P.329	
		Range	• When ⓫ [Carrier Gas Type] is He, N2, or Ar 0.0 to 1300.0 mL/min • When ⓫ [Carrier Gas Type] is H2 0.0 to 50.0 mL/min
		Default	50.0 mL/min
❽	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
❾	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 ❽ [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

<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">⑩</td><td rowspan="3">Flow Control Mode</td><td colspan="2">Sets flow control mode.</td></tr>
<tr><td>Items</td><td>• Press
Controls the system so that the inlet pressure remains constant during analysis.
• Velocity
Controls the system so that the velocity remains constant during analysis.
• Col Flow
Controls the system so that the column flow remains constant during analysis.</td></tr>
<tr><td>Default</td><td>Velocity</td></tr>
<tr><td rowspan="3">⑪</td><td rowspan="3">Carrier Gas Type</td><td colspan="2">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.</td></tr>
<tr><td>Range</td><td>He, N2, H2, Ar</td></tr>
<tr><td>Default</td><td>He</td></tr>
<tr><td rowspan="2">⑫</td><td rowspan="2">Primary Press</td><td colspan="2">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.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="3">⑬</td><td rowspan="3">Purge Flow</td><td colspan="2">Sets septum purge flow. This is the initial flow in the purge flow program.</td></tr>
<tr><td>Range</td><td>• When ⑪ [Carrier Gas Type] is He, N2, or Ar
0.0 to 1300.0 mL/min
• When ⑪ [Carrier Gas Type] is H2
0.0 to 500.0 mL/min
NOTE Control range is different depending on the column inlet pressure.
Reference "8.6.6 AFC and APC Control Ranges" P.329</td></tr>
<tr><td>Default</td><td>3.0 mL/min</td></tr>
</table>

No.	Item	Description
⓮	Press Program	Displays [Column Inlet Press Program] screen. This item is displayed when ⓾ [Flow Control Mode] is set at [Press]. Reference "7.4.5 [Column Inlet Press Program] Screen" P.143
	Linear Vel Program	Displays [Linear Velocity Program] screen. This item is displayed when ⓾ [Flow Control Mode] is set at [Velocity]. Reference "7.4.6 [Linear Velocity Program] Screen" P.145
	Col Flow Program	Displays [Column Flow Program] screen. This item is displayed when ⓾ [Flow Control Mode] is set at [Col Flow]. Reference "7.4.7 [Column Flow Program] Screen" P.147
⓯	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 "7.4.9 [Back Flush Settings] Screen" P.151

Submenu

Item	Description	See also
Column Information	Displays [Column Information] screen.	P.122
Carrier Gas Saver	Displays [Carrier Gas Saver] screen. The carrier gas saver saves carrier gas by reducing the split flow.	P.152
Split Ratio Program	Displays [Split Ratio Program] screen. Split ratio can be changed during analysis.	P.153
Purge Flow Program	Displays [Purge Flow Program] screen. Sets septum purge program.	P.155
High Press Setting	Displays [High Pressure Injection] screen. The system keeps the column inlet pressure at high value for a certain period of time during the injection.	P.157
Splitter Hold	Displays [Splitter Hold] screen. The system fixes the split flow line and keep the split ratio constant.	P.159
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.331

7.4.2 [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 system 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
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 system 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 system 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

<table>
<tr><th>No.</th><th>Item</th><th>Description</th></tr>
<tr><td>❷</td><td>Inj Temp</td><td>Sets the injection port temperature. Select a temperature suitable for each sample to instantly vaporize the sample in the injector.

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.

Range: 0.0 to 450.0 °C
Default: 25.0 °C</td></tr>
<tr><td>❸</td><td>Inlet Press</td><td>Sets the inlet pressure of the column. Set initial pressure when you use Pressure Program. When ❼ [Flow Control Mode] is set at [Col Flow], the actual value is displayed but you cannot set the value.

Range: 0.0 to 970.0 kPa
Default: 100.0 kPa</td></tr>
<tr><td>❹</td><td>Col Flow</td><td>Sets column flow. This can be set only when ❼ [Flow Control Mode] is [Col Flow].

NOTE
When the ❼ [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.

Range:
• When ❽ [Carrier Gas Type] is He, N2, or Ar 0.00 to 1300.00 mL/min
• When ❽ [Carrier Gas Type] is H2 0.00 to 50.00 mL/min
Default: 1.00 mL/min</td></tr>
<tr><td>❺</td><td>Linear Vel</td><td>Sets the average linear velocity of the carrier gas flowing in the capillary column. The system 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 ❼ [Flow Control Mode] is set at [Press] or [Velocity].

Range: 0.0 to 99999.9 cm/s
Default: 40.0 cm/s</td></tr>
<tr><td>❻</td><td>Total Flow</td><td>Displays the total flow, which is the sum total of column flow and septum purge flow.

Reference "8.6.6 AFC and APC Control Ranges" P.329</td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">❼</td><td rowspan="3">Flow Control Mode</td><td colspan="2">Sets flow control mode.</td></tr>
<tr><td>Items</td><td>• Press
Controls the system so that the inlet pressure remains constant during analysis.
• Velocity
Controls the system so that the velocity remains constant during analysis.
• Col Flow
Controls the system so that the column flow remains constant during analysis.</td></tr>
<tr><td>Default</td><td>Velocity</td></tr>
<tr><td rowspan="3">❽</td><td rowspan="3">Carrier Gas Type</td><td colspan="2">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.</td></tr>
<tr><td>Items</td><td>He, N2, H2, Ar</td></tr>
<tr><td>Default</td><td>He</td></tr>
<tr><td rowspan="2">❾</td><td rowspan="2">Primary Press</td><td colspan="2">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.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="3">❿</td><td rowspan="3">Purge Flow</td><td colspan="2">Sets septum purge flow. This is the initial flow in the purge flow program.</td></tr>
<tr><td>Range</td><td>• When ❽ [Carrier Gas Type] is He, N2, or Ar
0.0 to 1300.0 mL/min
• When ❽ [Carrier Gas Type] is H2
0.0 to 500.0 mL/min
NOTE Control range is different depending on the column inlet pressure.
Reference "8.6.6 AFC and APC Control Ranges" P.329</td></tr>
<tr><td>Default</td><td>3.0 mL/min</td></tr>
</table>

No.	Item	Description
⓫	Press Program	Displays [Column Inlet Press Program] screen. This item is displayed when ❼ [Flow Control Mode] is set at [Press]. Reference "7.4.5 [Column Inlet Press Program] Screen" P.143
	Linear Vel Program	Displays [Linear Velocity Program] screen. This item is displayed when ❼ [Flow Control Mode] is set at [Velocity]. Reference "7.4.6 [Linear Velocity Program] Screen" P.145
	Col Flow Program	Displays [Column Flow Program] screen. This item is displayed when ❼ [Flow Control Mode] is set at [Col Flow]. Reference "7.4.7 [Column Flow Program] Screen" P.147

Submenu

Item	Description	See also
Column Information	Displays [Column Information] screen.	P.122
Purge Flow Program	Displays [Purge Flow Program] screen. Sets septum purge program.	P.155
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.331

7.4.3 [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 system 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
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 system 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 system 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

<table>
<tr><th>No.</th><th>Item</th><th>Description</th></tr>
<tr><td>❷</td><td>Inj Temp</td><td>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 ⓭ [Inj Temp Program]. Select a temperature suitable for each sample to instantly vaporize the sample in the injector.
NOTE Set the initial temperature at a value lower than the boiling point of sample solvent.
Range: 0.0 to 450.0 °C
Default: 25.0 °C</td></tr>
<tr><td>❸</td><td>Inlet Press</td><td>Sets the inlet pressure of the column. Set initial pressure when you use Pressure Program. When ❼ [Flow Control Mode] is set at [Col Flow], the actual value is displayed but you cannot set the value.
Range: 0.0 to 970.0 kPa
Default: 100.0 kPa</td></tr>
<tr><td>❹</td><td>Col Flow</td><td>Sets column flow. This can be set only when ❼ [Flow Control Mode] is [Col Flow].
NOTE When the ❼ [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.
Range:
• When ❽ [Carrier Gas Type] is He, N2, or Ar 0.00 to 1300.00 mL/min
• When ❽ [Carrier Gas Type] is H2 0.00 to 50.00 mL/min
Default: 1.00 mL/min</td></tr>
<tr><td>❺</td><td>Linear Vel</td><td>Sets the average linear velocity of the carrier gas flowing in the capillary column. The system 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 ❼ [Flow Control Mode] is set at [Press] or [Velocity].
Range: 0.0 to 99999.9 cm/s
Default: 40.0 cm/s</td></tr>
<tr><td>❻</td><td>Total Flow</td><td>Displays the total flow, which is the sum total of column flow and septum purge flow.
Reference "8.6.6 AFC and APC Control Ranges" P.329</td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">❼</td><td rowspan="3">Flow Control Mode</td><td colspan="2">Sets flow control mode.</td></tr>
<tr><td>Items</td><td>• Press
Controls the system so that the inlet pressure remains constant during analysis.
• Velocity
Controls the system so that the velocity remains constant during analysis.
• Col Flow
Controls the system so that the column flow remains constant during analysis.</td></tr>
<tr><td>Default</td><td>Velocity</td></tr>
<tr><td rowspan="3">❽</td><td rowspan="3">Carrier Gas Type</td><td colspan="2">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.</td></tr>
<tr><td>Items</td><td>He, N2, H2, Ar</td></tr>
<tr><td>Default</td><td>He</td></tr>
<tr><td rowspan="3">❾</td><td rowspan="3">Primary Press</td><td colspan="2">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.</td></tr>
<tr><td>Items</td><td>He, N2, H2, Ar</td></tr>
<tr><td>Default</td><td>He</td></tr>
<tr><td rowspan="3">❿</td><td rowspan="3">Purge Flow</td><td colspan="2">Sets septum purge flow. This is the initial flow in the purge flow program.</td></tr>
<tr><td>Range</td><td>• When ❽ [Carrier Gas Type] is He, N2, or Ar
0.0 to 1300.0 mL/min
• When ❽ [Carrier Gas Type] is H2
0.0 to 500.0 mL/min
NOTE Control range is different depending on the column inlet pressure.
Reference "8.6.6 AFC and APC Control Ranges" P.329</td></tr>
<tr><td>Default</td><td>3.0 mL/min</td></tr>
</table>

No.	Item	Description
⓫	Press Program	Displays [Column Inlet Press Program] screen. This item is displayed when ❼ [Flow Control Mode] is set at [Press]. Reference "7.4.5 [Column Inlet Press Program] Screen" P.143
	Linear Vel Program	Displays [Linear Velocity Program] screen. This item is displayed when ❼ [Flow Control Mode] is set at [Velocity]. Reference "7.4.6 [Linear Velocity Program] Screen" P.145
	Col Flow Program	Displays [Column Flow Program] screen. This item is displayed when ❼ [Flow Control Mode] is set at [Col Flow]. Reference "7.4.7 [Column Flow Program] Screen" P.147
⓬	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
⓭	Inj Temp Program	Displays [INJ Temp Program] screen. Reference "7.4.8 [INJ Temp Program] Screen" P.149

Submenu

Item	Description	See also
Column Information	Displays [Column Information] screen.	P.122
Purge Flow Program	Displays [Purge Flow Program] screen. Sets septum purge program.	P.155
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.331

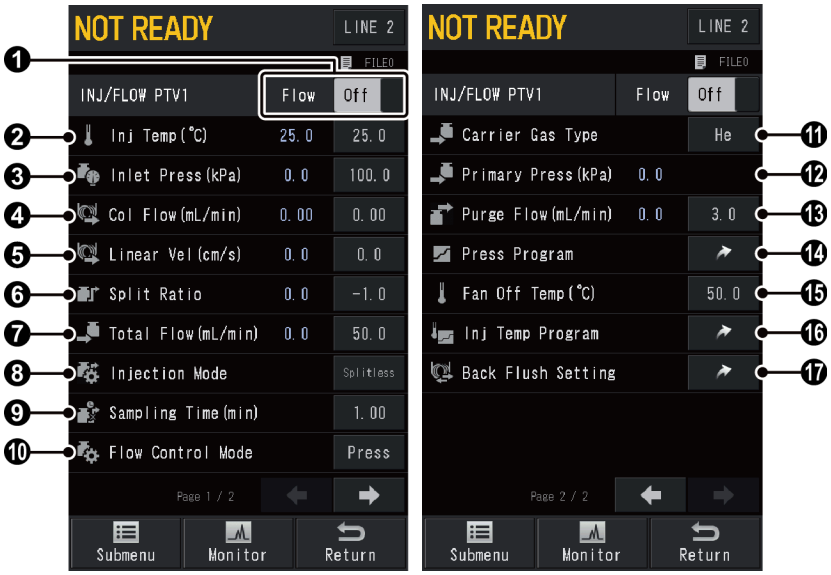
7.4.4 [INJ/FLOW] Screen (PTV)

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 system 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
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 system 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 system 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	
❷	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 ⓰ [Inj Temp Program]. Select a temperature suitable for each sample to instantly vaporize the sample in the injector. NOTE Set the initial temperature at a value lower than the boiling point of sample solvent.	
		Range	0.0 to 450.0 °C
		Default	25.0 °C
❸	Inlet Press	Sets the inlet pressure of the column. Set initial pressure when you use Pressure Program.	
		Range	0.0 to 970.0 kPa
		Default	100.0 kPa
❹	Col Flow	Sets column flow. The system 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 ⓫ [Carrier Gas Type] is He, N2, or Ar 0.00 to 1300.00 mL/min • When ⓫ [Carrier Gas Type] is H2 0.00 to 50.00 mL/min
		Default	1.00 mL/min
❺	Linear Vel	Sets the average linear velocity of the carrier gas flowing in the capillary column. The system 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
❻	Split Ratio	The split ratio is "split flow / column flow". When you set a split ratio, the system 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

No.	Item	Description	
❼	Total Flow	Sets the total flow, which is the sum total of column flow, split flow, and septum purge flow. ▶▶ Reference "8.6.6 AFC and APC Control Ranges" P.329	
		Range	• When ⓫ [Carrier Gas Type] is He, N2, or Ar 0.0 to 1300.0 mL/min • When ⓫ [Carrier Gas Type] is H2 0.0 to 500.0 mL/min
		Default	50.0 mL/min
❽	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
❾	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 ❽ [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
❿	Flow Control Mode	Sets flow control mode.	
		Items	• Press Controls the system so that the inlet pressure remains constant during analysis. • Velocity Controls the system so that the velocity remains constant during analysis. • Col Flow Controls the system so that the column flow remains constant during analysis.
		Default	Velocity

<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">⓫</td><td rowspan="3">Carrier Gas Type</td><td colspan="2">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.</td></tr>
<tr><td>Items</td><td>He, N2, H2, Ar</td></tr>
<tr><td>Default</td><td>He</td></tr>
<tr><td>⓬</td><td>Primary Pressure</td><td colspan="2">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.</td></tr>
<tr><td rowspan="3">⓭</td><td rowspan="3">Purge Flow</td><td colspan="2">Sets septum purge flow. This is the initial flow in the purge flow program.</td></tr>
<tr><td>Range</td><td>• When ⓫ [Carrier Gas Type] is He, N2, or Ar
0.0 to 1300.0 mL/min
• When ⓫ [Carrier Gas Type] is H2
0.0 to 500.0 mL/min

NOTE Control range is different depending on the column inlet pressure.

Reference "8.6.6 AFC and APC Control Ranges" P.329</td></tr>
<tr><td>Default</td><td>3.0 mL/min</td></tr>
<tr><td rowspan="3">⓮</td><td>Press Program</td><td colspan="2">Displays [Column Inlet Press Program] screen. This item is displayed when ⓾ [Flow Control Mode] is set at [Press].

Reference "7.4.5 [Column Inlet Press Program] Screen" P.143</td></tr>
<tr><td>Linear Vel Program</td><td colspan="2">Displays [Linear Velocity Program] screen. This item is displayed when ⓾ [Flow Control Mode] is set at [Velocity].

Reference "7.4.6 [Linear Velocity Program] Screen" P.145</td></tr>
<tr><td>Col Flow Program</td><td colspan="2">Displays [Column Flow Program] screen. This item is displayed when ⓾ [Flow Control Mode] is set at [Col Flow].

Reference "7.4.7 [Column Flow Program] Screen" P.147</td></tr>
<tr><td rowspan="3">⓯</td><td rowspan="3">Fan Off Temp</td><td colspan="2">Sets the upper limit when controlling the temperature using the fan.</td></tr>
<tr><td>Range</td><td>0.0 to 100.0 °C</td></tr>
<tr><td>Default</td><td>50.0 °C</td></tr>
</table>

No.	Item	Description
⑯	Inj Temp Program	Displays [INJ Temp Program] screen. Reference "7.4.8 [INJ Temp Program] Screen" P.149
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 "7.4.9 [Back Flush Settings] Screen" P.151

Submenu

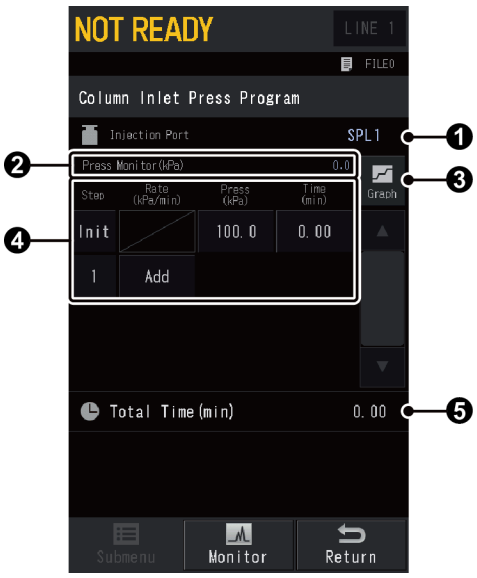
Item	Description	See also
Column Information	Displays [Column Information] screen.	P.122
Carrier Gas Saver	Displays [Carrier Gas Saver] screen. The carrier gas saver saves carrier gas by reducing the split flow.	P.152
Split Ratio Program	Displays [Split Ratio Program] screen. Split ratio can be changed during analysis.	P.153
Purge Flow Program	Displays [Purge Flow Program] screen. Sets septum purge program.	P.155
High Press Setting	Displays [High Pressure Injection] screen. The system keeps the column inlet pressure at high value for a certain period of time during the injection.	P.157
Splitter Hold	Displays [Splitter Hold] screen. The system fixes the split flow line and keep the split ratio constant.	P.159
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.331

7.4.5 [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.

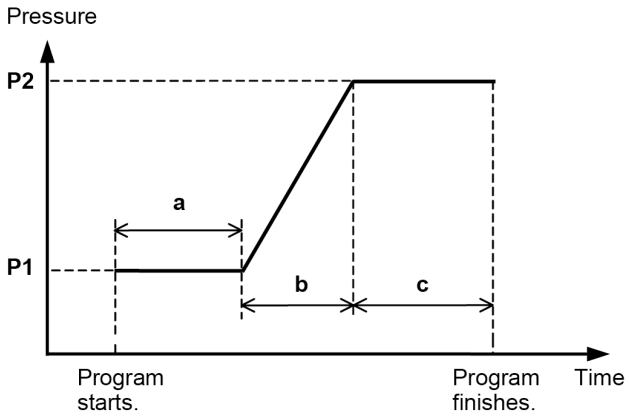


No.	Item	Description
❶	Injection Port	Displays active injection port.
❷	Press Monitor	Displays the current pressure.
❸	Graph (Graph)	You can see the set pressure program in graph form. Reference "Graph window" P.17

No.	Item		Description	
❹	Creating a program		You can create a pressure 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 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 "8.6.6 AFC and APC Control Ranges" P.329
			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
❺	Total Time		Displays the total time of the program.	

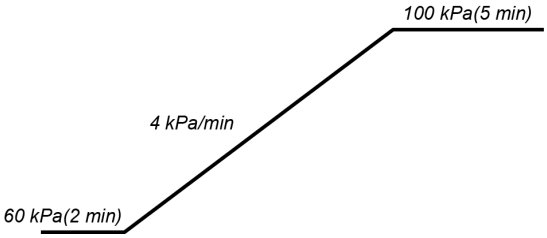
Creating a column inlet press program

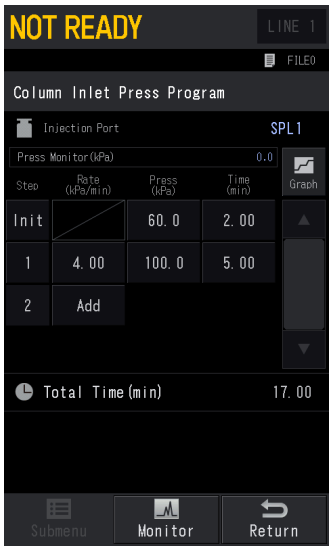
• Screen terminology (1-ramp pressure program)



Initial pressure (PRSS) ····· P1
Initial pressure hold time (TIME) ····· a
Program rate (RATE) ····· $\frac{P2-P1}{b}$
Final pressure (PRS) ····· P2
Final pressure hold time (TIM) ····· c

• Example for 1-ramp pressure program



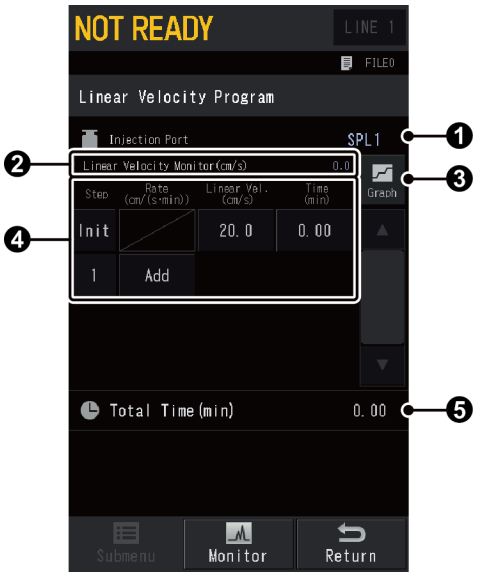


7.4.6 [Linear Velocity Program] Screen

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.

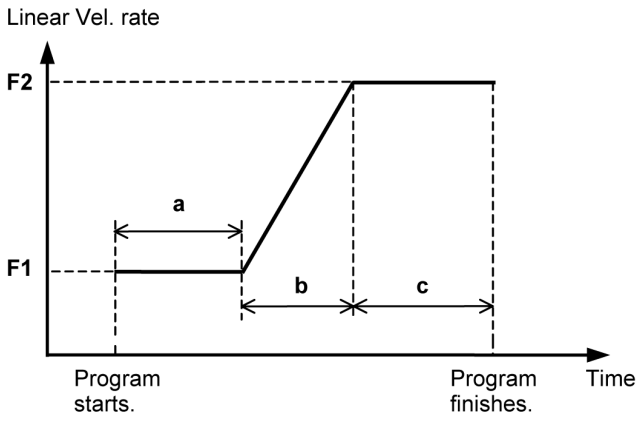


No.	Item	Description
❶	Injection Port	Displays active injection port.
❷	Linear Velocity Monitor	Displays the current velocity.

No.	Item		Description	
❸	Graph (Graph)		You can see set linear velocity program in graph form. Reference "Graph window" P.17	
❹	Creating a program		You can create a linear velocity 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 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 "8.6.6 AFC and APC Control Ranges" P.329
			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
❺	Total Time		Displays the total time of the program.	

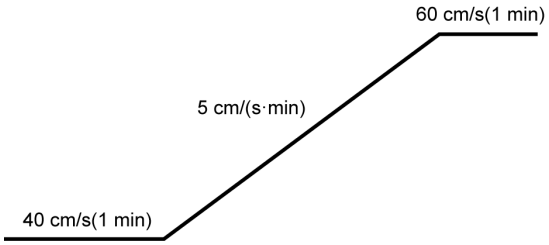
Creating a linear velocity program

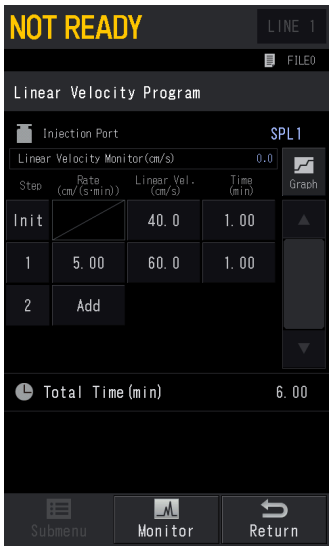
• Screen terminology (1-ramp velocity program)



Initial linear vel. rate (VELCTY) ····· V1
Initial linear vel. rate hold time (TIME) ····· a
Program rate (RATE) ····· $\frac{V2-V1}{b}$
Final linear vel. rate (VEL) ····· V2
Final linear vel. rate hold time (TIM) ····· c

• Example for 1-ramp velocity program



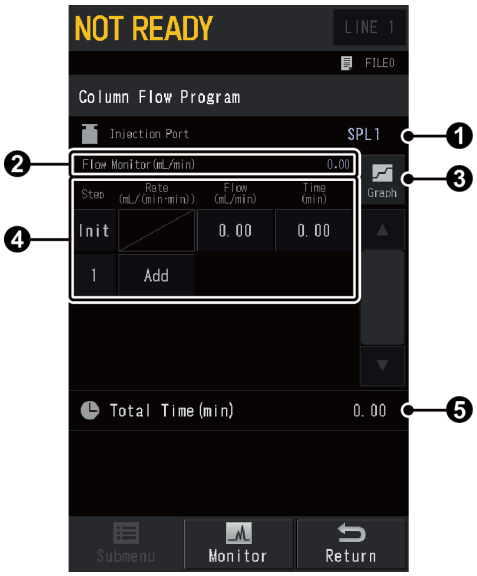


7.4.7 [Column Flow Program] Screen

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.

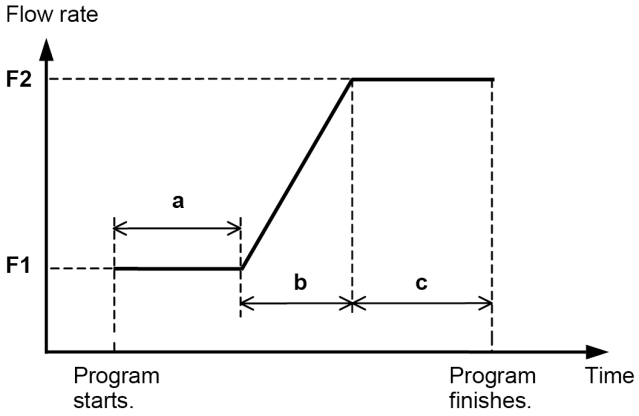


No.	Item	Description
❶	Injection Port	Displays active injection port.
❷	Flow Monitor	Displays the current column flow.

No.	Item		Description	
❸	Graph (Graph)		You can see the set flow program in graph form. Reference "Graph window" P.17	
❹	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 "8.6.6 AFC and APC Control Ranges" P.329
			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
❺	Total Time		Displays the total time of the program.	

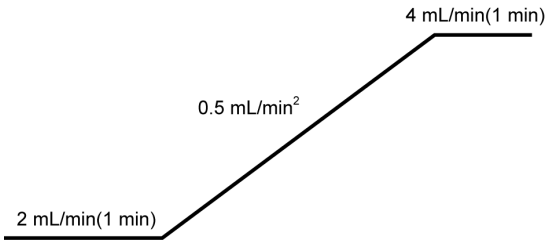
Creating a column flow program

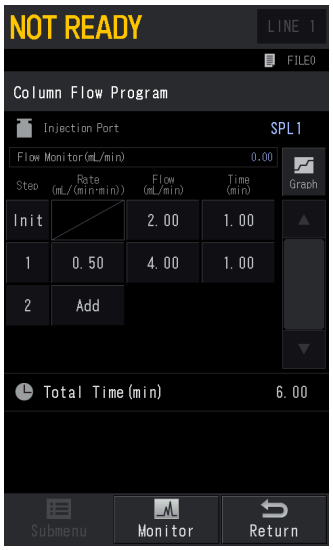
• Screen terminology (1-ramp flow program)



Initial flow rate (FLOW)····· F1
Initial flow rate hold time (TIME) ····· a
Program rate (RATE) ····· $\frac{F2-F1}{b}$
Final flow rate (FLW) ····· F2
Final flow rate hold time (TIM) ····· c

• Example for 1-ramp flow program



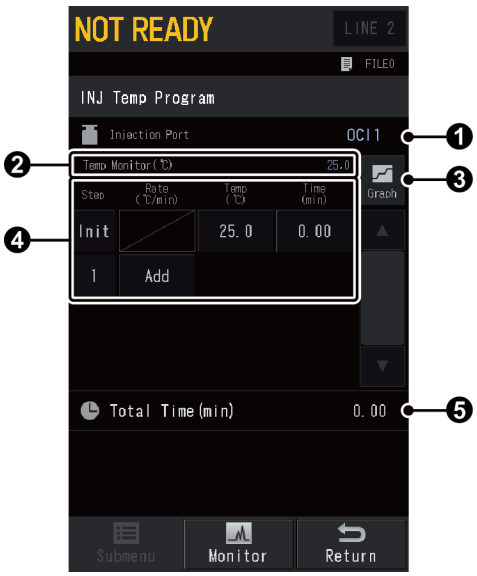


7.4.8 [INJ Temp Program] Screen

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 system 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
❶	Injection Port	Displays active injection port.

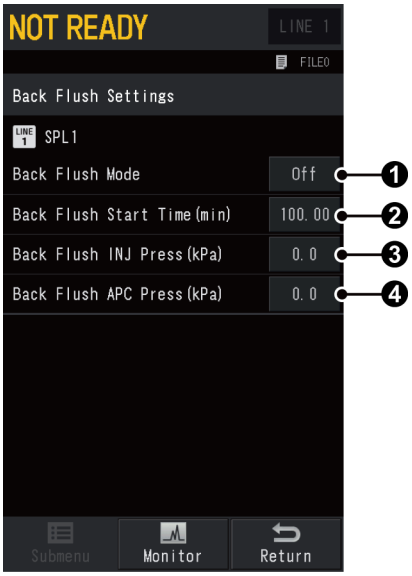
No.	Item		Description	
❷	Temp Monitor		Displays the current temperature.	
❸	 (Graph)		You can see the set temperature program in graph form. Reference "Graph window" P.17	
❹	Creating a program		You can create a temperature program (1 to 7 steps).	
		Step	Displays the number of steps currently set. Press [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
❺	Total Time		Displays the total time of the program.	

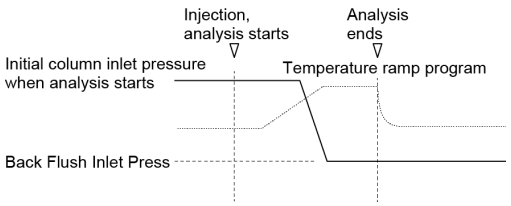
7.4.9 [Back Flush Settings] Screen

[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.340



No.	Item	Description	
❶	Back Flush Mode	Sets this item when using back flush function for analysis.	
		Items	• Off Disables back flush. • On Enables back flush. The system maintains the set value in ❸ [Back Flush INJ Press] and ❹ [Back Flush APC Press] and continues to blow the carrier gas back toward the column inlet even after analysis. The pressure returns to the value set at the start of the analysis when the system starts AOC-20 series for the next analysis. 
		Default	Off
❷	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	
❸	Back Flush INJ Press	Sets the column inlet pressure during back flush mode.	
		Range	0.0 to 970.0 kPa
		Default	0.0 kPa
❹	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 ❹ [Back Flush APC Press] should be higher than that in ❸ [Back Flush INJ Press].
- Press PREP RUN (PREP RUN) on the control panel to return the pressure from back flush mode to the set value for normal mode.

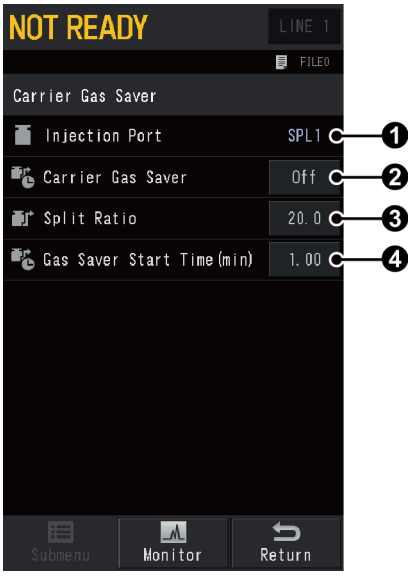
Reference "7.8.10 [PREP RUN] Screen" P.284

7.4.10 [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
❶	Injection Port	Displays active injection port.

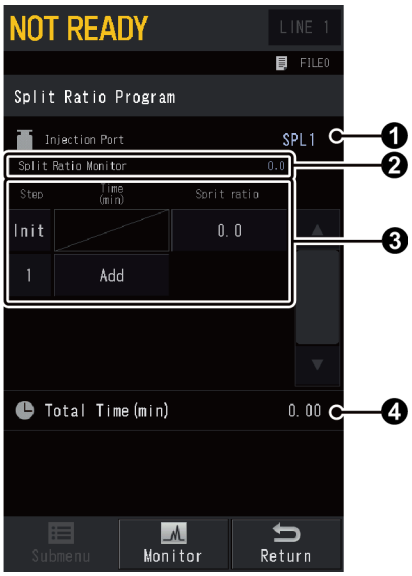
No.	Item	Description	
❷	Carrier Gas Saver	Select [On] to use settings to save carrier gas consumption (Carrier Gas Saver).	
		Items	Off, On
		Default	Off
❸	Split Ratio	Sets split ratio when using the carrier gas saver. Setting "0" closes the split flow line.	
		Range	0.0 to 9999.9
		Default	20.0
❹	Gas 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

7.4.11 [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.

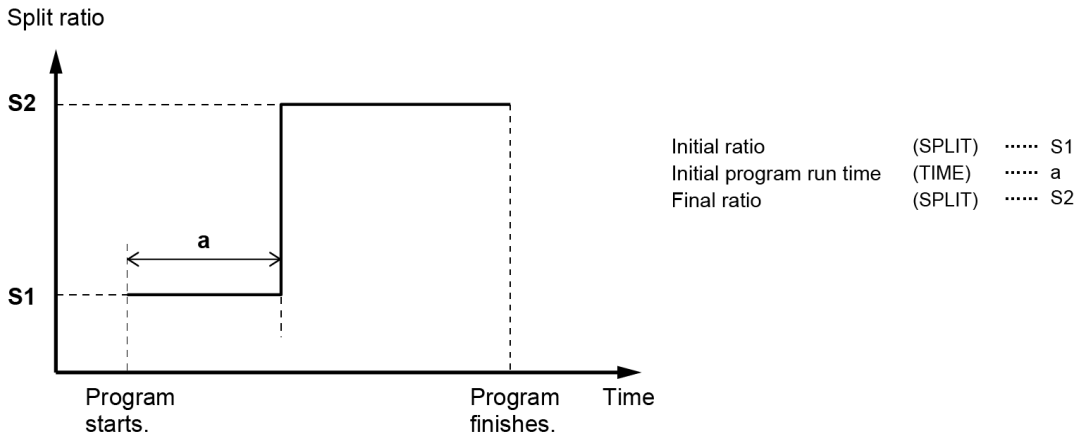


No.	Item	Description
❶	Injection Port	Displays active injection port.
❷	Split Ratio Monitor	Displays the current split ratio.

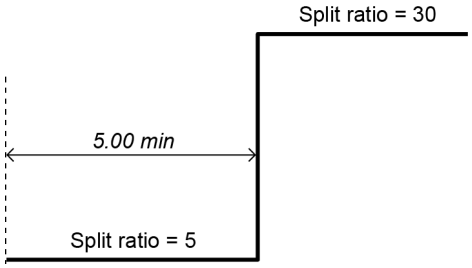
No.	Item		Description	
❸	Creating a program		You can create a split ratio program (1 to 7 steps).	
		Step	Displays the number of steps currently set. Press [Init] or the number to insert or delete the step. Inserted step includes the same content as the step of [Init] or specified number.	
		Time	Sets 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
			Default	-1.0
❹	Total Time		Displays the total time of the program.	

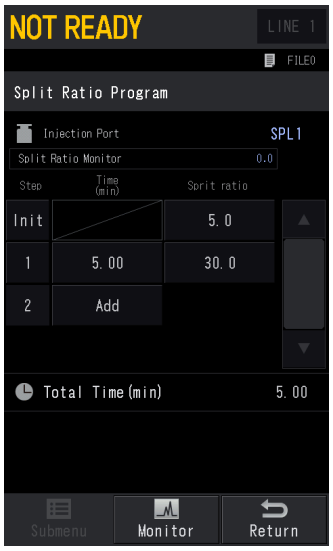
Creating a split ratio program

• Screen terminology (1-ramp)



• Example for 1-ramp split ratio program

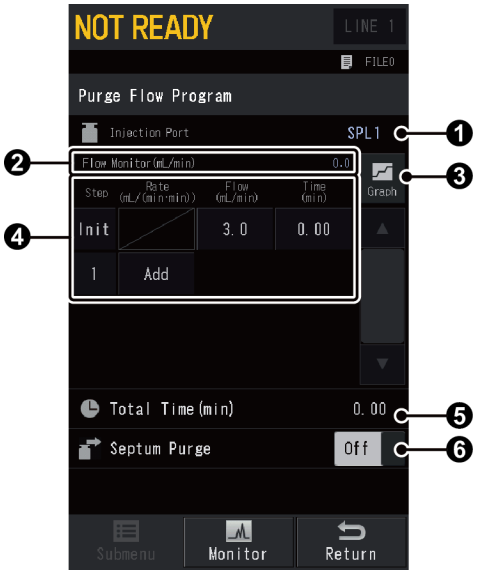




7.4.12 [Purge Flow Program] Screen

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
❶	Injection Port	Displays active injection port.
❷	Flow Monitor	Displays the current flow.
❸	Graph (Graph)	You can see the set flow program in graph form. Reference "Graph window" P.17

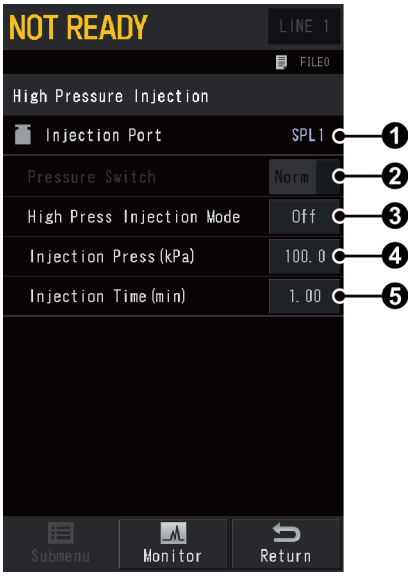
No.	Item		Description	
❹	Creating a program		You can create a purge flow program (1 to 7 steps).	
		Step	Displays the number of steps currently set. Press [Init] or the number to insert or delete the step. Inserted step includes the same content as the step of [Init] or specified number.	
		Rate	Sets 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	• When [Carrier Gas Type] is He, N2, or Ar 0.0 to 1300.0 mL/min • When [Carrier Gas Type] is H2 0.0 to 500.0 mL/min NOTE Control range is different depending on the inlet pressure or the total flow. Reference "8.6.6 AFC and APC Control Ranges" P.329
			Default	3.0 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
❺	Total Time		Displays the total time of the program.	
❻	Septum Purge		Select [Off] to stop septum purge.	
			Items	Off, On
			Default	On

7.4.13 [High Pressure Injection] Screen

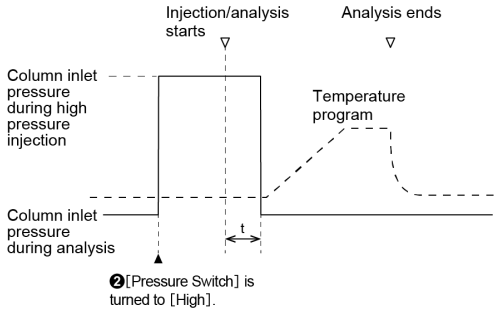
Press (HOME) - [Injection Port] - [Submenu] - [High Press Setting] to display [High Pressure Injection] screen.

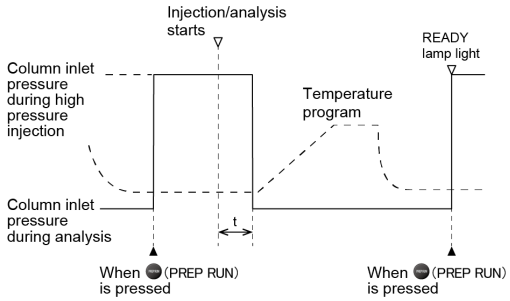
High pressure injection is a split/splitless injection method which keeps the column inlet pressure at a value higher than the analysis pressure for a specified period of time while the sample is injected. Then, the column inlet pressure returns to the normal analysis value. High pressure injection is 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	
❶	Injection Port	Displays active injection port.	
❷	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 ❸ [High Press Injection Mode] is set at [On] or [Auto].	
		Items	Default, High
		Default	-

<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">❸</td><td rowspan="3">High Press Injection Mode</td><td colspan="2">Sets high press injection mode.</td></tr>
<tr><td>Items</td><td>• Off
Disables high pressure injection.
• On
When ❷ [Pressure Switch] is set at [High], column inlet pressure is changed to the pressure for high pressure injection.
 

• Auto
Column inlet pressure is changed to the pressure for high pressure injection when you set ❷ [Pressure Switch] at [High] or you press PREP RUN (PREP RUN) on the control panel.
 
</td></tr>
<tr><td>Default</td><td>Off</td></tr>
<tr><td rowspan="3">❹</td><td rowspan="3">Injection Press</td><td colspan="2">Sets the inlet pressure for high pressure injection.</td></tr>
<tr><td>Range</td><td>0.0 to 970.0 kPa
Reference "8.6.6 AFC and APC Control Ranges" P.329</td></tr>
<tr><td>Default</td><td>100.0 kPa</td></tr>
<tr><td rowspan="3">❺</td><td rowspan="3">Injection Time</td><td colspan="2">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.</td></tr>
<tr><td>Range</td><td>0.00 to 9999.99 min</td></tr>
<tr><td>Default</td><td>1.00 min</td></tr>
</table>

7.4.14 [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 injector drastically increases when the solvent vaporizes. The pressure inside the injector may also increases 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.325

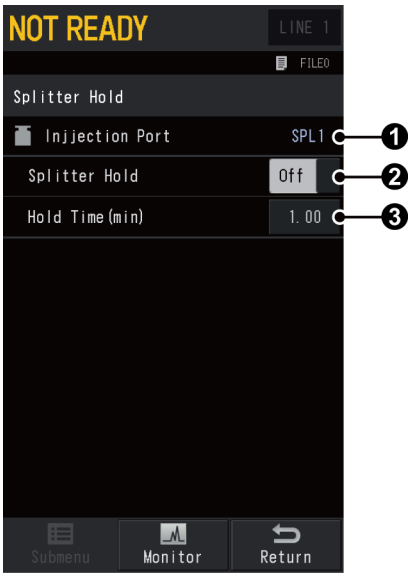
In the splitter hold mode, the voltage on the ESC is fixed right before the sample injection, which prevents the discharge of the sample at more than the specified split ratio.

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 system is ready, wait for several seconds, and inject the sample to start analysis.
- Not available when using autosampler or other sampler.



No.	Item	Description
❶	Injection Port	Displays active injection port.

No.	Item	Description	
❷	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
❸	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

7.5 Detector

Sets the detector temperature and the detector gas flow, etc.

The detectors which can be used with the system are shown below:

- Hydrogen flame ionization detector (FID)

  Reference • "7.5.1 [Detector] Screen (FID Tab)" P.162
  • "8.5.1 Hydrogen Flame Ionization Detector (FID)" P.312

- Thermal conductivity detector (TCD)

  Reference • "7.5.2 [Detector] Screen (TCD Tab)" P.167
  • "8.5.2 Thermal Conductivity Detector (TCD)" P.313

- Flame thermionic detector/Nitrogen phosphorous detector (FTD/NPD)

  Reference • "7.5.3 [Detector] Screen (FTD Tab) " P.171
  • "8.5.3 Flame Thermionic Detector/Nitrogen Phosphorous Detector (FTD/NPD)" P.313

- Flame photometric detector (FPD)

  Reference • "7.5.4 [Detector] Screen (FPD Tab)" P.177
  • "8.5.4 Flame Photometric Detector (FPD)" P.316

- Electron capture detector (ECD)

  Reference • "7.5.5 [Detector] Screen (ECD Tab)" P.182
  • "8.5.5 Electron Capture Detector (ECD)" P.318

- Barrier discharge ionization detector (BID)

  Reference • "7.5.6 [Detector] Screen (BID Tab)" P.187
  • "8.5.6 Barrier Discharge Ionization Detector (BID)" P.322

Configure detectors to be used in the analytical line before using the system.

Reference "7.7.2 [Line Configuration] Screen" P.220

7.5.1 [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	
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 the analytical line, the detector temperature and makeup gas flow can be controlled even when ❶ [Detector Control] is set at [Off]. When you select [Off] after the GC starts, the system stops detector signal output and supply of hydrogen and air to extinguish the flame. Select [On] to restart detector signal output. Select [On] in ❹ [Flame] to ignite the flame again.	
		Items	Off, On
		Default	On
❷	Tab	Detectors configured in analytical line are displayed. Press the tab to switch detectors.	

No.	Item	Description	
❸	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.242	
		Range	0.0 to 450.0 °C
		Default	25.0 °C
❹	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 ❺ [Auto Ignition] turned [Off], press [On] after the system is ready to ignite the flame.	
		Items	Off, On
		Default	Off
❺	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
❻	Auto Reignition	Select [On] to automatically re-ignite the flame when the system detects the extinguishment.	
		Items	Off, On
		Default	On
❼	Constant Flow (Column Flow + Makeup Gas Flow)	Select [On] to control the system 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.	
		Items	Off, On
		Default	Off

No.	Item		Description	
❽	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 system.	P.194
Makeup Program	Displays [DET Makeup Program] screen. Sets makeup gas flow programs.	P.192
H2 Program	Displays [DET H2 Program] screen. Sets hydrogen gas flow programs.	P.192
Air Program	Displays [DET Air Program] screen. Sets air flow programs.	P.192
Detector Gas Control	Displays [Detector Gas Control] screen. Turns On/Off detector gases and sets flows.	P.198

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.331

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 "7.5.1 [Detector] Screen (FID Tab)" P.162
2. Select [On] in [Detector] and [Auto Ignition] on [GC Start Sequence] screen.
   Reference "7.1.1 [GC Start Sequence] Screen" P.94
3. Press [GC Start].
   Control of the system 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 "7.5.1 [Detector] Screen (FID Tab)" P.162
2. Select [On] in [Detector] and [Off] in [Auto Ignition] on [GC Start Sequence] screen.
   Reference "7.1.1 [GC Start Sequence] Screen" P.94
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.94
2. Press [GC Start].
3. Select [On] in [Detector Control] on [Detector] screen.
   Reference "7.5.1 [Detector] Screen (FID Tab)" P.162

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.

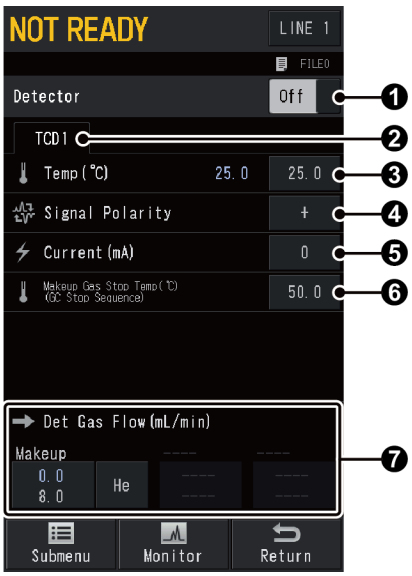
- Auto extinguishment
  Press [Stop GC] on [GC Stop Sequence] screen to stop supply of hydrogen and air automatically and extinguish the flame. When a program is running or [Stop Time] is set in [GC Stop Sequence] screen, the detector gas is automatically shut off at the end of the program, extinguishing 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.

7.5.2 [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	
❶	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 ❶ [Detector Control] is set at [On], the detector can be controlled.	
		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. 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.242	
		Range	0.0 to 400.0 °C
		Default	25.0 °C

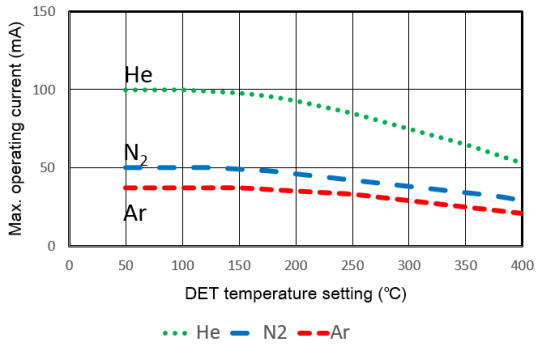
<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">❹</td><td rowspan="3">Signal Polarity</td><td colspan="2">Normally, set signal polarity to [+]. Set it to [-] when analyzing compounds with a thermal conductivity higher than the carrier gas because baseline peaks will be inverted (negative) if [+] is selected for these cases.</td></tr>
<tr><td>Items</td><td>-, +</td></tr>
<tr><td>Default</td><td>+</td></tr>
<tr><td rowspan="3">❺</td><td rowspan="3">Current</td><td colspan="2">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.

⚠ 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.

 
</td></tr>
<tr><td>Range</td><td>0 to 100 mA</td></tr>
<tr><td>Default</td><td>0 mA</td></tr>
</table>

No.	Item	Description	
❻	Makeup Gas Stop Temp	Sets a temperature at which makeup gas supply stops. The system 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 system starts to count the flow off time after the temperature reaches the set value in ❻ [Make Up Gas Stop Temperature]. • If the temperature is set in uncontrollable range, count of flow off time may not start and gas control may not stop.	
		Range	0.0 to 100.0 °C
		Default	50.0 °C

No.	Item		Description
	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 mL/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.
❼		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 ($\times 10^{-4}$ W・m^{-1}・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_2O	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 system.	P.194
Makeup Program	Displays [DET Makeup Program] screen. Sets makeup gas flow programs.	P.192

Item	Description	See also
Detector Gas Control	Displays [Detector Gas Control] screen. Turns On/Off detector gases and sets flows.	P.198
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.331

7.5.3 [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.	

<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">❸</td><td rowspan="3">Temp</td><td colspan="2">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.242</td></tr>
<tr><td>Range</td><td>0.0 to 450.0 °C</td></tr>
<tr><td>Default</td><td>25.0 °C</td></tr>
<tr><td rowspan="5">❹</td><td rowspan="3">Current</td><td colspan="2">Sets background current. This item is displayed when ❺ [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 system stabilizes. The alkaline source life can be shortened.
• Background current is adjusted when the current value is changed if ❶ [Detector Control] and ❻ [Power Controller] is set at [On].</td></tr>
<tr><td>Range</td><td>0.00 to 10.00 pA</td></tr>
<tr><td>Default</td><td>1.00 pA</td></tr>
<tr><td rowspan="3">Voltage</td><td colspan="2">Sets the voltage applied on the filament. This item is displayed when ❺ [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 system stabilizes. The alkaline source life can be shortened.</td></tr>
<tr><td>Range</td><td>0 to 100 %</td></tr>
<tr><td>Default</td><td>0 %</td></tr>
<tr><td rowspan="3">❺</td><td rowspan="3">Control Mode</td><td colspan="2">Sets control mode.</td></tr>
<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>

<table>
<tr><th>No.</th><th>Item</th><th>Description</th></tr>
<tr><td>❻</td><td>Power controller</td><td>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 ❺ [Control Mode] is set at [Voltage] and ❻ [Power Controller] is set at [Off], background current adjustment will not start even if you set ❶ [Detector Control] to [On].
• When ❺ [Control Mode] is set at [Current] and ❶ [Detector Control] is set at [Off], background current adjustment will not start even if you set ❻ [Power Controller] to [On]. Set ❹ [Current] and then set ❻ [Power Controller] to [On] to adjust background current automatically.

Items: Off, On
Default: Off</td></tr>
<tr><td>❼</td><td>Adjustment</td><td>Press [Start] to adjust the background current again without the current value change. [Complete] is displayed after the set time in ❽ [Adjustment Time] elapses. The system automatically perform adjustment when you change the value in ❹ [Current] This item is used when ❺ [Control Mode] is set at [Current].</td></tr>
<tr><td>❽</td><td>Adjustment Time</td><td>Sets adjustment time for background current. This item is used when ❺ [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.

Range: 0.00 to 9999.99 min
Default: 60.00 min</td></tr>
<tr><td>❾</td><td>Power</td><td>Displays the percentage (%) of the voltage applied on the filament to full power.</td></tr>
<tr><td>❿</td><td>Constant Flow (Column Flow + Makeup Gas Flow)</td><td>Select [On] to control the system 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.

Items: Off, On
Default: Off</td></tr>
</table>

<table>
<tr><th>No.</th><th colspan="2">Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="11">⓫</td><td colspan="2">Det Gas Flow</td><td colspan="2">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 (Helium) : about 10.0 to 30.0 mL/min
H2 : about 1.0 to 2.0 mL/min
Air : about 140.0 to 150.0 mL/min

• Phosphorus compound
Makeup (Helium) : about 10.0 to 30.0 mL/min
H2 : about 3.0 to 6.0 mL/min
Air : about 140.0 to 150.0 mL/min</td></tr>
<tr><td rowspan="4"></td><td rowspan="4">Makeup</td><td colspan="2">Sets makeup gas flow supplied to the detector to optimize its sensitivity. The gas is supplied upon the GC start.</td></tr>
<tr><td>Items</td><td>He, N2, Ar</td></tr>
<tr><td>Range</td><td>0.0 to 100.0 mL/min</td></tr>
<tr><td>Default</td><td>He, 27.5 mL/min</td></tr>
<tr><td rowspan="3">H2</td><td colspan="2">Used to generate rubidium radicals from alkaline source.</td></tr>
<tr><td>Range</td><td>0.0 to 30.0 mL/min</td></tr>
<tr><td>Default</td><td>1.5 mL/min</td></tr>
<tr><td rowspan="3">Air</td><td colspan="2">Used to generate rubidium radicals from alkaline source.</td></tr>
<tr><td>Range</td><td>0.0 to 1000.0 mL/min</td></tr>
<tr><td>Default</td><td>145.0 mL/min</td></tr>
</table>

Submenu

Item	Description	See also
Signal Settings	Displays [Signal Settings] screen. Sets the detector signal outputted from the system.	P.194
Makeup Program	Displays [DET Makeup Program] screen. Sets makeup gas flow programs.	P.192
H2 Program	Displays [DET H2 Program] screen. Sets hydrogen gas flow programs.	P.192
Air Program	Displays [DET Air Program] screen. Sets air flow programs.	P.192
Detector Gas Control	Displays [Detector Gas Control] screen. Turns On/Off detector gases and sets flows.	P.198

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.331

Setting of background current

Reference "About background current" P.315

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 system 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 system 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 system 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.

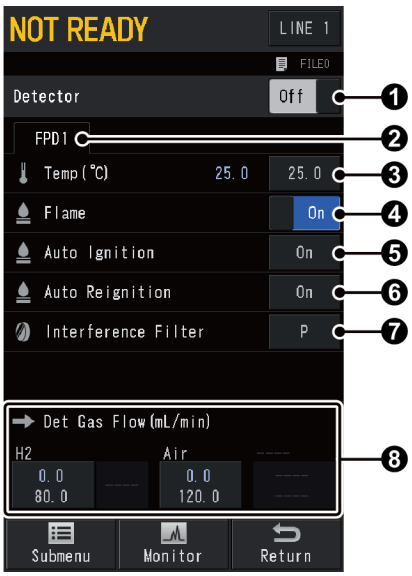
> **NOTE**
> - Set the temperatures and flows at the same values as the previous background adjustment, and then press [Start]. If the conditions are different, background current is not adjusted to the same level.
> - The system does not start background adjustment even after you set [Current] at the 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.

7.5.4 [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	
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 can be controlled even when ❶ [Detector Control] is set at [Off]. When you select [Off] after the GC starts, the system stops detector signal output and supply of hydrogen and air to extinguish the flame. Select [On] to restart detector signal output. Select [On] in ❹ [Flame] to ignite the flame again.	
		Items	Off, On
		Default	On
❷	Tab	Detectors configured in analytical line are displayed. Press the tab to switch detectors.	

<table>
<tr><th>No.</th><th>Item</th><th>Description</th></tr>
<tr><td>❸</td><td>Temp</td><td>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.242
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.
Range: 0.0 to 450.0 °C
Default: 25.0 °C</td></tr>
<tr><td>❹</td><td>Flame</td><td>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 ❺ [Auto Ignition] turned [Off], press [On] after the system is ready to ignite the flame.
Items: Off, On
Default: Off</td></tr>
<tr><td>❺</td><td>Auto Ignition</td><td>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.
Items: Off, On
Default: On</td></tr>
<tr><td>❻</td><td>Auto Reignition</td><td>Select [On] to automatically re-ignite the flame when the system detects the extinguishment.
Items: Off, On
Default: On</td></tr>
<tr><td>❼</td><td>Interference Filter</td><td>Select a filter suitable for the target element. Select the same filter as one attached to the system.
Items:
• P: For phosphorus
• S: For sulfur
• Sn: For tin
Default: P</td></tr>
</table>

<table>
<tr><th>No.</th><th colspan="2">Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">❽</td><td colspan="2">Det Gas Flow</td><td colspan="2">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</td></tr>
<tr><td rowspan="3"></td><td rowspan="3">H2</td><td colspan="2">Sets hydrogen gas flow used for the hydrogen flame which burns in the detector. The supply starts right before the ignition.</td></tr>
<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>
<tr><td rowspan="3"></td><td rowspan="3">Air</td><td colspan="2">Sets air flow used for the hydrogen flame which burns in the detector. The supply starts right before the ignition.</td></tr>
<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>

Submenu

Item	Description	See also
Signal Settings	Displays [Signal Settings)] screen. Sets the detector signal outputted from the system.	P.194
H2 Program	Displays [DET H2 Program] screen. Sets hydrogen gas flow programs.	P.192
Air Program	Displays [DET Air Program] screen. Sets air flow programs.	P.192
Detector Gas Control	Displays [Detector Gas Control] screen. Turns On/Off detector gases and sets flows.	P.198
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.331

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 "7.5.4 [Detector] Screen (FPD Tab)" P.177
2. Select [On] in [Detector] and [Auto Ignition] on [GC Start Sequence] screen.
   Reference "7.1.1 [GC Start Sequence] Screen" P.94
3. Press [GC Start].
   Control of the system 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 "7.5.4 [Detector] Screen (FPD Tab)" P.177
2. Select [On] in [Detector] and [Off] in [Auto Ignition] on [GC Start Sequence] screen.
   Reference "7.1.1 [GC Start Sequence] Screen" P.94
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.94
2. Press [GC Start].
3. Select [On] in [Detector Control] on [Detector] screen.
   Reference "7.5.4 [Detector] Screen (FPD Tab)" P.177
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.

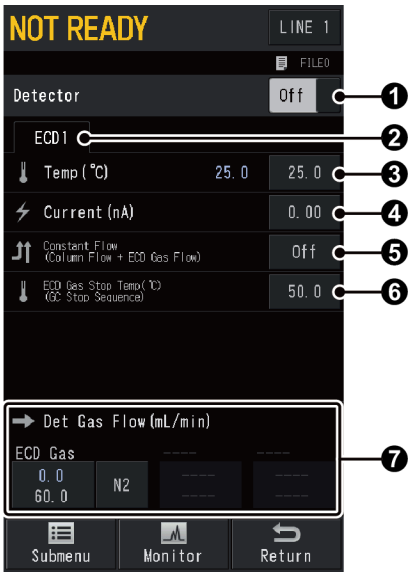
NOTE Normally, you do not need to turn the adjustment knob on the top surface of the flow controller because it is set at an optimal value when the system is shipped or installed. During replacement, do not turn the adjustment knob.
If you turn the adjustment knob by mistake, adjust it by checking the actual value at the connecting part.

7.5.5 [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.242	
		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 system can perform Auto Zero.	
		Range	0.0 to 3.50 nA
		Default	2.00 nA
❺	Constant Flow (Column Flow + ECD Gas Flow)	Select [On] to control the system 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 system 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

<table>
<tr><th>No.</th><th colspan="2">Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">❼</td><td colspan="2">Det Gas Flow</td><td colspan="2">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. 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 (N_2), ❺ [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.186</td></tr>
<tr><td></td><td>ECD Gas</td><td colspan="2">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</td></tr></table></td></tr>
</table>

Submenu

Item	Description	See also
Signal Settings	Displays [Signal Settings] screen. Sets the detector signal outputted from the system.	P.194
ECD Gas Program	Displays [DET ECDGas Program] screen. Sets ECD gas flow programs.	P.192
Detector Gas Control	Displays [Detector Gas Control] screen. Turns On/Off detector gases and sets flows.	P.198
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.331

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 system 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 to 50 °C higher than column oven temperature. Remember that the maximum operating temperature of ECD is 350 °C.

Reference "7.5.5 [Detector] Screen (ECD Tab)" P.182

- 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 system 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 system need to supply sweep gas flowing at 5 to 10 mL/min to ECD even while the system 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.97

2. Press (HOME) - [Detector] - [Submenu] - [Detector Gas Control].

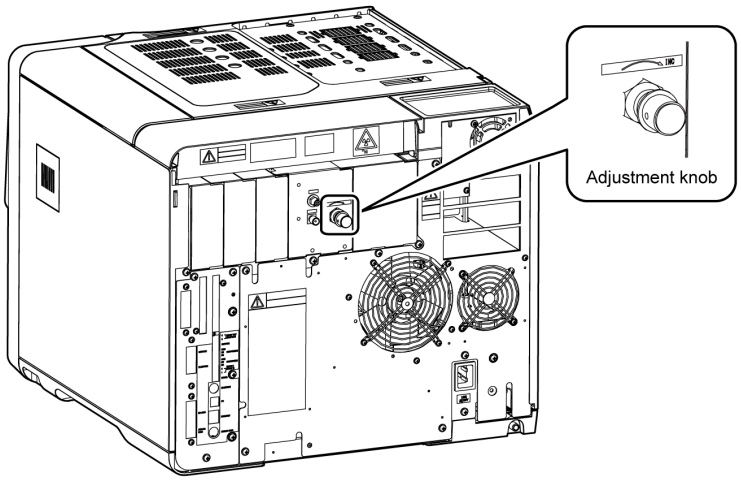
   [Detector Gas Control] screen appears.

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).



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.

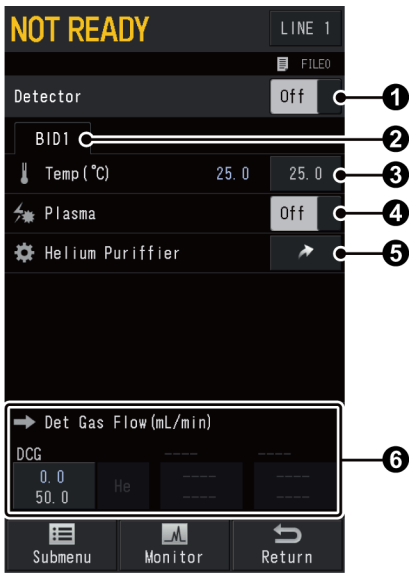
> **NOTE** If [ECD Gas] is not set at [On], ECD gas flow does not reach the set flow on the next startup.

7.5.6 [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	
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 the analytical line, the detector temperature and DCG can be controlled even when ❶ [Detector Control] is set at [Off]. When you select [Off] after the GC starts, the system stops detector signal output and turns on the plasma. Select [On] to restart detector signal output. Select [On] in ❹ [Plasma] to turn on the plasma again.	
		Items	Off, On
		Default	On
❷	Tab	Detectors configured in analytical line are displayed. Press the tab to switch detectors.	

<table>
<tr><th>No.</th><th>Item</th><th>Description</th></tr>
<tr><td>❸</td><td>Temp</td><td>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.242
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.
Range: 0.0 to 350.0 °C
Default: 25.0 °C</td></tr>
<tr><td>❹</td><td>Plasma</td><td>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 system is illuminating the plasma.
Items: Off, On
Default: Off</td></tr>
<tr><td>❺</td><td>Helium Purifier</td><td>Displays [Helium Purifier] screen.
Reference "7.6.7 [Helium Purifier] Screen" P.218</td></tr>
</table>

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Description</th></tr>
<tr><td rowspan="2">❻</td><td colspan="2">Detector Gas</td><td>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><tr><th>Column Flow</th><th>Detector Gas Flow (Recommended)</th></tr><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></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 system 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.</td></tr>
<tr><td></td><td>DCG</td><td>Sets DCG flow supplied to the detector to optimize its sensitivity. The gas is supplied upon the GC start.

NOTE
The system continuously consumes sweep gas (helium gas flowing at 5 to 10 mL/min) even while the system 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.190
• "7.6.7 [Helium Purifier] Screen" P.218
<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></td></tr>
</table>

Submenu

Item	Description	See also
Signal Settings	Displays [Signal Settings] screen. Sets the detector signal outputted from the system.	P.194
DCG Program	Displays [DET DCG Program] screen. Sets DCG flow programs.	P.192
Detector Gas Control	Displays [Detector Gas Control] screen. Turns On/Off detector gases and sets flows.	P.198
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.331

BID sweep gas

The system need to supply sweep gas flowing at 5 to 10 mL/min to BID even while the system 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.97

2. Press (HOME) - [Detector] - [Submenu] - [Detector Gas Control].

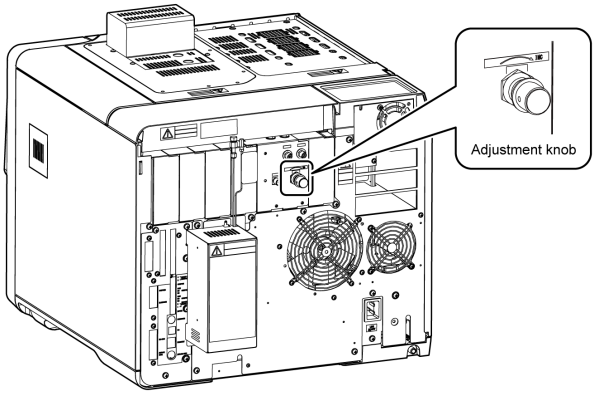
   [Detector Gas Control] screen appears.

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 system 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.

7.5.7 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.

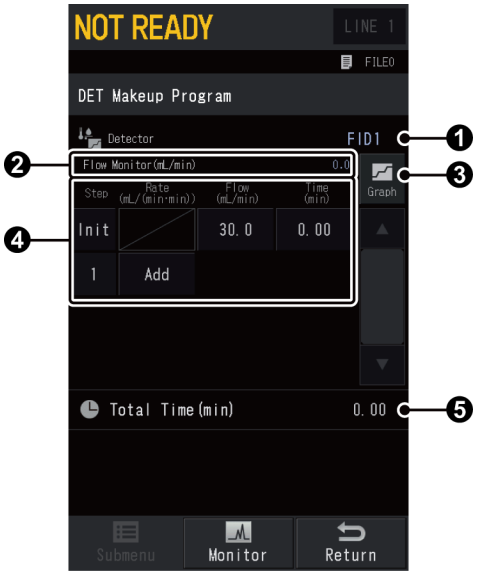
This section describes FID Makeup Program screen as an example.

Reference See "7.4.7 [Column Flow Program] Screen" P.147 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.

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	-	-	-



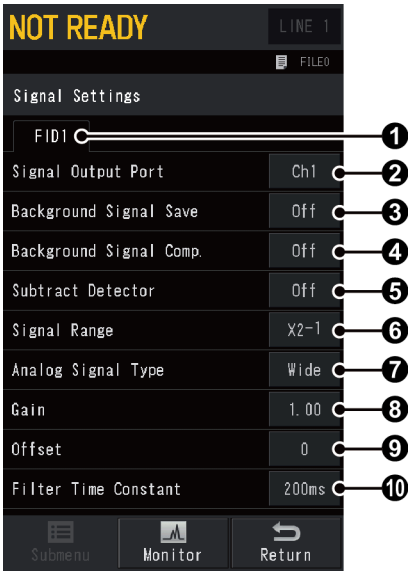
No.	Item	Description
❶	Detector	Displays active detector.
❷	Flow Monitor	Displays the current flow.
❸	Graph (Graph)	You can see the set program in graph form. Reference "Graph window" P.17

No.	Item		Description
❹	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.
❺	Total Time		Displays the total time of the program.

7.5.8 [Signal Settings] Screen

Press (HOME) - [Detector] - [Submenu] - [Signal Settings] to display [Signal Settings] screen.

Sets the detector signal outputted from the system.

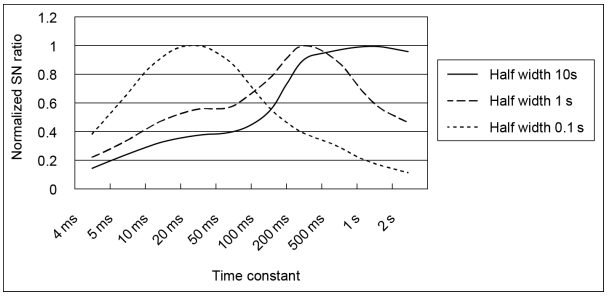


No.	Item	Description	
❶	Tab	Displays the name of detector currently set. When several detectors are installed in the system, press a tab to switch detectors.	
❷	Signal Output Port	Sets the channel for detector signal outputted from the system. The system can output digital and analogue signal and has 4 channels in total. The system 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
❸	Background Signal Save	Baseline signals obtained from blank run (not using sample) can be saved as background baseline in the system memory. Use this function if the baseline fluctuates considerably during programmed analysis. Reference "Background signal save/comp." P.197	
		Items	Off, Buff1, Buff2
		Default	Off

<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">❹</td><td rowspan="3">Background Signal Comp.</td><td colspan="2">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.197</td></tr>
<tr><td>Items</td><td>Off, Buff1, Buff2</td></tr>
<tr><td>Default</td><td>Off</td></tr>
<tr><td rowspan="3">❺</td><td rowspan="3">Subtract Detector</td><td colspan="2">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 system acquires signals from each detector at the same time and calculates the difference between them to provide stable baselines.</td></tr>
<tr><td>Items</td><td>Off, DET#1, DET#2, DET#3, DET#4</td></tr>
<tr><td>Default</td><td>Off</td></tr>
<tr><td rowspan="3">❻</td><td rowspan="3">Signal Range</td><td colspan="2">Multiplies the analog signal by the coefficient "$10^{-\times}$" when ❼ [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 $\times1$➡$\times10^{-1}$ or from $\times10^{-2}$➡$\times10^{-3}$ to decrease the intensity. If the peak is too small and the system cannot detect weak peaks, for example, change the setting from $\times10^{-1}$➡$\times1$ or from $\times10^{-3}$➡$\times10^{-2}$ to increase the intensity.
Multiplies the analog signal by the coefficient "$2^{-\times}$" when ❼ [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 $\times1$➡$\times2^{-1}$ and from $\times2^{-2}$➡$\times2^{-3}$ to decrease the intensity. If the peak is too small and the system cannot detect weak peaks, for example, change the setting from $\times2^{-1}$➡$\times1$ or from $\times2^{-3}$➡$\times2^{-2}$ to increase the intensity.
In case of the digital signal, the signal is always outputted with $\times1$.</td></tr>
<tr><td>Items</td><td>• When ❼ [Analog Signal Type] is [Linear]
$\times1$, $\times10^{-1}$, $\times10^{-2}$, $\times10^{-3}$, $\times10^{-4}$
• When ❼ [Analog Signal Type] is [Wide]
$\times1$, $\times2^{-1}$, $\times2^{-2}$, $\times2^{-3}$, $\times2^{-4}$</td></tr>
<tr><td>Default</td><td>$\times2^{-1}$</td></tr>
</table>

No.	Item	Description	
❼	Analog Signal Type	Set this item when the system 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 system outputs compressed signal; then, the signal received by Chromatopac is decompressed. When connecting the system to C-R8A/C-R7A/C-R7A plus for the first time, or replacing Chromatopac, set ❷ [Signal Output Port] at [Off] and perform calibration (Z.Calib) by Chromatopac. ▶▶ Reference "8.9.2 Connecting to CHROMATOPAC" P.349
		Default	Wide
❽	Gain	Sets the detector signal gain.	
		Range	0.00 to 1000.00
		Default	1.00
❾	Offset	Sets the detector signal offset.	
		Range	-999999 to 999999
		Default	0

<table>
<tr><th>No.</th><th>Item</th><th>Description</th></tr>
<tr><td>⑩</td><td>Filter Time Constant</td><td>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></td></tr>
</table>

Background signal save/comp.

If the baseline fluctuates considerably during programmed analysis, the system can save baseline signals obtained from blank run (not using sample) as background baseline in the system memory, 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 (START) without sample injection.

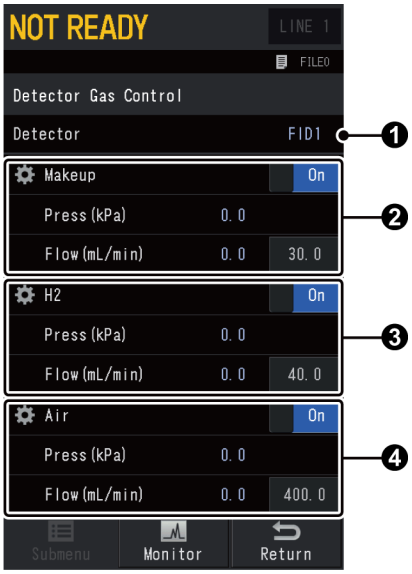
   The system starts analysis and the background baseline is saved.
4. Set [Background Signal Comp.] at [Buff 1] or [Buff 2], the same selection in [Background Signal Save] (procedure 2).
5. Inject a sample and press START (START).

   The system starts analysis and then outputs the signal after background signal compensation.

7.5.9 [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.



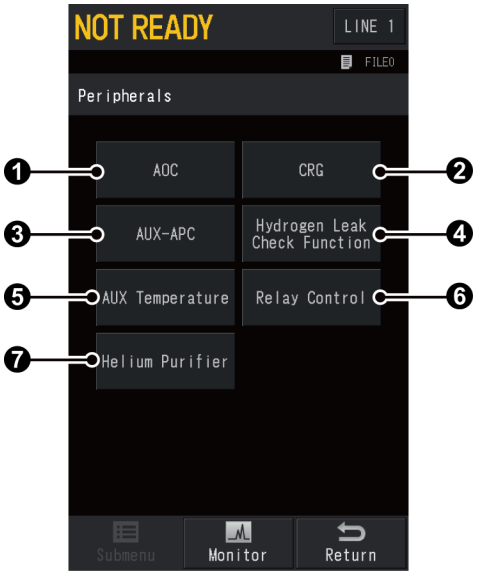
No.	Item		Description	
❶	Detector		Displays active detector.	
❷	Makeup		NOTE [ECD Gas] is displayed when the detector is ECD. And [DCG] is displayed when the detector is BID.	
		Makeup control	Displays the status of makeup gas supply. Select [Off] to stop the gas supply.	
			Items	Off, On
			Default	On
		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 • TCD: 8.0 mL/min

No.	Item		Description	
❸	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
❹	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

7.6 Peripherals

You can set up optional devices including Shimadzu Gas Chromatographic Auto Injector AOC-20i/AOC-20s (AOC-20 series) and CRG.

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



No.	Item	Description	See also
❶	AOC	Set this item when using AOC-20 series.	P.201
❷	CRG	Set this item when using low-temperature oven controller CRG.	P.210
❸	AUX-APC	Set this item when using APC other than detector gas (AUX-APC).	P.211
❹	Hydrogen Leak Check Function	Set this item when using hydrogen sensor.	P.214
❺	AUX Temperature	Sets temperature controllers other than column oven, injection port, and detector.	P.215
❻	Relay Control	Sets relay control.	P.216
❼	Helium Purifier	Set this item when using helium purifier.	P.218

7.6.1 [Auto Injector] Screen

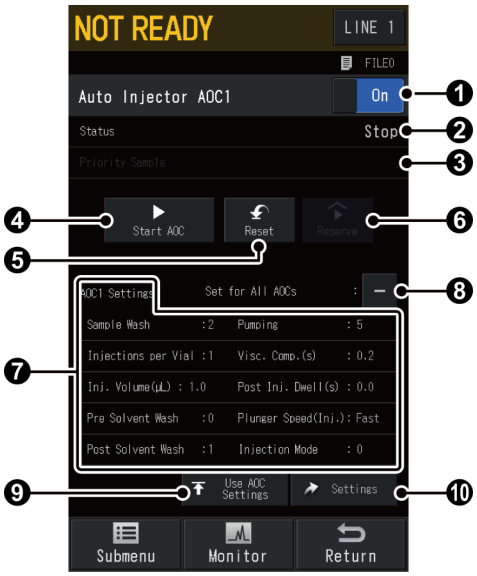
To display [Auto Injector AOC], press (HOME) - [Peripherals] - [AOC] after you install AOC-20 series on the system and configure AOC in the analytical line.

On this screen, you can check the status of AOC-20 series and set parameters for them.

Install AOC-20 series on the system 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 • "7.7.2 [Line Configuration] Screen" P.220

- For detailed setting procedures for AOC-20 series, refer to the AOC-20i/AOC-20s Instruction Manual and the AOC-20 Dual Injection System Instruction Manual.



No.	Item	Description	
❶	Auto Injector Control	Select [On] to control AOC-20 series with the system.	
		Items	Off, On
		Default	Off
❷	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 system is putting vial.
Waiting	AOC is waiting for analysis.

❸	Priority Sample	Displays vial No. of priority sample. Analysis for the displayed sample starts after the ongoing analysis are completed.

No.	Item	Description	
❹	Start AOC	Press [Start AOC] to start AOC-20 series operation and send a start signal to the GC upon an injection. [Stop AOC] is displayed when AOC-20 series is active.	
❺	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.	
❻	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
❼	AOC1 Settings	Displays the current set values for AOC-20 series.	
❽	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.	
❾	Use AOC Settings	Import parameters set on AOC-20 series to the system. Use this function when you change settings with AOC-20 series.	
❿	Settings	Displays [AOC Settings] screen. Sets AOC-20 series. ▶▶ Reference "[AOC Settings] Screen" P.203	

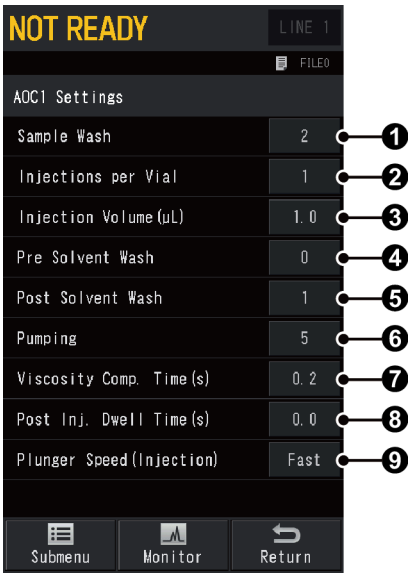
Submenu

Item	Description	See also
Overlap	Displays [Overlap] screen.	P.207
Auto Sampler Setting	Displays [Auto Sampler Setting] screen.	P.209
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) - [Peripherals] - [AOC] - [Settings] to display [AOC Settings] screen.

You can set basic parameters for AOC-20 series.



No.	Item	Description	
❶	Sample Wash	Sets the number of times to rinse the syringe with sample before injection.	
		Range	0 to 99
		Default	2
❷	Injections per Vial	Sets the number of injections to analyze the sample several times.	
		Range	1 to 99
		Default	1
❸	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	
❹	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
❺	Post Solvent Wash	Sets the number of times to rinse the syringe with solvent after injection.	
		Range	0 to 99
		Default	1
❻	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
❼	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
❽	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
❾	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.205

■ [AOC Advanced Settings] Screen

Press (HOME) - [Peripherals] - [AOC] - [Settings] - [Submenu] - [Advanced Settings] to display [AOC Advanced Settings] screen.

You can set advanced parameters for AOC-20 series.

No.	Item	Description	
❶	Syringe Injection Speed	Sets syringe insertion speed.	
		Items	Slow, Fast
		Default	Fast
❷	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.209	
		Items	1, 3
		Default	1
❸	Solvent Selection	Selects solvent to be used. This item is available when ❷ [Number of Solvent Vials] is set at [3] or the autosampler AOC-20s is in use. ▶▶ Reference "[Auto Sampler Setting] Screen" P.209	
		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	
❹	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
❺	Plunger Speed (Suction)	Sets the plunger speed (suction) during sample injection.	
		Items	Slow, Mid, Fast
		Default	Fast
❻	Plunger Speed (Wash)	Sets the plunger speed during rinse with sample or pumping.	
		Items	Slow, Mid, Fast
		Default	Fast
❼	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
❽	Syringe Height (Low)	Sets the syringe height when it moves down to a sample vial (moves syringe down from default).	
		Range	• ⓫ [Vial Type] is [1.5 mL] 0 to 2 mm • ⓫ [Vial Type] is [4 mL] 0 to 10 mm
		Default	0 mm
❾	Syringe Injection Position	Sets the syringe height when it moves down for sample injection.	
		Range	0 to 22 mm
		Default	0 mm
❿	Multi Injection Count	Sets the number of injections for one analysis.	
		Range	1 to 99 times
		Default	1
⓫	Vial Type	Sets the vial type.	
		Items	1.5 mL, 4 mL
		Default	1.5 mL
⓬	Rack Type	Sets the rack type.	
		Items	Short, Long
		Default	Short

No.	Item	Description	
⓭	Syringe Type	Sets the syringe type.	
		Items	10 µL, 50 µL, 250 µL, 0.5 µL, 5 µL
		Default	10 µL
⓮	Suction Volume (Wash)	Sets the suction volume during rinse with sample and pumping.	
		Items	80 %, 60 %
		Default	80 %
⓯	Rack 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.209 • Maintenance Help	
		Range	0 to 2
		Default	1

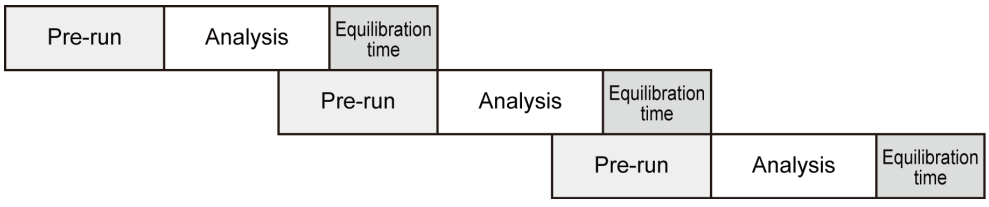
■ [Overlap] Screen

Press (HOME) - [Peripherals] - [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.

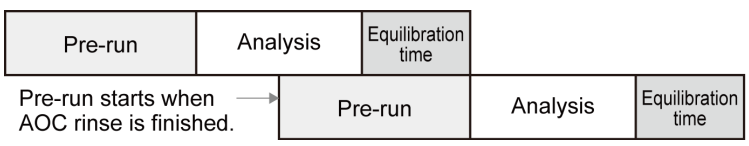
Without overlap

With overlap

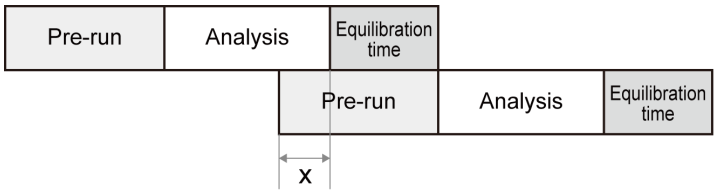


Overlap can be started at the following 3 timings.

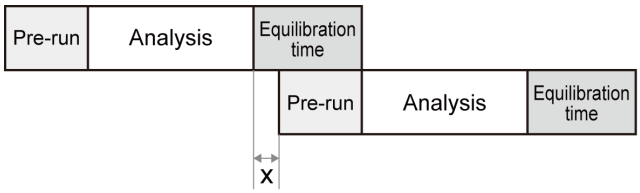
• Post-Injection



• Mid-Analysis (X minutes)



• Post-Analysis (X minutes)



NOTE When overlap function starts and pre-run is completed, AOC-20 series injects sample even if the system status is not "READY". Set an appropriate time.

On [Overlap] screen, you can set items related to Overlap function.

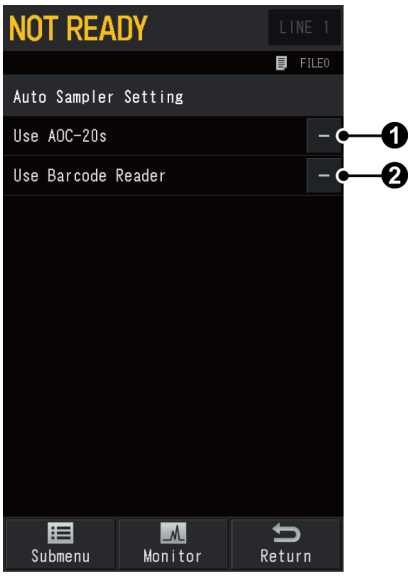
No.	Item	Description	
❶	Overlap Setting	Select [On] to use overlap function.	
		Items	Off, On
		Default	Off
❷	Post-Injection	Check to start pre-run for the next vial after the current vial is injected.	
❸	Mid-Analysis	Check to start pre-run for the next vial while the current vial being analyzed. Set the time to start the overlap.	

No.	Item	Description
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) - [Peripherals] - [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 ✔.
❷	Use Barcode Reader	To manage samples with barcode using a barcode reader, press – to change it to ✔.

Submenu

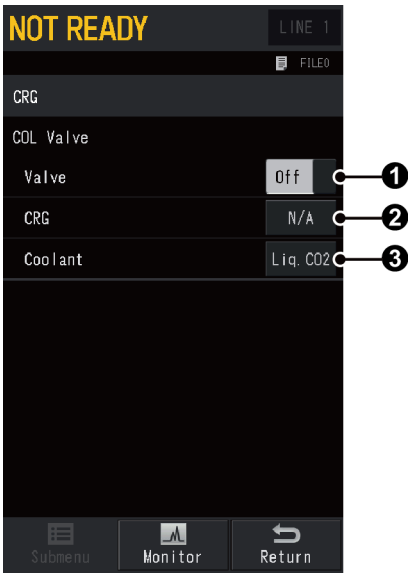
Item	Description
Allocation	Displays [Allocation] screen. Reference For details, refer to "3.4 Allocation" in User's Manual for AOC-20 Dual Injection System.

7.6.2 [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 CO_2 or liquid N_2). 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 CO_2, and -99.0 °C to 450.0 °C when using liquid N_2.

Reference "8.7.1 CRG CO_2/CRG N_2" P.336

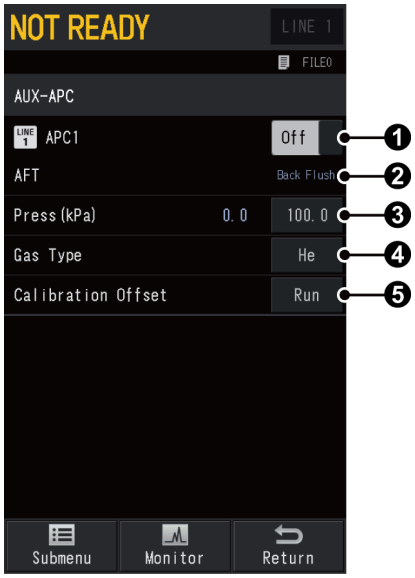


No.	Item	Description	
❶	Valve	Displays the control status of coolant valve. Press [Off] or [On] to switch the control status. Set at [On] to control the coolant valve. NOTE If you set ❶ [Valve] at [Off] after setting the temperature lower than room temperature using CRG, the system will not be READY 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
❸	Coolant	Sets coolant.	
		Items	Liq. CO2, Liq. N2
		Default	Liq. CO2

7.6.3 [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.



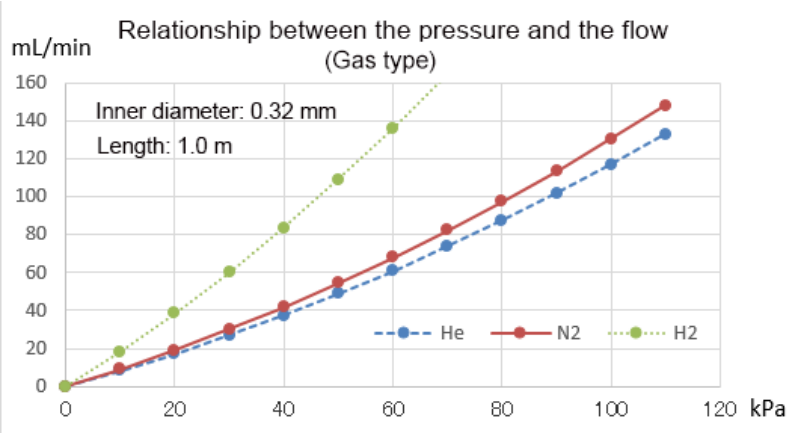
No.	Item	Description	
❶	AUX-APC Control	Displays the current status of AUX-APC control. Press [Off] or [On] to switch the control status. Set at [On] to control AUX-APC.	
		Items	Off, On
		Default	Off
❷	AFT	Displays AFT mode. Cannot set this item.	
❸	Press	Sets the pressure. Blue text is the actual value.	
		Range	0.0 to 970.0 kPa
		Default	100 kPa
❹	Gas Type	Selects the gas type supplied to the APC.	
		Items	He, N2, H2, Ar
		Default	He
❺	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

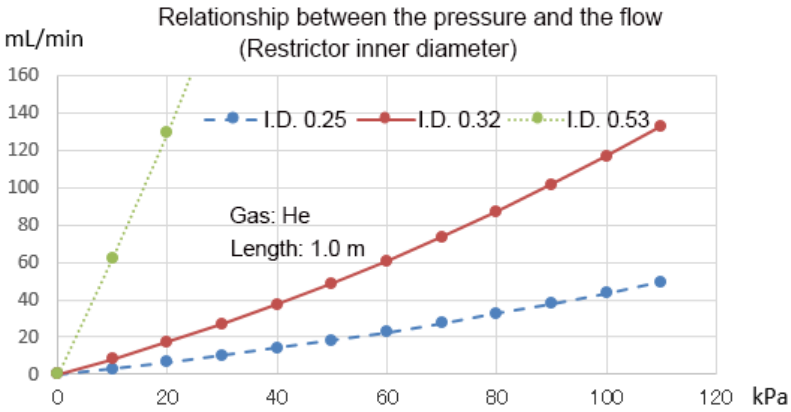
Item	Description	See also
Back Flush Setting	Displays [Back Flush Settings] screen. This item is displayed when AFT and the injection port are configured in the same analytical line.	P.151
APC Program	Displays [AUX-APC Pressure Program] screen.	P.213

Relationship between the pressure and the flow

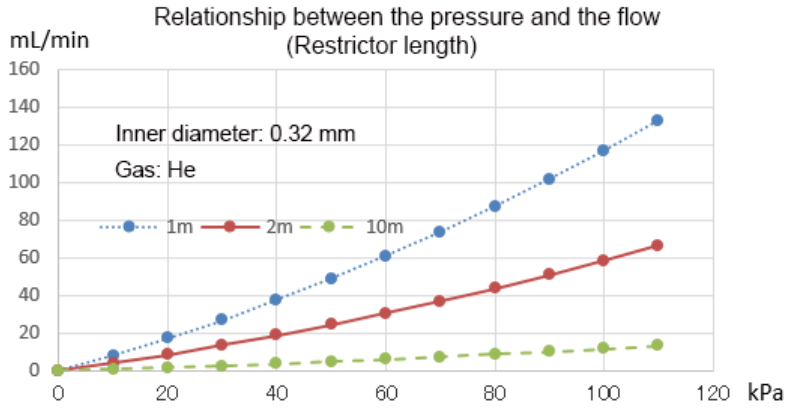
- Relationship between the pressure and the flow of different gas types



- Relationship between the pressure and the flow when using the restrictor with different inner diameters

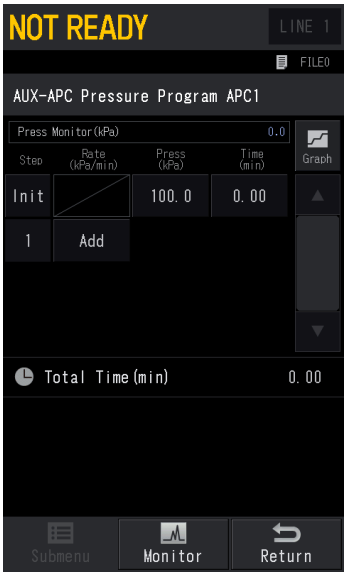


- Relationship between the pressure and the flow when using the restrictor with different length



■ [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).



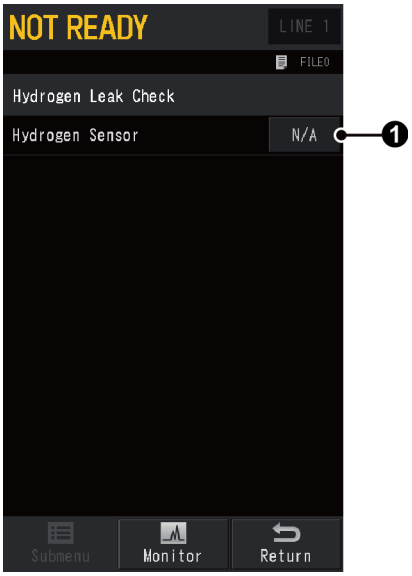
Reference Creating procedure is the same as analysis program. For details, see each program sections.
"7.4.5 [Column Inlet Press Program] Screen" P.143

7.6.4 [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) is connected.

Reference "8.7.3 Hydrogen Sensor" P.339

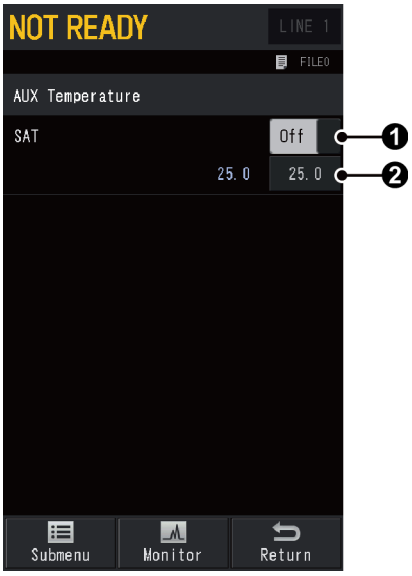


No.	Item	Description	
❶	Hydrogen Sensor	Set [Usable] to display (hydrogen sensor) icon on the screen, monitors hydrogen leak.	
		Items	N/A, Usable
		Default	N/A

7.6.5 [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	
❶	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
❷	Temp Setting	Sets the temperature. This can be set when ❶ [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

7.6.6 [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.356

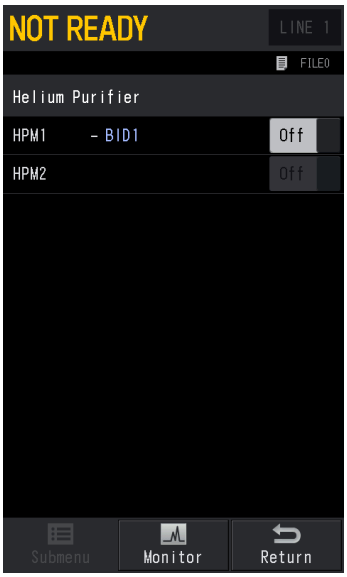
No.	Item	Description	
❶	OUTPUT1	Sets the type of relay output 1. Outputs the signal set in ❷ [Polarity] when the system is in the state set in [Item].	
		Items	Ready, Run, Start, Error, Disable
		Default	Ready
❷	Polarity	Sets the polarity of relay output 1. Relay switches to the set polarity when the system outputs signals.	
		Items	Open, Close
		Default	Open
❸	OUTPUT2	Sets the type of relay output 2. Outputs the signal set in ❹ [Polarity] when the system is in the state set in [Item].	
		Items	Ready, Run, Start, Error, Disable
		Default	Disable
❹	Polarity	Sets the polarity of relay output 2. Relay switches to the set polarity when the system outputs signals.	
		Items	Open, Close
		Default	Close

No.	Item	Description	
❺	OUTPUT3 (1C)	Sets the type of relay output 3. Outputs the signal set in ❻ [Polarity] when the system is in the state set in [Item]. When [Event91] is selected, you cannot set ❻ [Polarity].	
		Items	Ready, Run, Start, Error, Event91, Disable
		Default	Disable
❻	Polarity	Sets the polarity of relay output 3. Relay switches to the set polarity when the system outputs signals.	
		Items	NO, NC
		Default	NO
❼	OUTPUT4 (1C)	Sets the type of relay output 4. Outputs the signal set in ❽ [Polarity] when the system is in the state set in [Item]. When [Event92] is selected, you cannot set ❽ [Polarity].	
		Items	Ready, Run, Start, Error, Event92, Disable
		Default	Disable
❽	Polarity	Sets the polarity of relay output 4. Relay switches to the set polarity when the system outputs signals.	
		Items	NO, NC
		Default	NO
❾	INPUT1	Sets the type of relay input 1. Performs the set action when the signal set in ❿ [Polarity] is inputted.	
		Items	Start, Wait, PREP RUN, Stop, Disable
		Default	Start
❿	Polarity	Sets the polarity of relay input 1. Performs the action set in ❾ [INPUT1] when a signal with the set polarity is inputted.	
		Items	Open, Close
		Default	Close
⓫	INPUT2	Sets the type of relay input 2. Performs the set action when the signal set in ⓬ [Polarity] is inputted.	
		Items	Start, Wait, PREP RUN, Stop, Disable
		Default	Disable
⓬	Polarity	Sets the polarity of relay input 2. Performs the action set in ⓫ [INPUT2] 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.

7.6.7 [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 Settings

On this screen, you can set analysis conditions and line configuration.

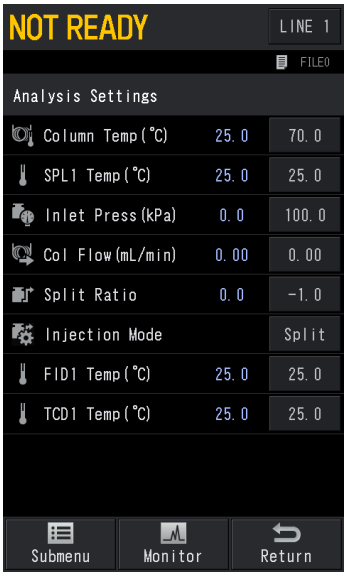
7.7.1 [Analysis Settings] Screen

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 "7.7.2 [Line Configuration] Screen" P.220

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.
- "7.3 Column" P.115
- "7.4 Injection Port" P.125
- "7.5 Detector" P.161

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.220

7.7.2 [Line Configuration] Screen

Press (HOME) - [Settings] - [Submenu] - [Line Configuration] to display [Line Configuration] screen.

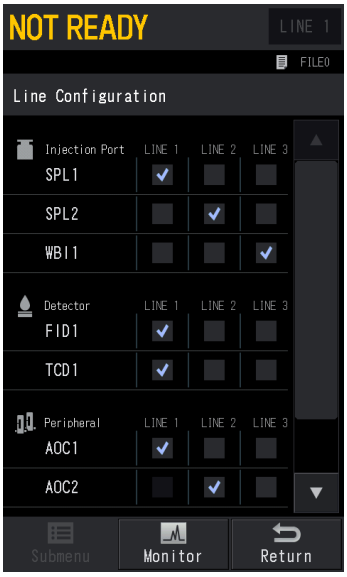
Line configuration is a function to configure a combination of units for analysis. The system can control each combination configured in analytical lines separately.

[Line Configuration] screen shows all units installed on the system. 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 system 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-20 series or AFT, configure them in the analytical line same as injection port and detector.

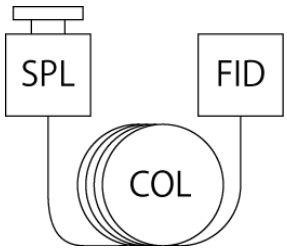


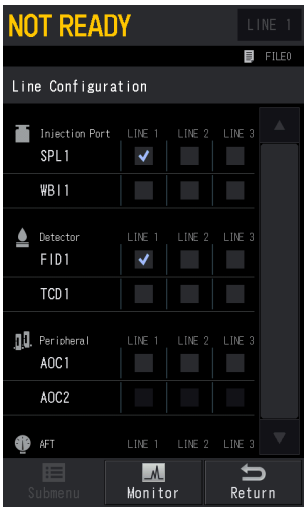
NOTE When using Heart-Cut or Detector Switching of AFT, set it at "LINE1".

Example 1 for line configuration

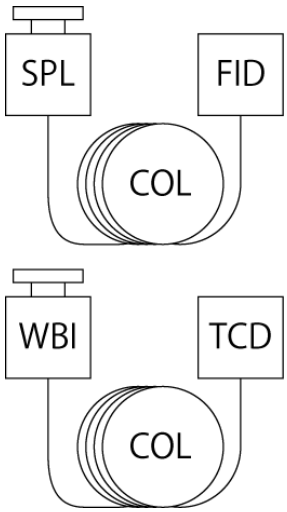
When the system equipped with SPL and WBI for injection port, and FID and TCD for detector

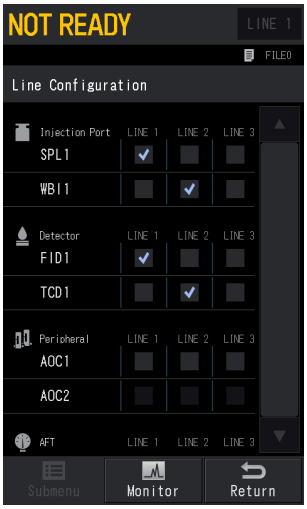
- When using SPL and FID
  Configure SPL and FID in [LINE 1].





- When using two combinations; SPL and FID, WBI and TCD
  Configure SPL and FID in [LINE 1], and WBI and TCD in [LINE 2].

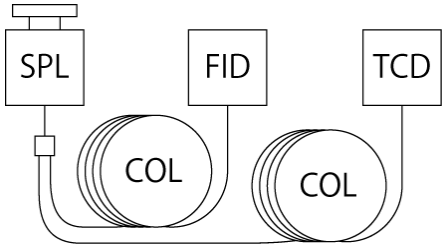


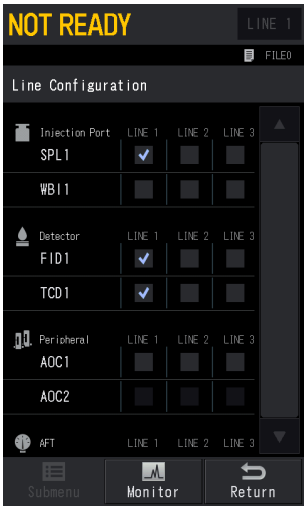


• When using SPL, FID, and TCD
Configure both detectors in [LINE 1].

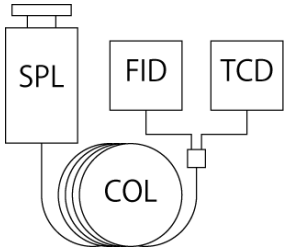
(1) When branching the column inlet to connect two columns

> **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.





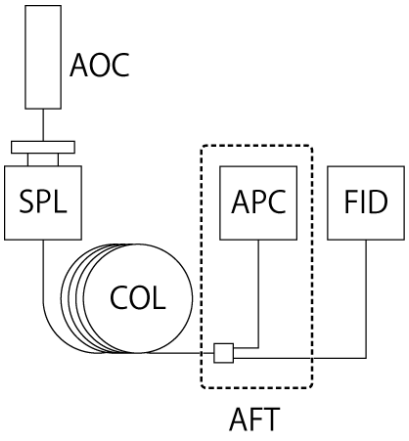
(2) When branching the column outlet

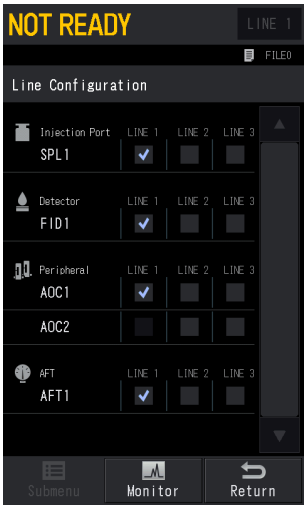


Example 2 for line configuration

When the system equipped with SPL for injection port, and FID for detector

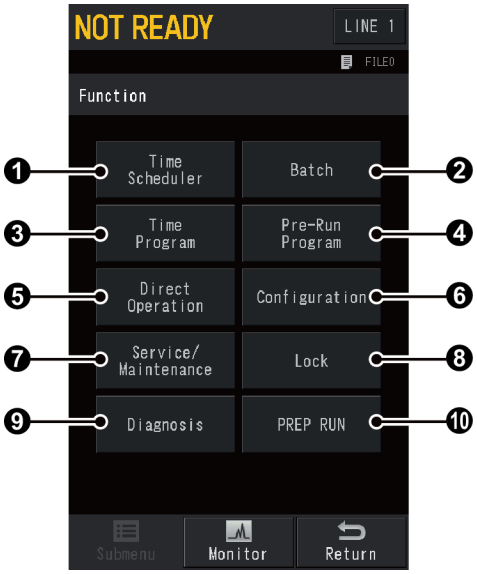
• When using SPL, FID, AOC, and AFT
Configure SPL, FID, AOC, and AFT in [LINE 1].





7.8 Function

You can set various items.

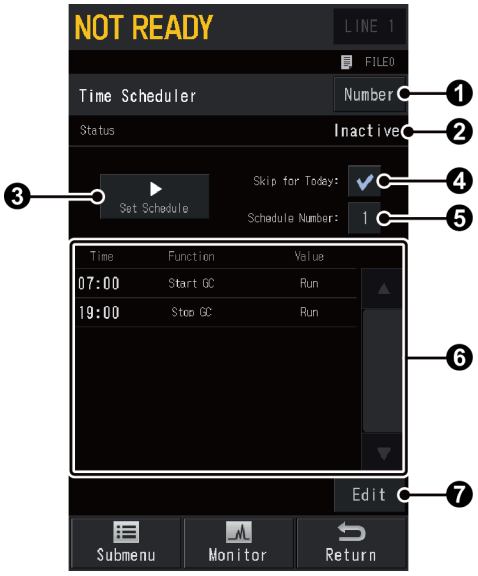


No.	Item	Description	See also
❶	Time Scheduler	Use this function to set analysis schedule.	P.224
❷	Batch	Use this function when you change analysis settings, etc. for each sample injection.	P.228
❸	Time Program	Set this item to perform Auto Zero or relay control during analysis.	P.231
❹	Pre-Run Program	Set this item to perform flow controller control or relay control before analysis (sample injection).	P.235
❺	Direct Operation	Set this item to run programs registered as events.	P.239
❻	Configuration	Set this item depending on the system usage.	P.240
❼	Service/Maintenance	Checks the installed status and initializes settings.	P.257
❽	Lock	Sets screen lock and parameter lock.	P.265
❾	Diagnosis	Diagnoses units and checks the system status.	P.270
❿	PREP RUN	Sets items related to PREP RUN function.	P.284

7.8.1 [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	
❶	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
❷	Status	Displays the operation status of time scheduler.	
❸	Set Schedule/Cancel Schedule	Press [Set Schedule] to perform the set operations according to the set schedule. When ❶ [Mode] is set at [Number], the system performs analysis according to the set schedule and uses the same schedule from the next day. When ❶ [Mode] is set at [Day], the system 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.	
❹	Skip for Today	Check here to start the set schedule from the next day.	
❺	Schedule Number	Select schedule number to be performed. This item is displayed when ❶ [Mode] is set at [Number].	
❻	Scheduler Display	Displays the set schedule.	
❼	Edit	Displays the screen to edit schedules. Reference "Editing time scheduler" P.225	

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 "7.9.1 [Eco Setting] Screen" P.287

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

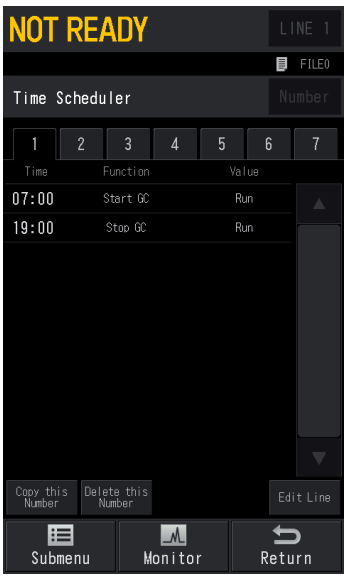
For example, if you set [Mode] at [Number] and then register a schedule to [1], the same schedule as [1] is displayed in [Sun] when you set [Mode] to [Day].

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.227
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 system is READY.
	Clean Up	Sets when the cleanup program starts; immediately or after the system is READY.
	Pre-Run Program	Sets when the pre-run program starts; immediately or after the system 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.359

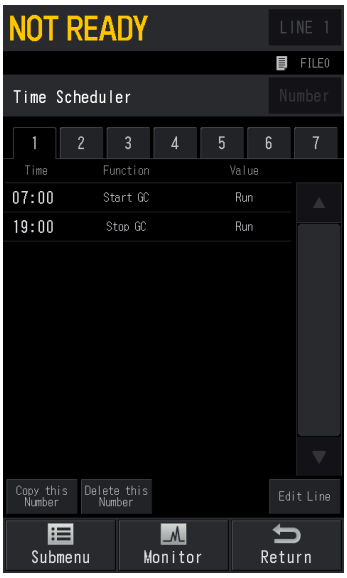
Available parameters for [Relay]

Relay	Switch Point	Event 91,92 *1	V91	NO
				NC
			V92	NO
				NC
		PRG *2	V93	NO
				NC
			V94	NO
				NC
	Relay On/Off *2	Event 1 to 16	Off	
			On	
	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 system. 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.



7.8.2 [Batch] Screen

Press (HOME) - [Function] - [Batch] to display [Batch] screen.

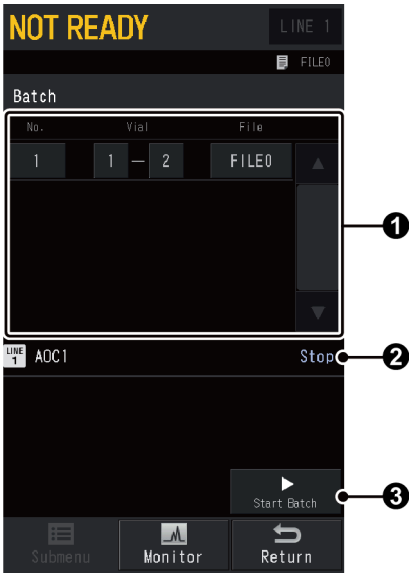
Set this item when analyzing several samples continuously with AOC-20 series (option) or when the order of sample analysis is decided.

Up to 150 lines are available when AOC-20 series is single configuration. Up to 75 lines are available when AOC-20 series is dual configuration.

> **NOTE** Do NOT use this batch settings when using LabSolutions to set batch schedule.

Reference For advanced settings for AOC-20 series, refer to the manuals shown below:

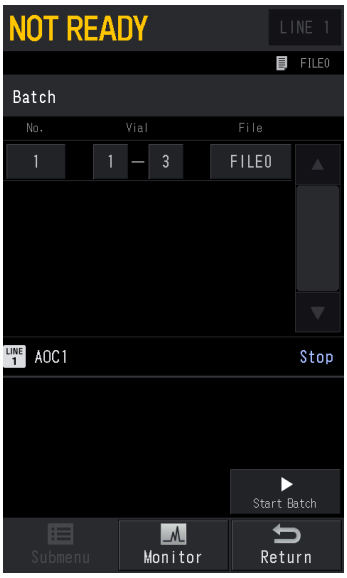
- User's Manual for AOC-20i/AOC-20s
- User's Manual for AOC-20 Dual Injection System
- "7.6.1 [Auto Injector] Screen" P.201



<table>
<tr><th>No.</th><th colspan="2">Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="5">❶</td><td colspan="2">Batch Setting</td><td colspan="2">Sets batch schedule. Several lines are displayed when AOC-20 series is dual configuration.</td></tr>
<tr><td rowspan="4"></td><td>No.</td><td colspan="2">Displays line No. of the batch schedule. Press the number to delete or insert a line.</td></tr>
<tr><td rowspan="3">Vial</td><td colspan="2">Sets the initial and final vial No. Range is different depending on the type and the number of vials.</td></tr>
<tr><td>Range</td><td>• 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</td></tr>
<tr><td>Default</td><td>0 (Not Set)</td></tr>
<tr><td>File</td><td colspan="2">Sets the file to be used for batch schedule.</td></tr>
<tr><td>❷</td><td colspan="2">AOC status</td><td colspan="2">Displays the current status of AOC-20 series. Several lines are displayed when AOC-20 series is dual configuration.
<table><tr><th>Screen display</th><th>Status</th></tr><tr><td>Stop</td><td>AOC is not operating.</td></tr><tr><td>Taking vial</td><td>A vial is being picked up.</td></tr><tr><td>Preparation</td><td>AOC is operating (before injection).</td></tr><tr><td>Rinse</td><td>AOC is operating (after injection).</td></tr><tr><td>Putting vial</td><td>The system is putting vial.</td></tr><tr><td>Waiting</td><td>AOC is waiting for analysis.</td></tr></table></td></tr>
<tr><td>❸</td><td colspan="2">Start Batch/Stop Batch</td><td colspan="2">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.</td></tr>
</table>

Batch schedule example

- Single configuration
  To use [File 0] and analyze vial No.1 to 3.

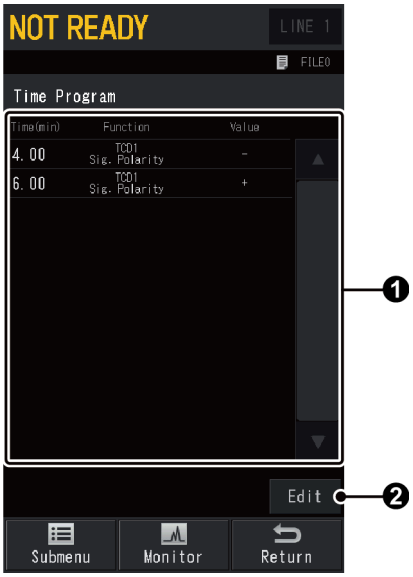


- Dual configuration
  To use [File 0] and analyze vial No.1 to 3 with main AOC and 76 to 78 with sub AOC.

7.8.3 [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
❶	Time Program	Displays the set time program.
❷	Edit	Displays the screen to edit time programs. Reference "Editing time program" P.231

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 "7.9.1 [Eco Setting] Screen" P.287

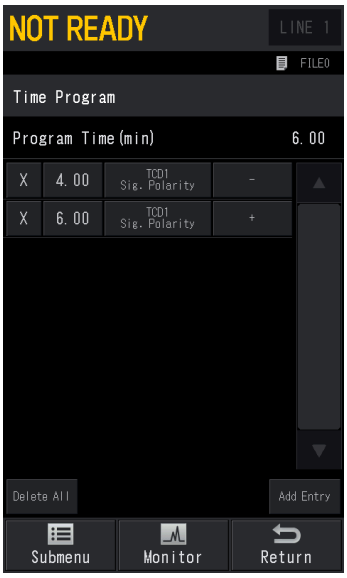
Editing time program

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.233
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.359

Available parameters for [Relay]

Relay	Switch Point	Event 91,92 *1	V91 *2	NO
				NC
			V92 *2	NO
				NC
		PRG *3	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 system. Switches relay NO and NC.

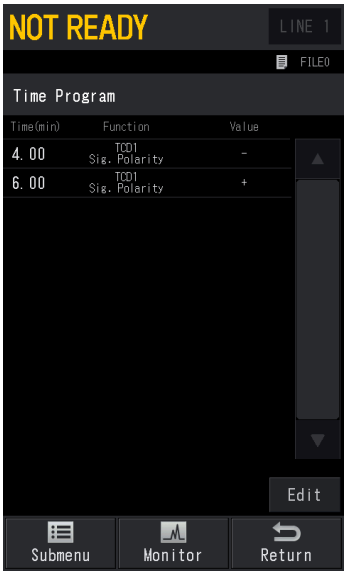
*2 After parameters are set, Vx (x: 1 to 16, 91 to 94) is displayed on the screen on the system. In Time Program of LabSolutions, Relay x (x: 1 to 16, 91 to 94) is displayed. Their meanings are the same.

*3 Relays on optional PRG board.

*4 Settings for I/O port of optional 24 V power supply board.

Time program example

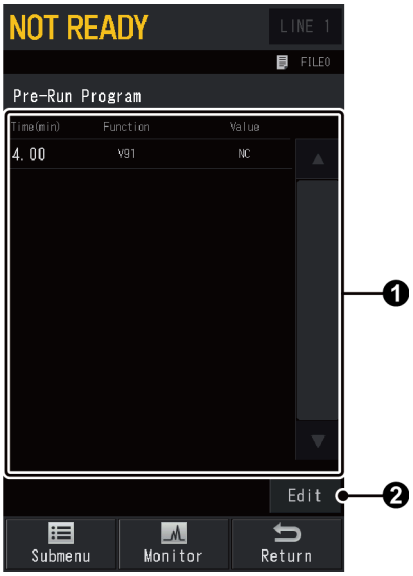
Four minutes after analysis starts, the polarity of the detector TCD is switched from plus to minus. Two minutes later (six minutes after the program starts), the polarity is switched back to plus.



7.8.4 [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.235

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 "7.9.1 [Eco Setting] Screen" P.287

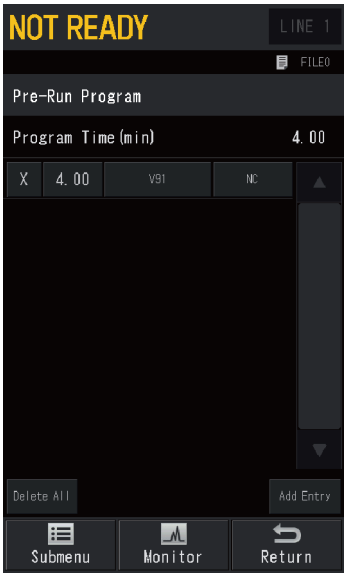
Editing pre-run program

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.238
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-20 series 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 system becomes ready.
	GC Start	After the Pre-Run program is finished, the system 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-20 series/HSS starts and then the sample is injected.
	Clean Up	After the Pre-Run program stops, clean up starts. After clean up finishes, the system becomes ready.
Other		Sets parameters by entering an event No. Reference "8.10 Event No." P.359

Hint

- When no parameter is selected for [Stop Pre-Run Program] in the pre-run program, the system 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 system 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.359 for details about the event No.

Available parameters for [Relay]

Relay	Switch Point	Event 91,92 *1	V91 *2	NO
				NC
			V92 *2	NO
				NC
		PRG *3	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 system. Switches relay NO and NC.

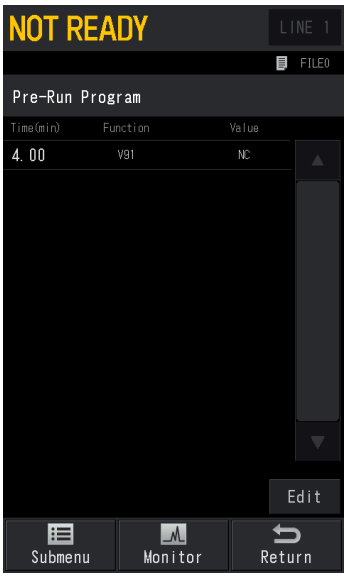
*2 After parameters are set, Vx (x: 1 to 16, 91 to 94) is displayed on the screen on the system. In Pre-Run Program of LabSolutions, Relay x (x: 1 to 16, 91 to 94) is displayed. Their meanings are the same.

*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.

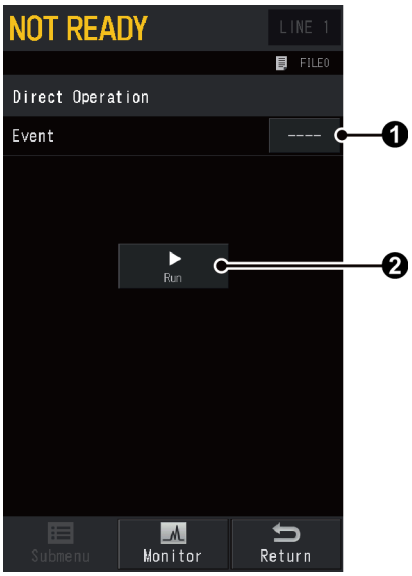


7.8.5 [Direct Operation] Screen

Press (HOME) - [Function] - [Direct Operation] to display [Direct Operation] screen.

Use the direct operation to control the system with the event No.

Reference See "8.10 Event No." P.359 for details about the event No.

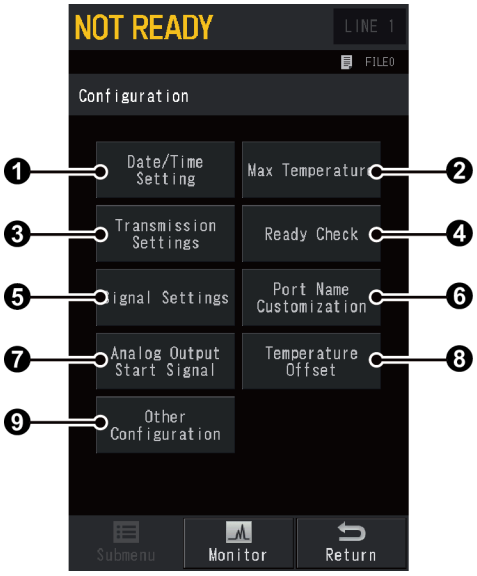


No.	Item	Description	
❶	Event	Sets the event No.	
		Range	-500 to 500
		Default	-
❷	Run	Runs the event.	

7.8.6 [Configuration] Screen

Press (HOME) - [Function] - [Configuration] to display [Configuration] screen.

Set this item depending on the system usage.

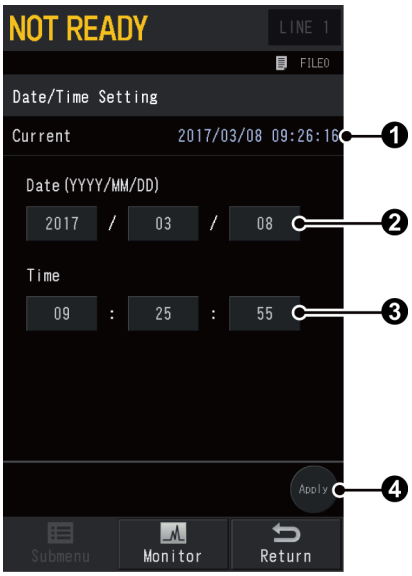


No.	Item	Description	See also
❶	Date/Time Setting	Sets the date and the time.	P.241
❷	Max Temperature	Sets the maximum temperature for each heater port.	P.242
❸	Transmission Settings	Sets parameters for transmission.	P.243
❹	Ready Check	Sets parameters for illumination of the status lights.	P.246
❺	Signal Settings	Sets the output signal from the system.	P.248
❻	Port Name Customization	Customizes the names of displayed items.	P.252
❼	Analog Output Start Signal	Set this item when connecting the system to Chromatopac.	P.253
❽	Temperature Offset	Sets the temperature offset for each heater port.	P.254
❾	Other Configuration	Specify the configuration of miscellaneous setup items.	P.255

■ [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 system is turned off.



No.	Item	Description
❶	Current	Displays the set date and time.
❷	Date	Changes the date.
❸	Time	Changes the time.
❹	Apply	Press ❹ [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 system.

No.	Item	Description	
❶	Column	Displays the maximum operating temperature of the column oven.	
		Range	10.0 to 470.0 °C
		Default	450.0 °C
❷	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.	
		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

⚠ CAUTION

Instruction

Set this value below 400 °C when using ECD.

No.	Item	Description
❸	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 system.

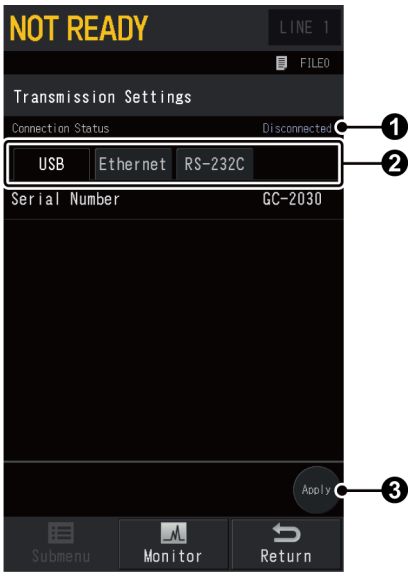
■ [Transmission Settings] Screen

Press (HOME) - [Function] - [Configuration] - [Transmission Settings] to display [Transmission Settings] screen.

Set up the communication when the system is connected to an external device.

Reference "8.9 Connecting to External Devices" P.348

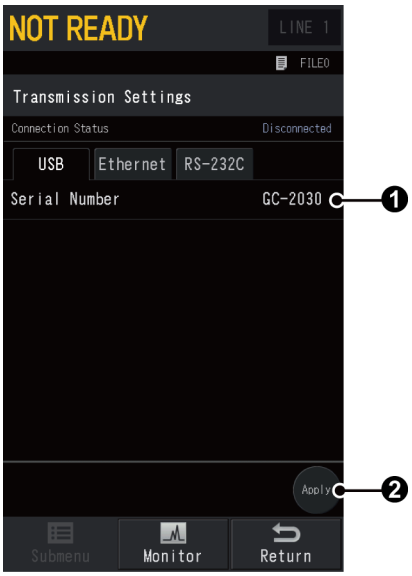
Common items



No.	Item	Description
❶	Connection Status	Displays the current connection status. Also displays communication method when the system is connected.
❷	Tab switching	Switch the tab to set each communication method.
❸	Apply	Press ❸ [Apply] to confirm the change.

[USB] tab

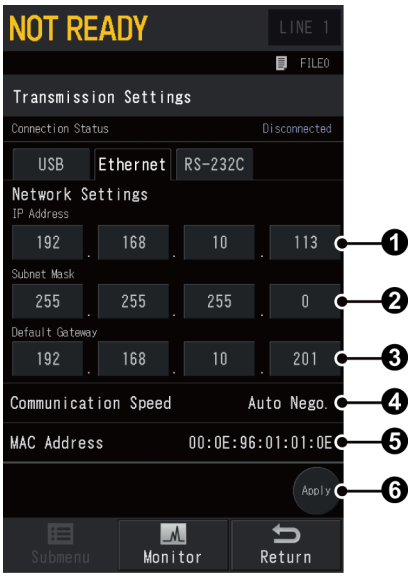
Set this item when connecting the system to PC with a USB cable.



No.	Item	Description
❶	Serial Number	Displays serial number of the system.
❷	Apply	Press ❷ [Apply] to confirm the change.

[Ethernet] tab

Set this item when connecting the system to PC with an Ethernet cable.

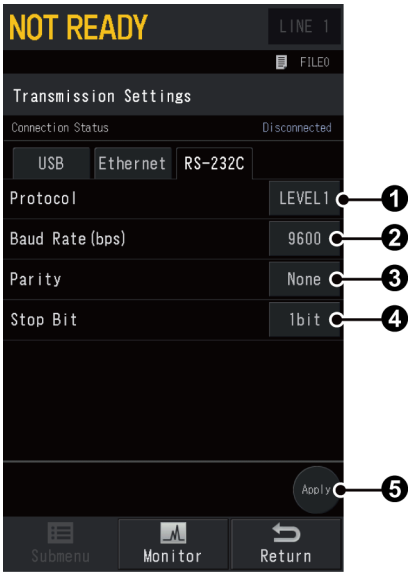


No.	Item	Description
❶	IP Address	Sets IP address.
❷	Subnet Mask	Sets subnet mask.
❸	Default Gateway	Sets default gateway.
❹	Communication Speed	Displays communication speed.

No.	Item	Description
❺	MAC Address	Displays MAC address.
❻	Apply	Press ❻ [Apply] to confirm the change.

[RS-232C] tab

Normally, RS-232C is not used to connect the system with an external device. Use it only for configurations such as system GC.



No.	Item	Description	
❶	Protocol	Sets communication protocol.	
		Items	None, Level.1, Level.2, Level.3
		Default	Level.1
❷	Baud rate	Sets the transmission speed.	
		Items	2400, 4800, 9600, 19200, 38400, 57600
		Default	9600
❸	Parity	Sets the parity.	
		Items	None, Even, Odd
		Default	None
❹	Stop Bit	Sets the stop bit.	
		Items	1 bit, 2 bit
		Default	1 bit
❺	Apply	Press ❺ [Apply] to confirm the change.	

■ [Ready Check] Screen

Press (HOME) - [Function] - [Configuration] - [Ready Check] to display [Ready Check] screen.

The system 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 system. The units configured in the analytical line are accompanied with Line No. on their left.

No.	Item	Description
❶	Heater Port	Sets whether to perform ready check for each heater port.
❷	Carrier Gas	Sets whether to perform ready check for each carrier gas.
❸	Septum Purge	Sets whether to perform ready check for each septum purge.
❹	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.
❺	AUX APC	Sets whether to perform ready check for APC when the optional APC is installed. Displays up to 18 APCs.
❻	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.247 The system restarts the evaluation 10 minutes after the system changes from NOT READY to READY. • Wait Signal : Checks wait signal from external devices.

Submenu

Item	Description	See also
Drift	Displays [Drift] screen.	P.247

■ [Drift] Screen

Press (HOME) - [Function] - [Configuration] - [Ready Check] - [Submenu] - [Drift] to display [Drift] screen.
Sets the drift threshold.

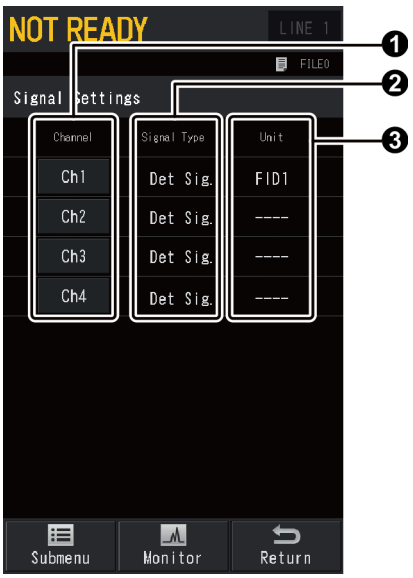
No.	Item	Description	
❶	Drift Threshold	Sets the drift threshold for each detector. This item is displayed for each detector installed on the system.	
		Range	0 to 20000
		Default	100

■ [Signal Settings] Screen

Press (HOME) - [Function] - [Configuration] - [Signal Settings] to display [Signal Settings] screen.

The system has 4 channels to output signals. On [Signal Settings] screen, parameters relating to output signals other than detector signal can be set.

Reference See "7.5.8 [Signal Settings] Screen" P.194 for settings for detector signal.



No.	Item	Description
❶	Channel	Press the channel name to display the setting screen. Output signal for each channel can be set. Reference "[Signal Setting] Screen" P.249
❷	Signal Type	Displays the signal type. Select the signal type on the setting screen. Reference "[Signal Setting] Screen" P.249
❸	Unit	Displays the heater port name of the unit. [----] is displayed when the signal type is not set.

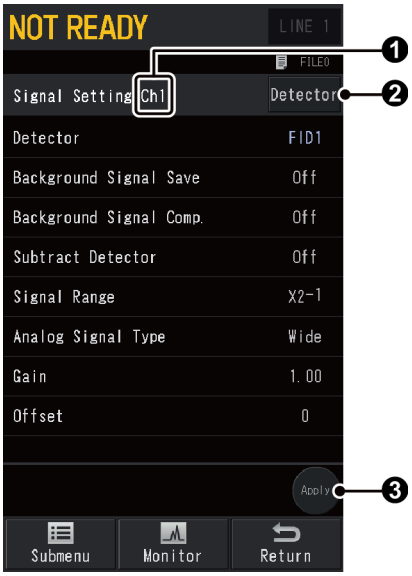
Submenu

Item	Description
Data File	Displays [Data File] screen. This item is automatically set after the system is connected to PC and establishes the link.

[Signal Setting] Screen

Press [Channel] on [Signal Settings] screen to display the setting screen.

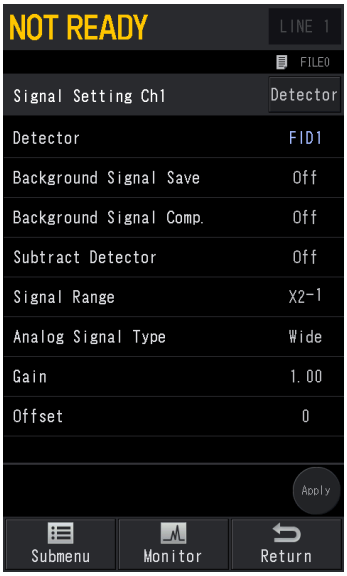
Common items



No.	Item	Description	
❶	Channel name	Displays the channel name.	
❷	Signal Type	Displays the signal type.	
		Items	Detector, Temp, Flow
❸	Apply	Press ❸ [Apply] to confirm the change.	

When [Signal Type] is set at [Detector]

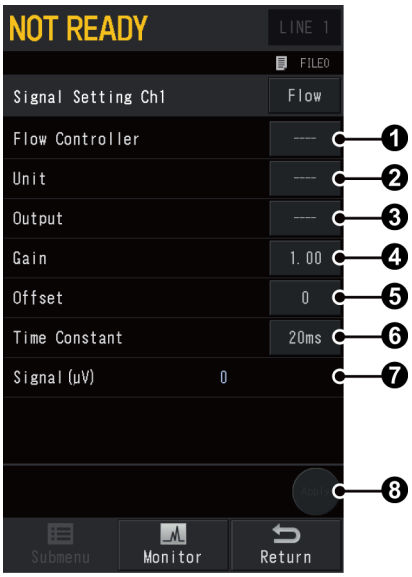
Reference See "7.5.8 [Signal Settings] Screen" P.194 for settings for detector signal.



When [Signal Type] is set at [Temp]

No.	Item	Description	
❶	Unit	Selects a unit. The selections are different depending on the temperature control units installed on the system.	
❷	Gain	Sets the gain.	
		Range	0.00 to 100.00
		Default	1.00
❸	Offset	Sets the offset.	
		Range	-999999 to 999999
		Default	0
❹	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
❺	Signal	Displays the signal value.	
❻	Apply	Press ❻ [Apply] to confirm the change. You can press ❻ [Apply] after setting ❶ [Unit].	

When [Signal Type] is set at [Flow]



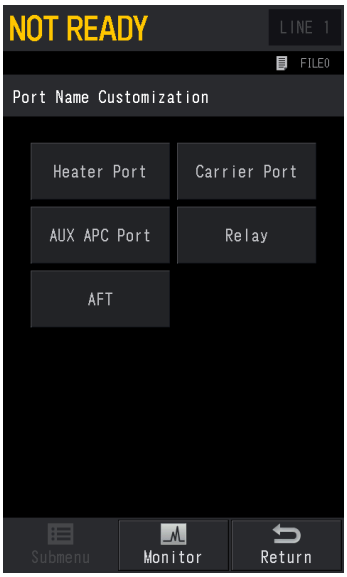
No.	Item	Description	
❶	Flow controller	Selects a flow controller. The selections are different depending on the flow controller types installed on the system.	
❷	Unit	Selects a unit. The selections are different depending on the settings in ❶ [Flow Controller].	
❸	Output	Selects the output signal. The selections are different depending on the settings in ❶ [Flow Controller] and ❷ [Unit].	
❹	Gain	Sets the gain.	
		Range	0.00 to 100.00
		Default	1.00
❺	Offset	Sets the offset.	
		Range	-999999 to 999999
		Default	0
❻	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
❼	Signal	Displays the signal value.	
❽	Apply	Press ❽ [Apply] to confirm the change. You can press ❽ [Apply] after setting ❶ [Flow Controller], ❷ [Unit], and ❸ [Output].	

■ [Port Name Customization] Screen

Press (HOME) - [Function] - [Configuration] - [Port Name Customization] to display [Port Name Customization] screen.

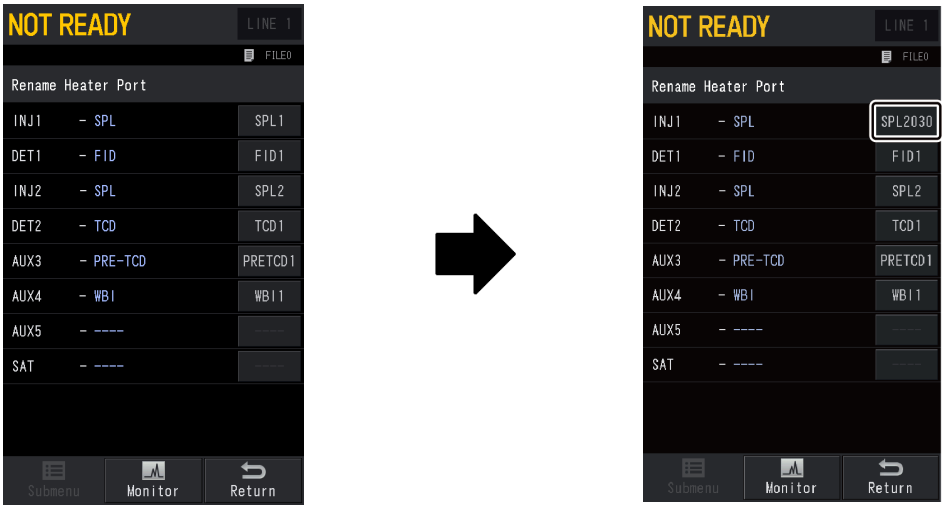
Although the system automatically recognize the names of units installed on the system, you can change the displayed name to a desired name. You cannot change the name of unit which are not installed on the system.

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".



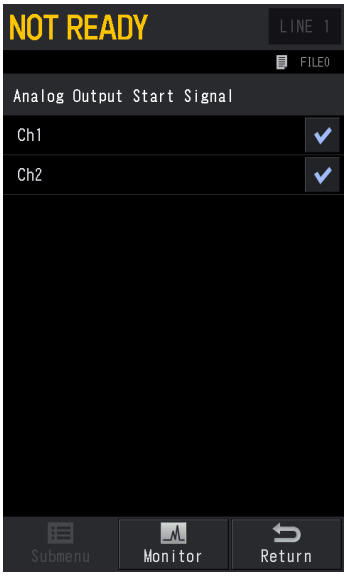
Before change

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 system, check the channel to be started as you press (START) on the control panel. Up to 2 channels can be set.



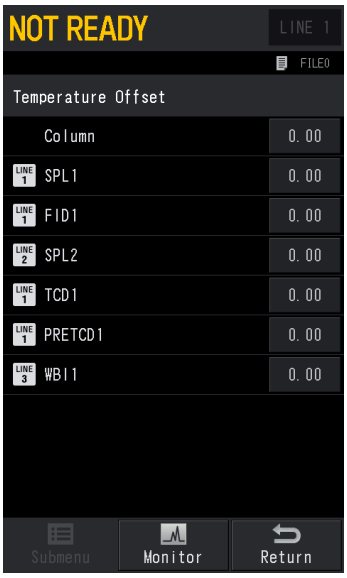
■ [Temperature Offset] Screen

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 system. 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.

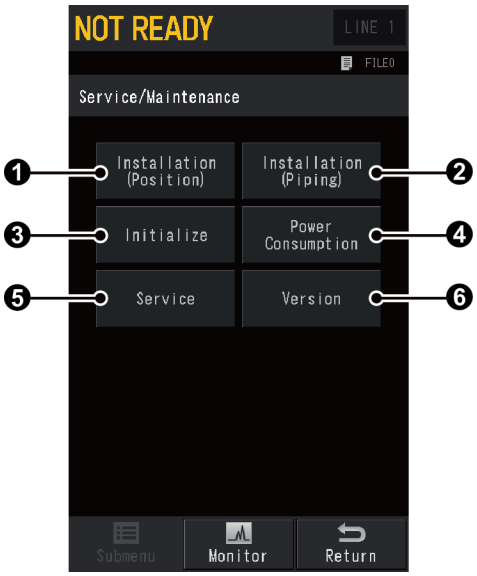
No.	Item	Description	
❶	Language	Sets the language to be displayed on the touch panel.	
		Items	Alt., English
		Default	English
❷	Backlight Auto Off	Sets the period of time until the backlight automatically turns off.	
		Range	0 to 9999 seconds
		Default	0 seconds
❸	Pressure Unit	Sets the pressure units NOTE The following items are expressed in the unit [kPa] regardless of the setting in ❸ [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
		Default	kPa
❹	Pressure Digits Display	Sets the digits of the pressure. Select [Explicit] to set pressure to three decimal places when ❸ [Pressure Unit] is set at [psi].	
		Items	Default, Explicit
		Default	Default

No.	Item	Description	
❺	Beep Volume	Sets the beep volume which sounds when errors occur or during the touch panel operation.	
		Items	Off, Low, Mid, High
		Default	Low
❻	Beep Pitch	Sets the beep sound. Use a different tone for different systems to be able to discern which system has a problem.	
		Items	Low, High
		Default	High
❼	Atmospheric Compensation	Select [On] to compensate inlet pressure depending on the atmospheric pressure.	
		Items	Off, On
		Default	Off
❽	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.246	
		Items	Off, On
		Default	On
❾	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 system is 700 kPa.	
		Items	500-900 kPa, 300-500 kPa, 900 kPa-
		Default	500-900 kPa
❿	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
⓫	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

7.8.7 [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 system and to perform maintenance.

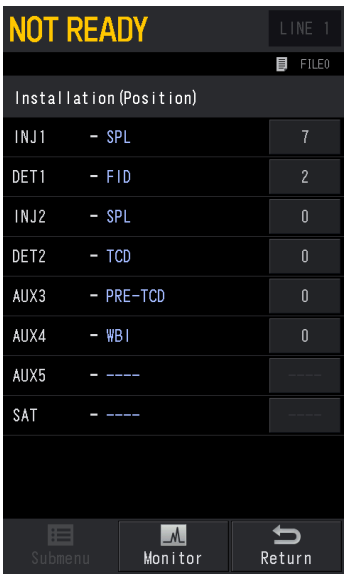


No.	Item	Description	See also
❶	Installation (Position)	Specifies positions of units connected to heater ports.	P.258
❷	Installation (Piping)	Sets up flow controllers of carrier gas, detector gas, and AFT.	P.259
❸	Initialize	Initialize Configuration, installation status, and analysis conditions.	P.262
❹	Power Consumption	Displays the sum of power consumption of all heaters.	P.263
❺	Service	[Service] screen is used by Shimadzu service personnel.	-
❻	Version	Displays the system version.	P.264

■ [Installation (Position)] Screen

Press (HOME) - [Function] - [Service/Maintenance] - [Installation (Position)] to display [Installation (Position)] screen.

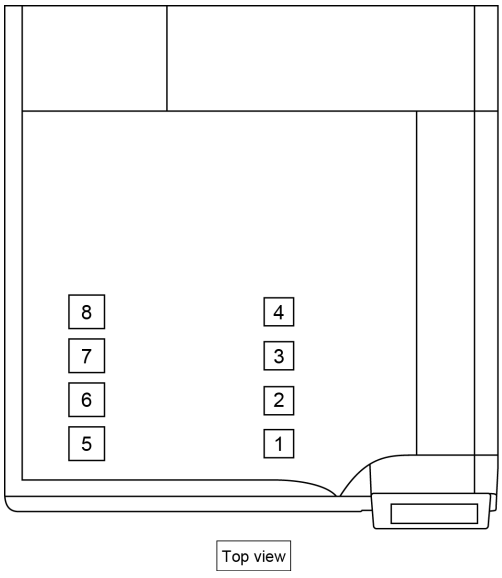
Specifies positions of units connected to heater ports.



When you connect injection port or detector to heater port, the system 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.



Top view

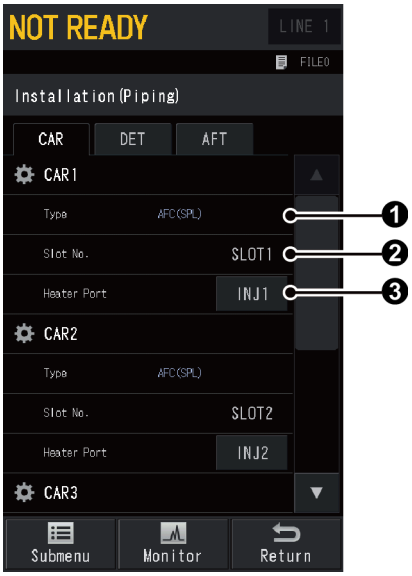
■ [Installation (Piping)] Screen

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

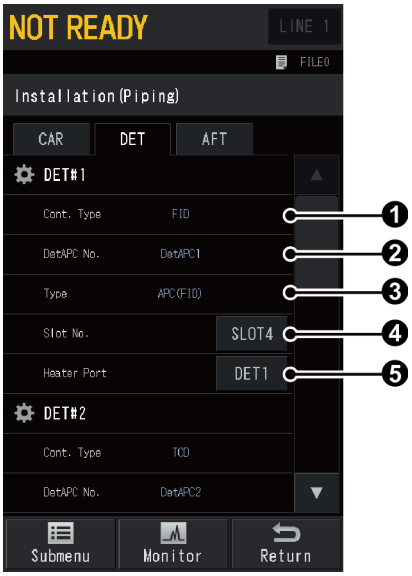
The names CAR1 to CAR4 are automatically assigned in ascending order of the slot No.



No.	Item	Description	
❶	Type	Automatically recognizes and displays flow controllers for carrier gas.	
❷	Slot No.	Automatically recognizes and displays installed slot No.	
❸	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 system.	
		Items	None, INJ1, INJ2, DET1, DET2, AUX3, AUX4, AUX5

[DET] tab

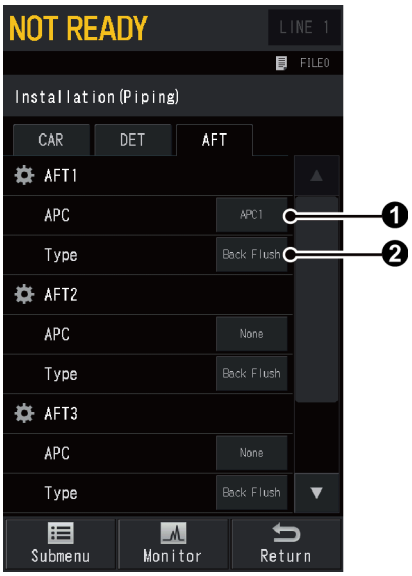
The names DET#1 to DET#4 are automatically assigned depending on the installation position of the detector (1 to 4 starting at the front of the system).



No.	Item	Description	
❶	Cont. Type	Automatically recognizes and displays detector controller.	
❷	DetAPC No.	Automatically recognizes and displays it according to the setting in ❹ [Slot No.].	
❸	Type	Automatically recognizes and displays it according to the setting in ❹ [Slot No.].	
❹	Slot No.	Sets the slot No.	
		Items	None, SLOT1, SLOT2, SLOT3, SLOT4, SLOT5, SLOT6
❺	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.



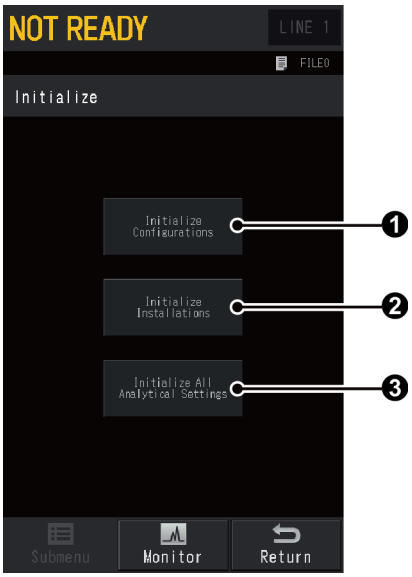
No.	Item	Description	
❶	APC	Sets the AUX-APC to be used.	
		Items	None, APC1 to APC18
❷	Type	Sets the AFT type. Reference "8.8 AFT (Advanced Flow Technology)" P.340	
		Items	Detector Splitting, Detector Switching, Back Flush, Heart-Cut

■ [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.

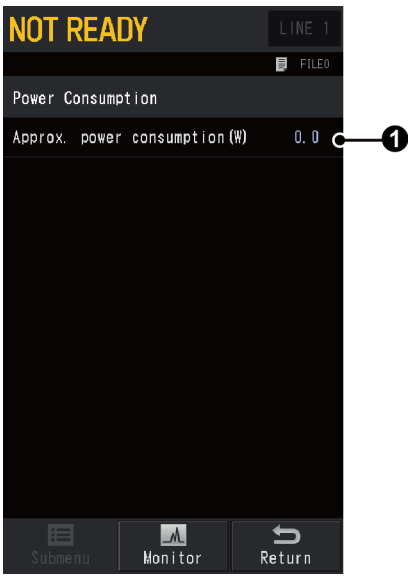


No.	Item	Description
❶	Initialize Configurations	This item initializes configuration settings such as heater port max temperature and ready check parameters. However the maximum operating temperature of the column oven is not reset.
❷	Initialize Installations	This item initializes the installation settings of injection ports, detector, flow controllers piping, etc.
❸	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 system.



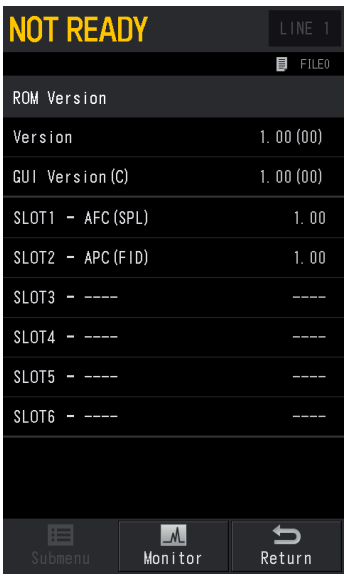
No.	Item	Description
❶	Approx. power consumption	Displays approximate calculation of the total power consumption of all heaters.

■ [ROM Version] Screen

Press (HOME) - [Function] - [Service/Maintenance] - [Version] to display [ROM Version] screen.

[ROM Version] screen shows the ROM version of the system.

Version information may be required for the system maintenance.



7.8.8 [Lock] Screen

Press (HOME) - [Function] - [Lock] to display [Lock] screen.

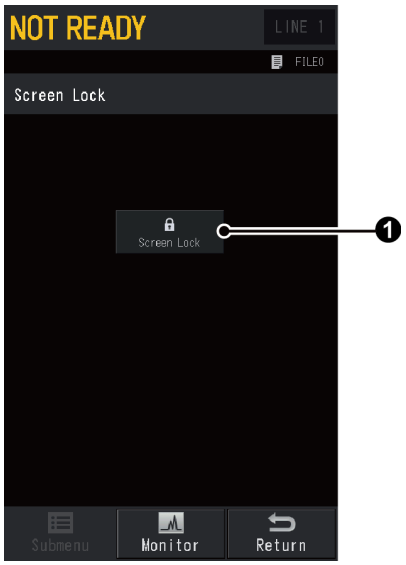
Hint If either key lock or parameter lock has already been activated, the Unlock screen appears instead.

No.	Item	Description	See also
❶	Screen Lock	Displays [Screen Lock] screen.	P.266
❷	Parameter Lock	Displays [Parameter Lock] screen.	P.267

■ [Screen Lock] Screen

Press (HOME) - [Function] - [Lock] - [Screen Lock] to display [Screen Lock] screen.

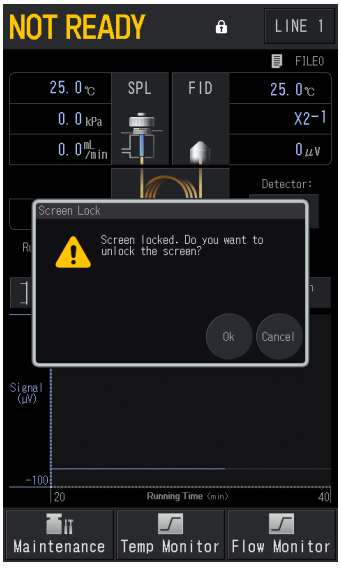
Use screen lock function to avoid misoperation of the screen.



No.	Item	Description
❶	Screen Lock	Locks the screen operation. After pressing [Screen Lock], (screen lock) appears on the monitor and no screen operation is accepted. However, START (START), STOP (STOP), and PREP RUN (PREP RUN) on the control panel is available even while the screen lock is active.

Unlocking the screen

Press anywhere on the monitor to display the following screen.

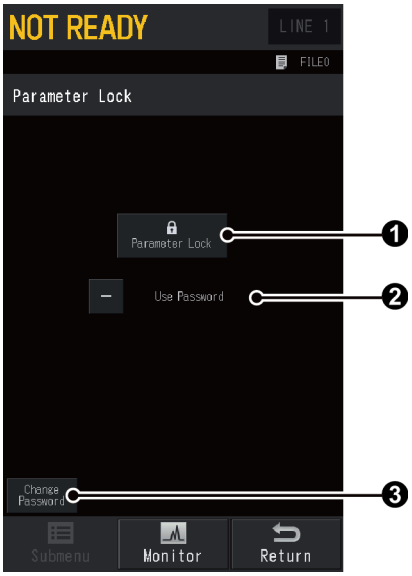


Press [Ok] to display [Screen Lock] screen and unlock the screen.

■ [Parameter Lock] Screen

Press (HOME) - [Function] - [Lock] - [Parameter Lock] to display [Parameter Lock] screen.

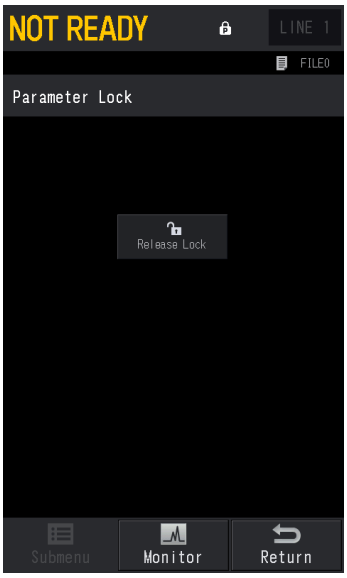
The parameter lock function prevents parameter changes in analytical conditions such as temperature, pressure and flow. Setup values can be monitored, but cannot be changed while parameter lock is active.



No.	Item	Description
❶	Parameter Lock	Locks the parameter changes. After pressing [Parameter Lock], (parameter lock) appears on the screen and no parameter change is accepted.
❷	Use Password	Check this item when using password.
❸	Change Password	Displays [Password] screen. **Hint** Factory default is "2030". **Reference** "[Password] Screen" P.269

Unlocking the parameter

While the parameter lock is active, press (HOME) - [Function] - [Lock] - [Parameter Lock] to display [Parameter Lock] screen.

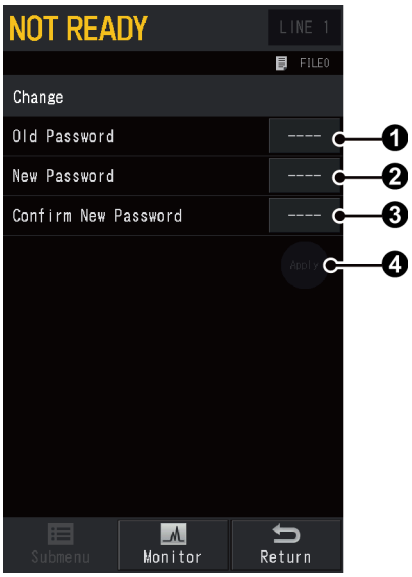


- Without password
  Press [Release Lock] to unlock parameters.
- With password
  Press [Release Lock] to display the password screen. Enter password to unlock parameters.

■ [Password] Screen

Press (HOME) - [Function] - [Lock] - [Parameter Lock] - [Change Password] to display [Password] screen.

Hint Remember the password.

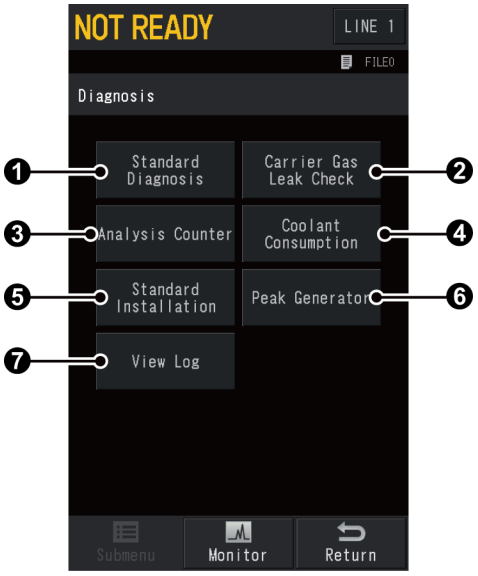


No.	Item	Description
❶	Old Password	Enter old password. **Hint** Factory default is "2030".
❷	New Password	Enter new password. Range: 4-digits number from 0000 to 9999.
❸	Confirm New Password	Enter ❷ [New Password] again.
❹	Apply	Press ❹ [Apply] to confirm the change. You can press ❹ [Apply] after you set all of ❶ to ❸.

7.8.9 [Diagnosis] Screen

Press (HOME) - [Function] - [Diagnosis] to display [Diagnosis] screen.

On [Diagnosis] screen, you can perform standard diagnosis and check analysis counter.

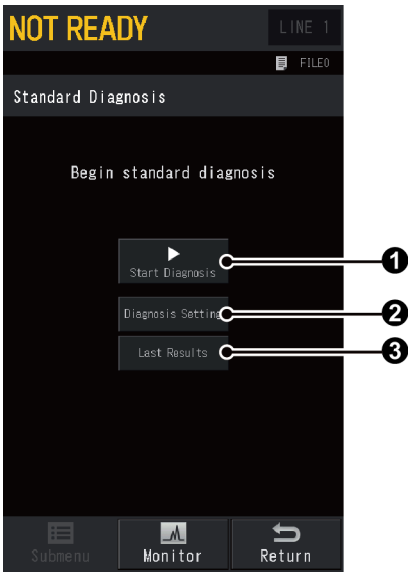


No.	Item	Description	See also
❶	Standard Diagnosis	Displays [Standard Diagnosis] screen.	P.271
❷	Carrier Gas Leak Check	Displays [Carrier Gas Leak Check] screen.	P.277
❸	Analysis Counter	Displays [Analysis Counter] screen.	P.278
❹	Coolant Consumption	Displays [Coolant Consumption] screen.	P.280
❺	Standard Installation	Displays [Standard Installation Test] screen.	P.281
❻	Peak Generator	Displays [Peak Generator] screen.	P.282
❼	View Log	Displays [Log Reading Menu] screen.	P.283

■ [Standard Diagnosis] Screen

Press (HOME) - [Function] - [Diagnosis] - [Standard Diagnosis] to display [Standard Diagnosis] screen.

On [Standard Diagnosis] screen, you can check whether each part of the system has a problem. Use this screen to maintain the system and diagnose problems.

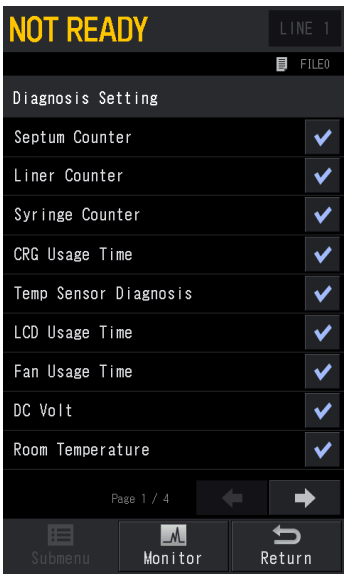


No.	Item	Description	See also
❶	Start Diagnosis	Press [Start Diagnosis] to start standard diagnosis program. After the diagnosis, test result and number of failures are displayed.	-
❷	Diagnosis Setting	Displays [Diagnosis Setting] screen. Selects diagnosis items and determines setup values used for diagnostic reference.	P.272
❸	Last Results	Displays [Diagnosis Report] screen. Displays the result of the last self-diagnosis. **NOTE** When Standard Diagnosis is not performed after the system is turned on, Last Results screen is not displayed.	P.275

■ [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.



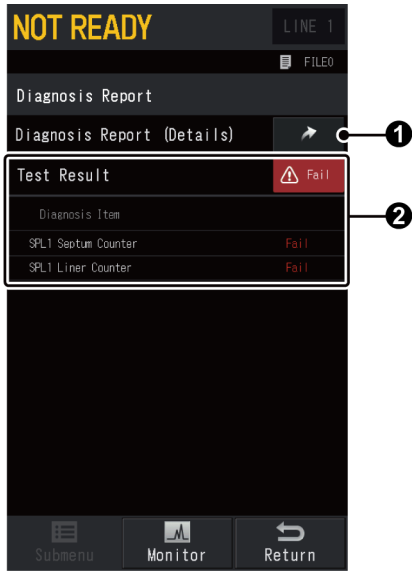
Item	Description
Septum Counter Liner Counter Syringe Counter	Verifies whether the number of usage is below the threshold. The threshold can be set on [Analysis Counter] screen. Reference "[Analysis Counter] Screen" P.278
CRG Usage Time	Verifies whether the operating time of CRG coolant is below the threshold. The threshold can be set on [Coolant Consumption] screen. Reference • "7.6.2 [CRG] Screen" P.210 • "[Coolant Consumption] Screen" P.280
Temp Sensor Diagnosis	Verifies whether noise has been generated, to detect deterioration of the temp sensor.
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 (DC5 V, DC24 V, DC-15 V, FTD DC 24 V) is below the threshold.
Room Temperature	Verifies whether the current room temperature is within the operation range. The threshold is 5 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	Verifies that the data saved in the flow controller ROM is read correctly.
CAR Gas ADC DET Gas ADC APC 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	Checks that carrier gas, detector gas, and AUX-APC 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.

■ [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".

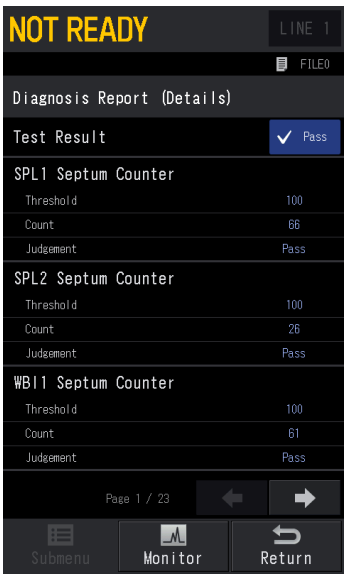
Hint [Diagnosis Report] is displayed also when you press [Details] on the screen displayed after the standard diagnosis.



No.	Item	Description	See also
❶	Diagnosis Report (Details)	Displays [Diagnosis Report (Details)] screen. You can see the results of self-diagnosis for each item.	P.275
❷	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.276 • 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.276
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.276
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.48 • "5.7.2 Cannot Ignite or Flame Is Extinguished (FPD)" P.54
Any other item	Contact your Shimadzu sales/service representative.

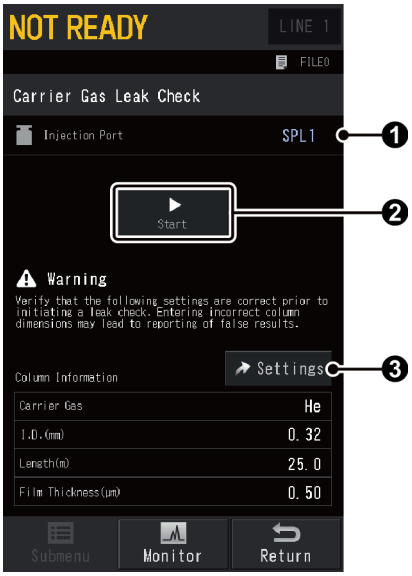
■ [Carrier Gas Leak Check] Screen

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.334.



No.	Item	Description
❶	Injection Port	Displays active injection port.
❷	Start	Press [Start] to start carrier gas leak check.
❸	Settings	Displays [Column Information] screen. Reference "7.3.2 [Column Information] Screen" P.122

■ [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	
❶	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 system continues batch behavior. When [Stop] is selected, a warning message is displayed and the system stops batch behavior.	
			Items	Continue, Stop
			Default	Continue
❷	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	
❸	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 grass insert exceeds the threshold.	
			Items	No, Yes
			Default	Yes
		Counter	Displays the number of uses of the 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 grass insert.	
			Range	0 to 9999
			Default	100
❹	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 grass 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, grass insert or AOC syringe.

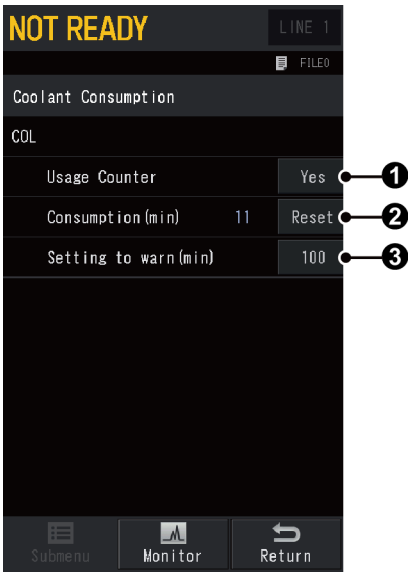
■ [Coolant Consumption] Screen

Press (HOME) - [Function] - [Diagnosis] - [Coolant Consumption] to display [Coolant Consumption] screen.

When using low-temperature oven controller CRG, the system monitors total time that [Valve] on [CRG] screen is set at [On], and displays it on [Consumption] on [Coolant Consumption] screen.

Reference "7.6.2 [CRG] Screen" P.210

When the coolant consumption counter is active and the coolant consumption exceeds the threshold, a warning message is displayed.



No.	Item	Description	
❶	Usage Counter	Select [Yes] to display a message in the message display when the coolant consumption exceeds the threshold.	
		Items	No, Yes
		Default	Yes
❷	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.	
❸	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 system 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 "7.7.2 [Line Configuration] Screen" P.220

3. Set the column information.
   Reference "7.3.2 [Column Information] Screen" P.122

4. Set analytical conditions.
   Reference
   - "7.4 Injection Port" P.125
   - "7.5 Detector" P.161
   - "7.7.1 [Analysis Settings] Screen" P.219

5. Start the GC.
   Reference "7.1.1 [GC Start Sequence] Screen" P.94

6. Inject a sample into the injection port and press (START).

7. Check whether the system performs the analysis according to the set conditions.

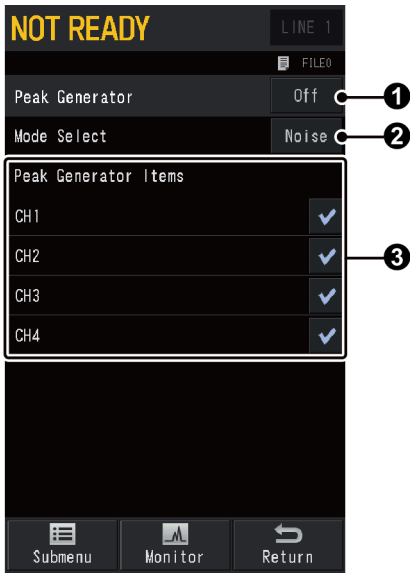
8 After the check, press [Unload] on [Standard Installation Test] screen to return the analysis conditions to the original values.

> NOTE If the system 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	
❶	Peak Generator	Select [On] to generate dummy peaks to confirm the operation of the data processing unit.	
		Items	Off, On
		Default	Off
❷	Mode Select	Sets the type of the dummy peak.	
		Items	Noise, No Noise
		Default	Noise
❸	Peak Generator Items	Check the channel which the system outputs peaks to.	

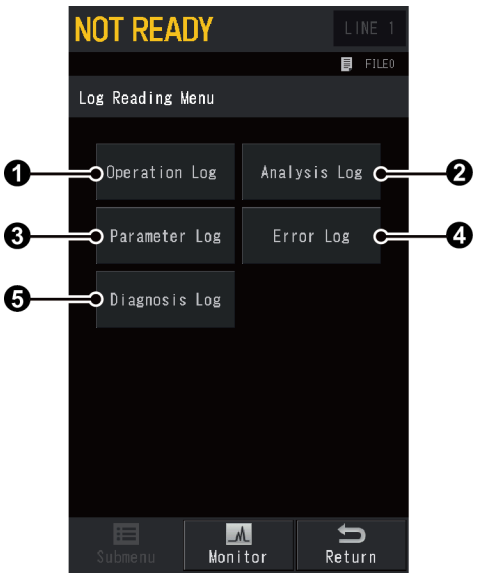
Submenu

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
❶	Operation Log	Displays the Power and GC (System) On/Off log.	50	-
❷	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.
❸	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	-
❹	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.
❺	Diagnosis Log	Displays the log of standard diagnosis.	50	For detailed result of the last self-diagnosis, see "[Diagnosis Report (Details)] Screen" P.275.

Hint Press [Clear Log] to delete the log.

7.8.10 [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 system 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 system is in the following settings or situations:

- [Carrier Gas Saver] is turned [On]

  Reference "7.9.1 [Eco Setting] Screen" P.287

- [Back Flush Mode] is turned [On]

  Reference "7.4.9 [Back Flush Settings] Screen" P.151

- [Split Mode] is set at [Splitless]

  Reference "7.4.1 [INJ/FLOW] Screen (SPL)" P.125

- [High Press Injection Mode] is set at [Auto]

  Reference "7.4.13 [High Pressure Injection] Screen" P.157

- Optional CRG is used, [Valve] is set at [On], and default value of [Temperature Program] is set under "Room Temperature + 2 °C".

  Reference "7.6.2 [CRG] Screen" P.210

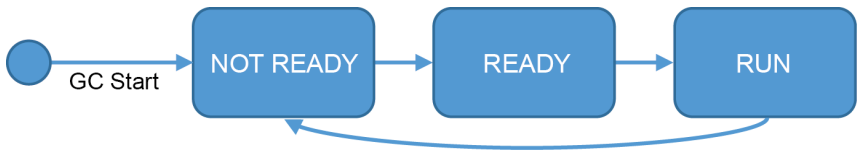
- [Final Temp Hold] is turned [On] in the setting for column oven temperature control

  Reference "7.3.3 [Colum Oven Temp Control Settings] Screen" P.124

The system status on the touch panel will flash when the system is set in waiting state by PREP RUN function.

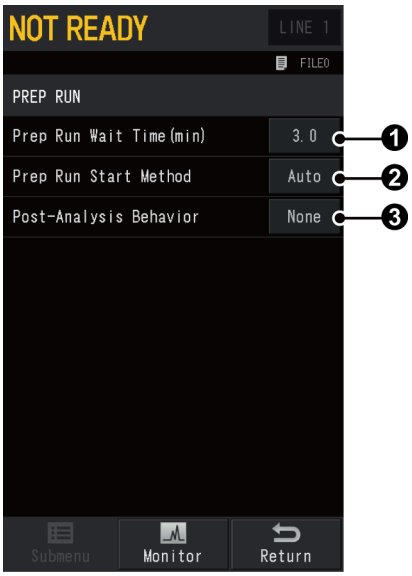
State transition while PREP RUN function is active

State transition while PREP RUN function is not active



When PREP RUN function is active, the system is in waiting status for analysis and cannot perform analysis. Press (PREP RUN) on the control panel to change the system from waiting status for analysis to the status which enables analysis (READY).

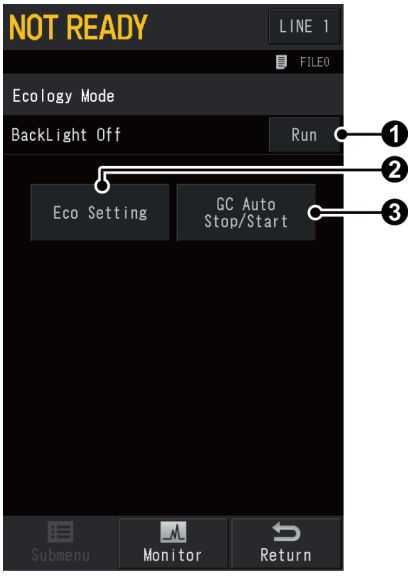
On [PREP RUN] screen, you can set items related to PREP RUN function.



No.	Item	Description	
❶	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 system goes into PREP RUN state.	
		Range	0.0 to 9999.0 min
		Default	3.0 min
❷	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
❸	Post-Analysis Behavior	Select [PREP RUN] to run PREP RUN function automatically after single analysis is completed.	
		Items	None, PREP RUN
		Default	None

7.9 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.287
❸	GC Auto Stop/Start	Displays [GC Auto Stop/Start] screen.	P.289

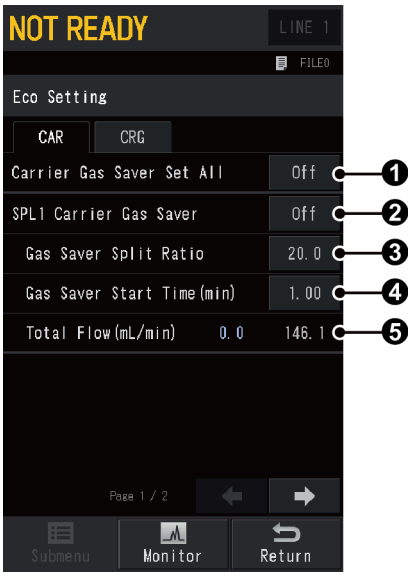
7.9.1 [Eco Setting] Screen

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 injector port is SPL or PTV. When several injector port are installed, you can set parameters for each injector port.

You can set up CRG when using optional CRG.

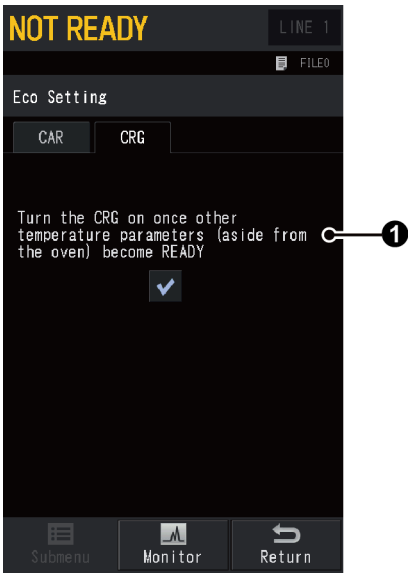
[CAR] tab



No.	Item	Description	
❶	Carrier Gas Saver Set All	Select [On] to set all ❷ [Carrier Gas Saver] at [On] when several injector port are installed.	
		Items	On, Off
		Default	Off
❷	Carrier Gas Saver	Select [On] to use settings to save carrier gas consumption (Carrier Gas Saver).	
		Items	On, Off
		Default	Off

No.	Item	Description
❸	Gas Saver Split Ratio	Sets split ratio when using the carrier gas saver. Setting "0" closes the split flow line. **Hint** Set this value so that the displayed value in ❺ [Total Flow] (blue) is over 20 to 30 mL/min. **NOTE** If flow value (blue) when using Carrier Gas Saver displayed in ❺ [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.
		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: 0.0 to 9999.99 min Default: 1.00 min
❺	Total Flow	Displays the flow. • Left value (blue): Flow when using carrier gas saver • Right value (black): Normal flow

[CRG] tab

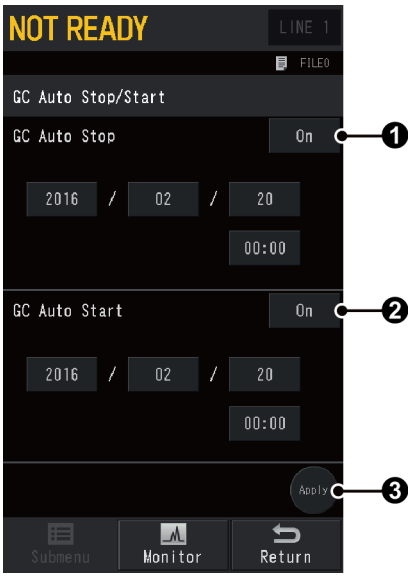


No.	Item	Description
❶	Turn the CRG on once other temperature parameters (aside from the oven) become READY	Check this item not to use CRG until the actual temperatures of parts other than column oven (injection port etc.) reach around the set value after analysis. Cooling time becomes longer, however, you can save coolant because CRG usage time becomes shorter. Uncheck this item to cool the oven with CRG immediately after analysis.

7.9.2 [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	
❶	GC Auto Stop	Select [On] to set the date and the time when the GC automatically stops.	
		Items	On, Off
		Default	Off
❷	GC Auto Start	Select [On] to set the date and the time when the GC automatically starts.	
		Items	On, Off
		Default	Off
❸	Apply	Press ❸ [Apply] to confirm the change.	

8 Technical Document

8.1 Specifications

■ The main body of the GC

Dimensions	515 mm (W) × 440 mm (H) × 530 mm (D) (excluding projections)*1
Mass	about 43.5 kg*1
Power requirements	AC100 V : 1800 VA*1, 50/60 Hz AC115 V : 1800 VA*1, 50/60 Hz AC230 V : 2600 VA*1, 50/60 Hz

*1 For SPL/FID model

■ Column oven

Range of temperature	Room temperature +2 °C to 450 °C
When using liquid CO_2*1	-50 °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
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 (option)
Hydrogen Sensor	Available (option)

*1 Optional parts are required to use liquid CO_2.

■ Injection unit

Maximum installation	Up to 3
Type	4 types (SPL unit, WBI unit, OCI unit, PTV 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
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 : 0 to 1300 mL/min N_2 : 0 to 600 mL/min H_2 : 0 to 500 mL/min NOTE The setting range of the flow is specified considering controllable range and safety. Reference "8.6.6 AFC and APC Control Ranges" P.329
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

■ Detector

Hydrogen flame ionization detector (FID)

Range of temperature	450 °C max
Minimum detection	1.2 pgC/s (dodecane)
Dynamic range	10^7

Thermal conductivity detector (TCD)

Range of temperature	400 °C max
Sensitivity	20000 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: 10^4 • S: 10^3

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

■ Others

Repeatability	Peak area	1.00 %*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		24-bit color touch panel
Cooling rate of column oven temperature		Three steps (Fast, Mid, Slow), or Custom setting

*1 Auto Injector AOC-20i(Plus), FID as the detector.
Tetradecane (2.5 ng to the column) split injection.
Results may vary depending on the sample and the analytical conditions.

■ Peripherals

CRG CO_2

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 20 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 system is used (When using central tubing equipment, the system 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.

PRG-2030 (for DC24 V)

Event*1	1 to 16, 93, 94
PCB A*2	EVENT1 to 8: valve output, DC24 V × 8 (Maximum supply current: 100 mA for each)
PCB B*2	EVENT9 to 16: valve output, DC24 V × 8 (Maximum supply current: 100 mA for each)
PCB C*2	EVENT93, 94: relay output, 2c relay (2 form c relay) × 2 (Relay rating: DC30 V, 2 A)

*1 Incorporate it into GC-2030 to use.

*2 Choose from PCB A+B or PCB A+C.

PRG box (for AC100 V / AC200 V)

Connect the valve output of PRG-2030 to a cable to use.

Power voltage	100 V series: 100 V to 120 V AC 200 V series: 220 V to 240 V AC
Relay rating	10 A, Relay a × 1 3 A, Relay c × 3 3 A, Relay a × 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 system in the following environment. The system 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.

- Rated current

Power voltage	Standard model with FID	The maximum value for models with peripherals
AC100 V	18 A	26 A
AC115 V	15.7 A	22.6 A
AC230 V	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

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
AC100 V (100 V~)	1800 VA	50 Hz/60 Hz	80 A
AC115 V (115 V~)	1800 VA	50 Hz/60 Hz	80 A
AC230 V (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.

■ Power voltage

For optimal performance, use a power supply which satisfies the following voltage specifications.

Power voltage	Recommended power voltage	Operating power voltage
AC100 V	AC95 V to 105 V, 50/60 Hz	AC90 V to 110 V, 50/60 Hz
AC115 V	AC100 V to 120 V, 50/60 Hz	AC103.5 V to 126.5 V, 50/60 Hz
AC230 V	AC218.5 V to 241.5 V, 50/60 Hz	AC207 V to 253 V, 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.

Power voltage	Standard model with FID	Optional temperature control block (INJ, etc.) per one	Maximum power	Short-circuit current rating
AC100 V AC115 V	1800 VA	150 VA	2600 VA	80 A
AC230 V	2600 VA	150 VA	3400 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

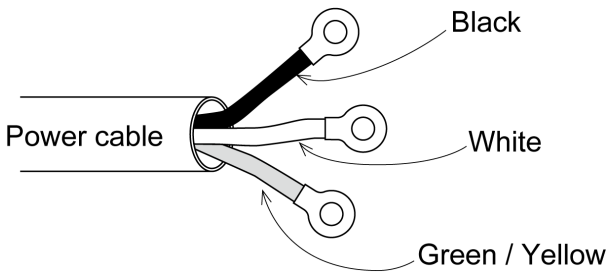
Instruction

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.

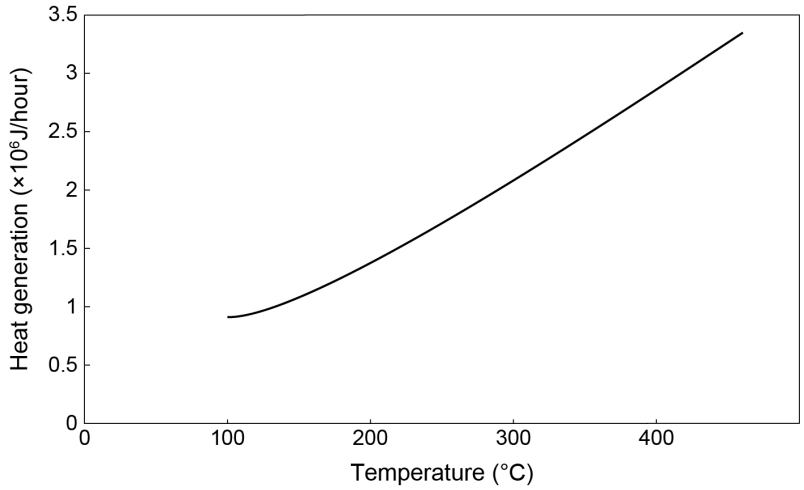
The power cables are color-coded as follows.

- 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 system.



■ Fuse

The following fuses are used in the system. Classification depends on "IEC127".

Normal oven

No.	Rated current/voltage	Type
F1, F2	8 A / 250 V	T
F3, F4	10 A / 250 V	T
F5, F6	15 A / 250 V	T

High power oven

No.	Rated current/voltage	Type
F1, F2	5 A / 250 V	T
F3, F4	10 A / 250 V	T
F5, F6	10 A / 250 V	T

■ Drying out of the system

> **NOTE** The system 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 system 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 "7.7.2 [Line Configuration] Screen" P.220

3 **Set the column oven temperature at "300 °C".**

Reference "7.3.1 [Column Oven] Screen" P.115

4 **Start the GC.**

Reference "7.1.1 [GC Start Sequence] Screen" P.94

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.107

8.3 Gas Supply

Read "Safety Instructions" P.iv and "Electromagnetic Compatibility" P.xvii 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 system 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	Argon
Carrier Gas	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	-	-	-

■ 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 SO_2 in the atmosphere may be detected. Pay close attention when using compressors.

■ ECD

	Helium	Nitrogen
Carrier Gas	Purity of 99.9999 % or more (Recommended)	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

8.3.2 Gas Supply Pressure

Gas type	Maximum pressure	Remarks
He, N2, Ar	300 to 980 kPa	Carrier gas, Makeup gas, Detector gas
H2	300 to 500 kPa	Carrier gas, Detector gas
Air	300 to 500 kPa	Detector gas

Hint

- The relationship of kPa and bar is as follows.
  100 kPa = 1 bar
- Convert units between kPa and kgf/cm^2 as follows.
  1 kPa = 1.02×10^{-2} kgf/cm^2
  1 kgf/cm^2 = 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

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.

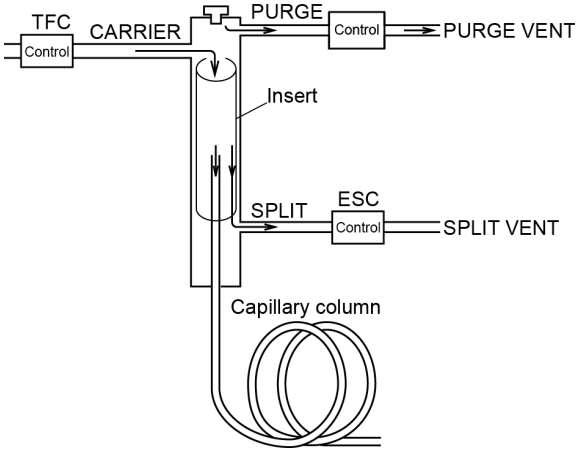
8.4 Sample Injection System

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.

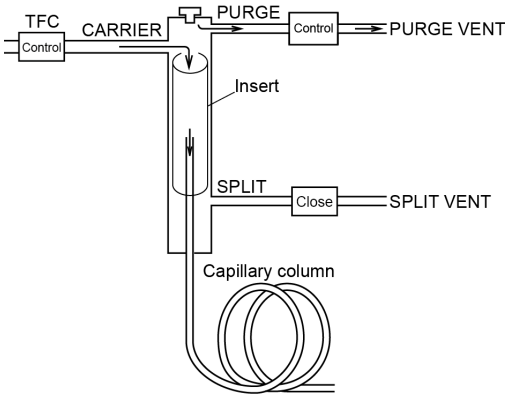


8.4.2 Splitless Injection System

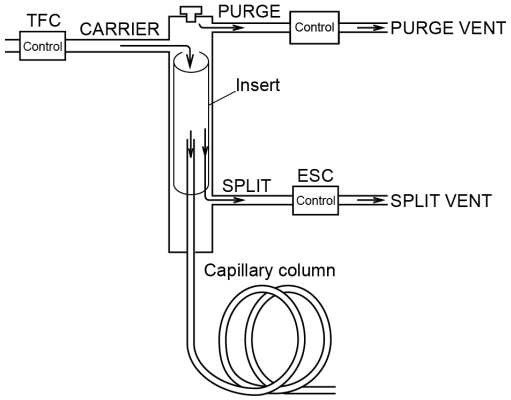
Injection Unit: SPL, PTV

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.



During sampling time

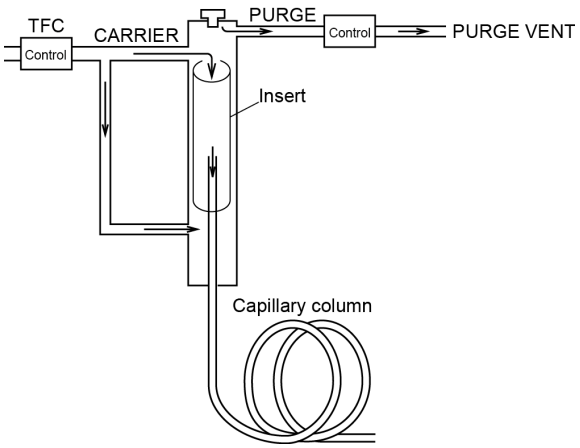


After sampling time

8.4.3 Direct Injection System

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.

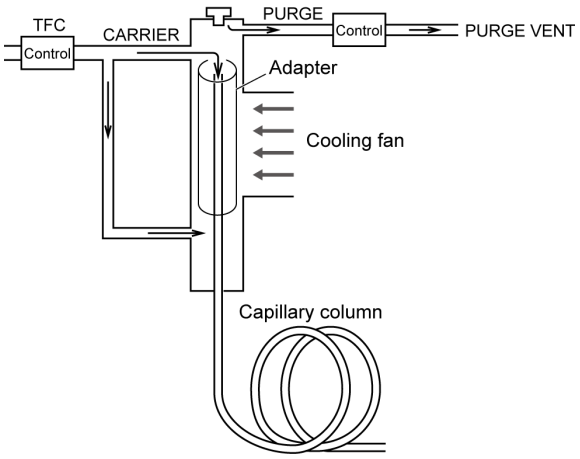


8.4.4 On-column Sample Injection System

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 insert.

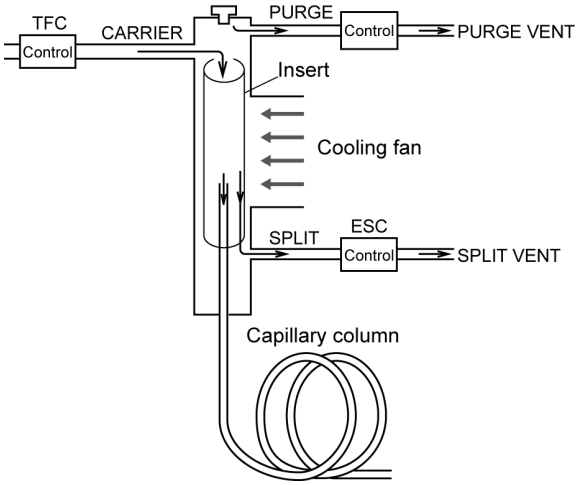
Hint Discrimination (distillation) is a phenomenon where the compositions are different between the sample, and the sample injected into the column and detected by the system when using micro syringe to inject the sample. This change of sample composition is caused because the remaining sample in the needle is heated, and then low-boiling component is vaporized and is introduced into the column.



8.4.5 Programmed Temperature Sample Injection System

Injection Unit: PTV

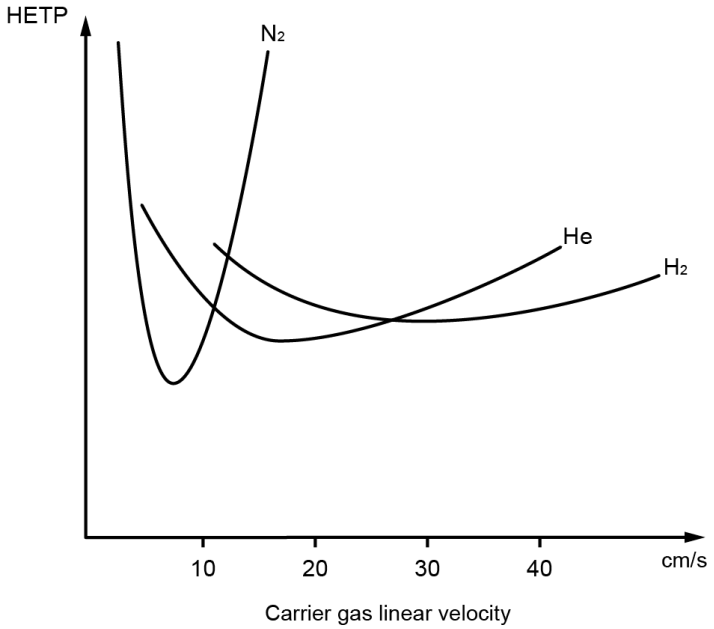
This system is an analysis method where the sample is injected to the column with an insert using heating program for injector inlet. Columns with various inner diameters can be connected using Programmed Temperature Vaporizer (PTV).
This method is suitable for analysis of heat-sensitive, easily decomposable materials because temperatures of inlet and column increase after sample injection.
Unlike OCI, an 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.



8.4.6 Setting the Flow Rate Parameters

■ Linear velocity and carrier gas selection

In capillary analysis, the type and the liner 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 valves 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 a 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.

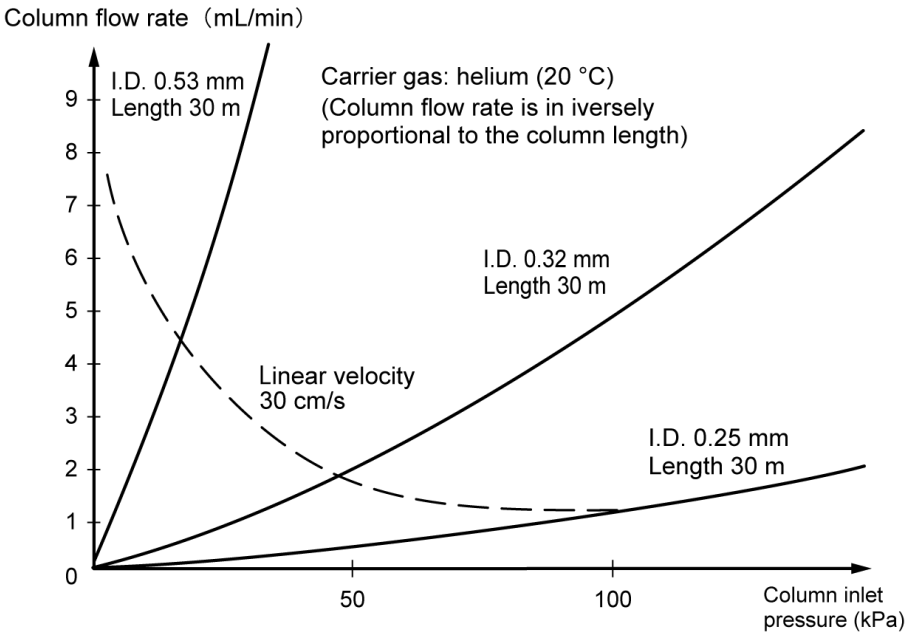
Column oven temperature = 50 °C (carrier gas = helium)

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.



$$F_C = \frac{60\ \pi d^4}{256\ \mu L} \times \frac{(P + P_0)^2 - P_0^2}{P_0} \times 10^3$$

F_C : Column flow rate [ml/min]
d : Column I.D [mm]
L : Column length [m]
P : Column inlet pressure [kPa]
P_0 : Column outlet pressure = atmospheric pressure [kPa]
μ : Viscosity coefficient (19.4 μPa・s (helium, 20 °C))

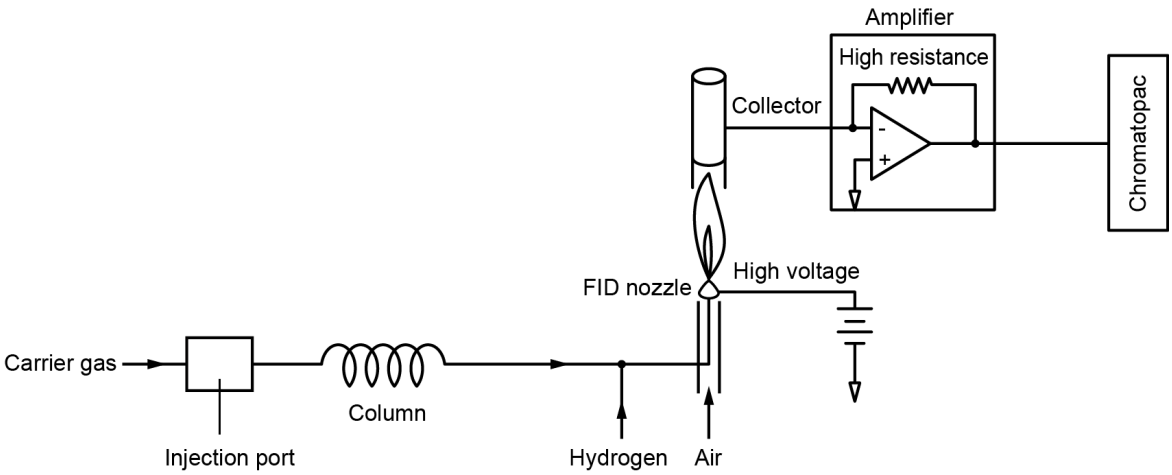
8.5 Detector

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.

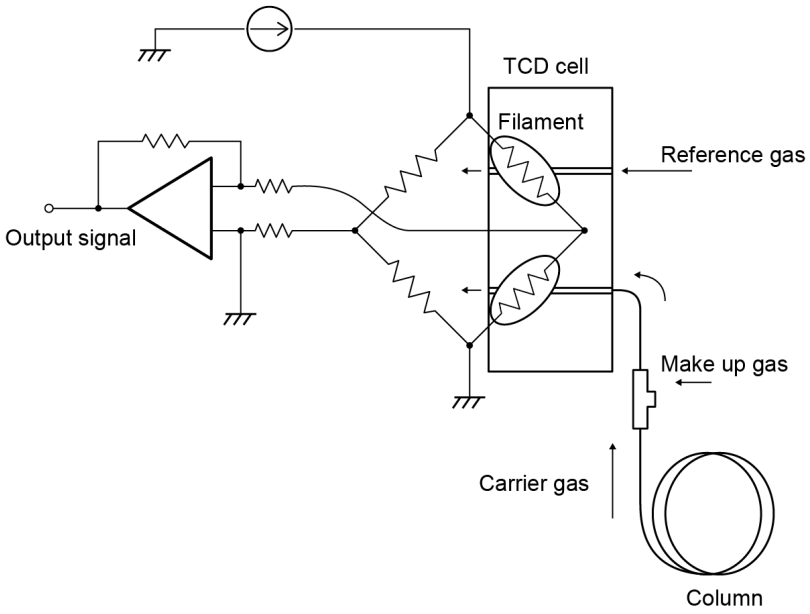
This is because ions (mainly carbon ions) are generated when an organic compound combusts within the hydrogen flame and the generated ions are captured by the collector. For isomers, the ion quantity generated is almost proportional to the number of carbons contained in the compound. However, carbon 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)

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.



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 perfomance 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 (PO_2*) after thermal decomposition on the surface of the heated alkali metal bead (alkali source).

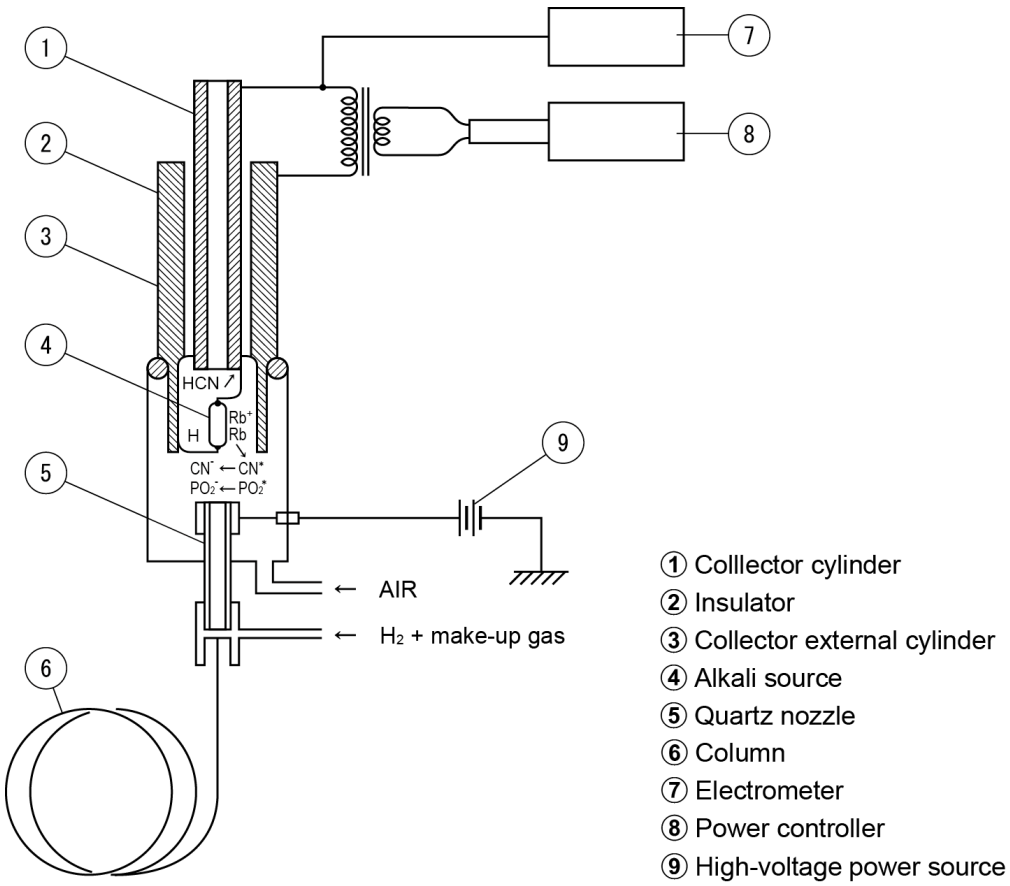
⬇

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 (PO_2-).

⬇

3. Produced ions bind to hydrogen atom and form HCN and HPO_2. Alkali metal (Rb) which lost an electron is collected as a positive ion, and then, the system 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

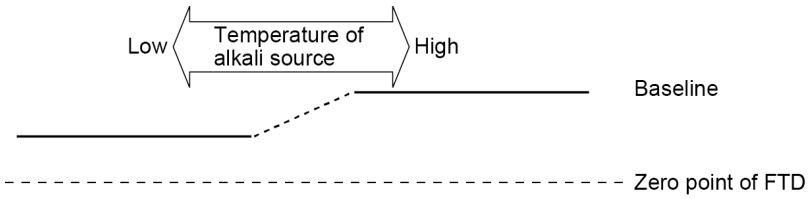
Background current is a current passing through FTD collector when no peak is detected.

Background current is sent to data processing device as stable baseline level.

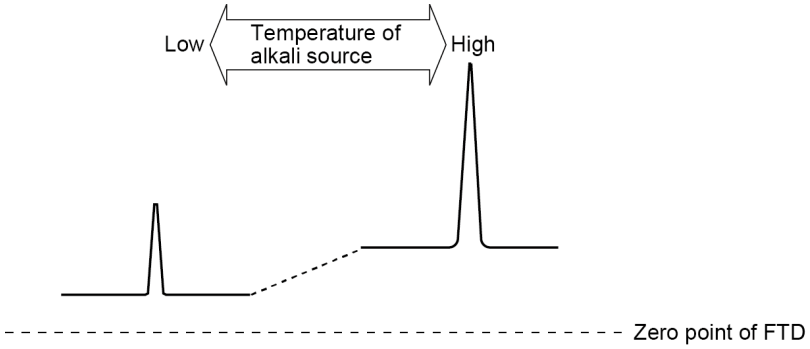
Alkaline source temperature

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.

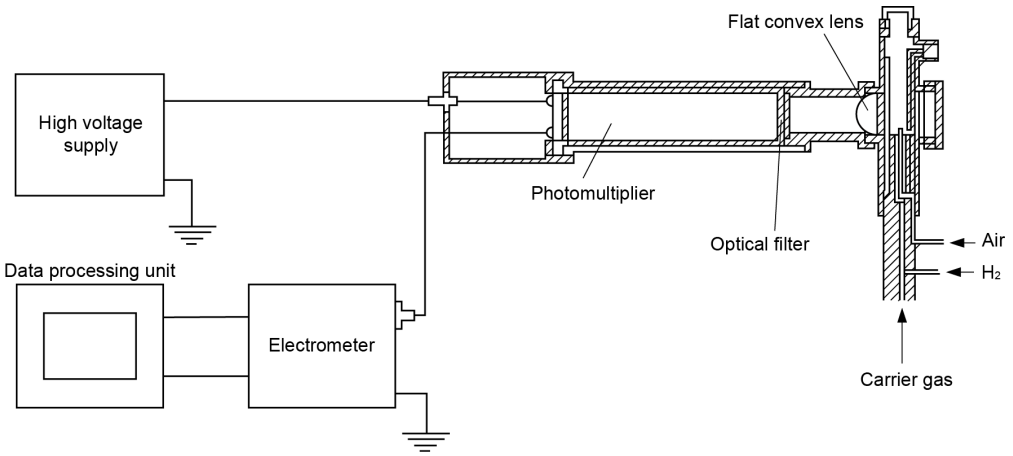
If alkaline source is consumed, thermal capacity decreases. Thus, the temperature of alkaline source increases and the sensitivity also increases, however, it promotes consumption of alkaline source. Therefore, you need to readjust background current depending on the alkaline source status to perform 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

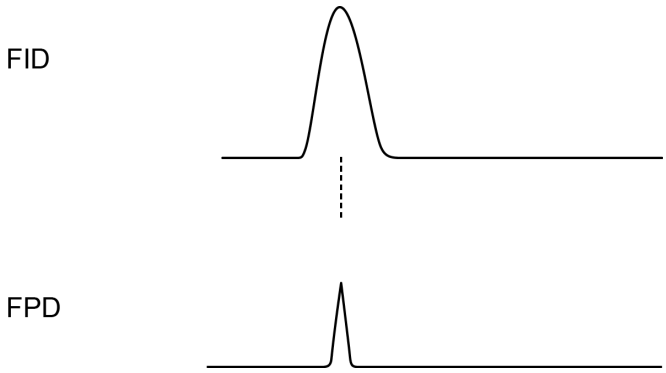
Light having only these wavelengths passes through the respective filters and reaches the photomultiplier.
The light intensity is converted into electrical signals by the photomultiplier, the signals are amplified in the electrometer, and then output to the data processor.
Approximately -700 V is applied to the cathode of the photomultiplier.



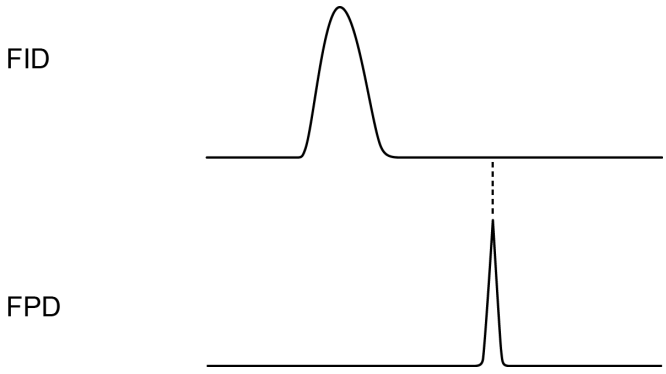
■ Quenching

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.

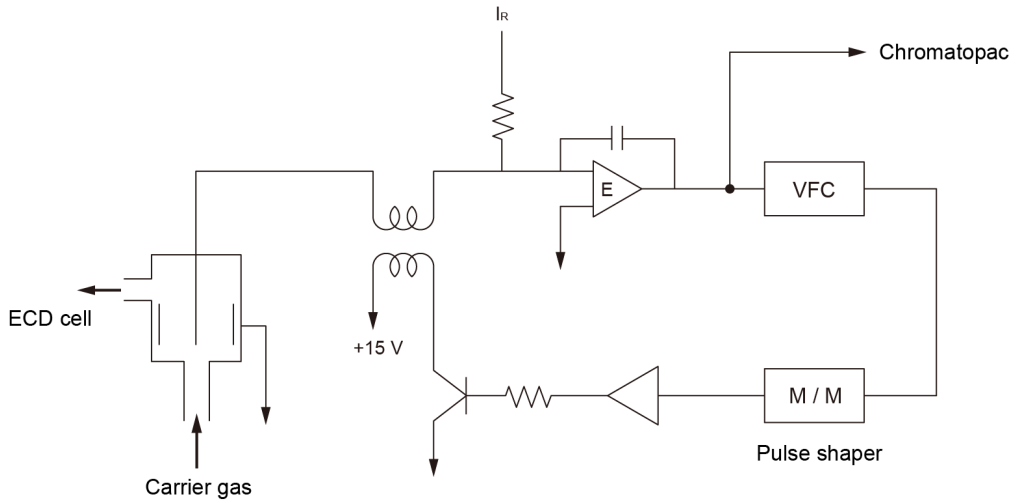
$$\Delta f = f - f0 = Ka$$

- f : Pulse frequency
- f0 : 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 captivating substance

Reference

R.J.Maggs, et al Anal. Chem. 43(1971), 1966

The construction of the system is schematically shown below.



Amplifier E compares the average pulse current from the ECD cell with reference current IR 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

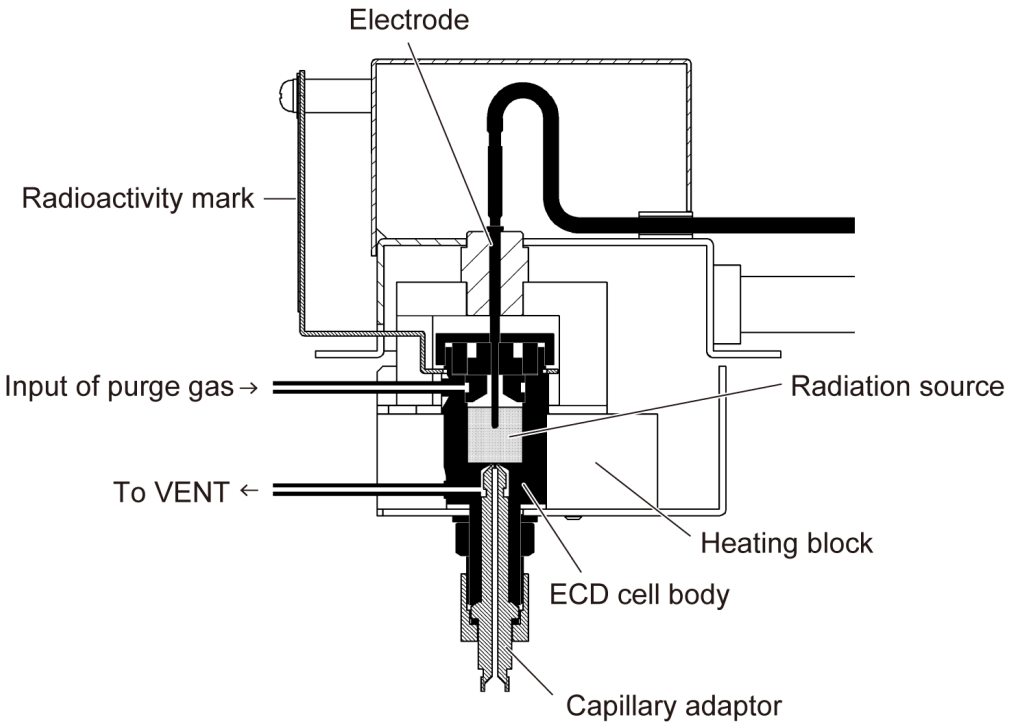
* Reference
Phillippe Devaux, Georges Guiochon ; in "Advances in Gas Chromatography 1967", A. Zlatkis, ed.

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

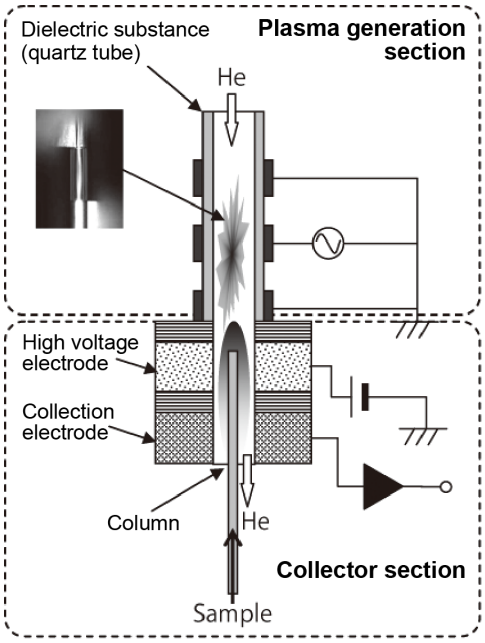
* Reference
K.P.Dimick, H.Hartmann ; presented at ACS Winter Meeting Cincinnati, Ohio January 13-18, 1963.

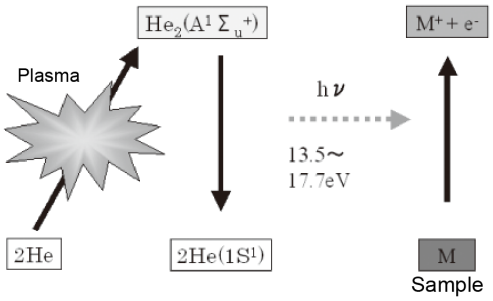
■ Structure of ECD cell



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).





	Ionization Potential (eV)
Ne	21.56
He	17.7
N_2	15.6
O_2	12.1
Acetone	9.7
Toluene	8.8

8.6 AFC, APC

8.6.1 Overview

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.324

Column flow rate

The column flow rate in the system 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:

$$Fc = \frac{60\pi d^4}{256\mu L T} \times \left(P^2 - P_0^{\ 2}\right) \times \frac{T_S}{P_S}$$

Fc	:	Column flow rate (mL/min)
d	:	Column inner diameter (mm)
L	:	Column length (m)
P	:	Column inlet pressure (kPa)
T	:	Column Temperature
P0	:	Column outlet pressure (= atmospheric pressure) (kPa)
μ	:	Viscosity coefficient (19.4 μPas helium at 20 °C)
TS	:	Standard temperature (25 °C)
PS	:	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:

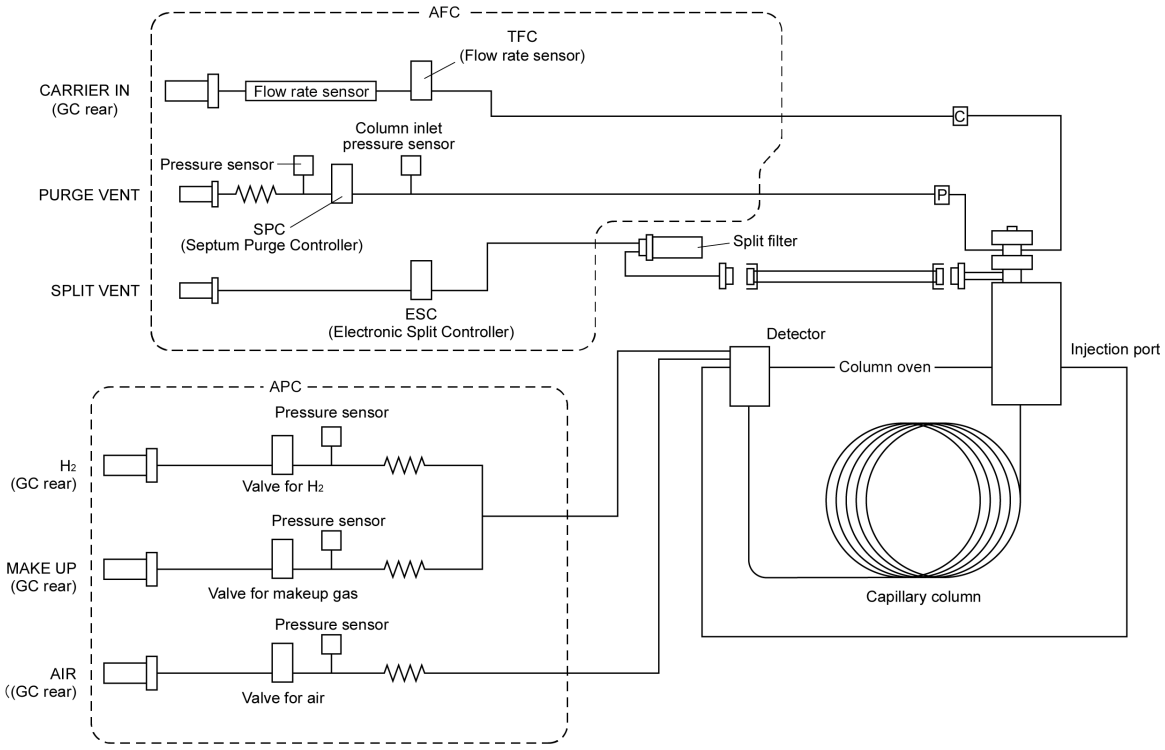
$$V=\frac{0.75\times d^2}{32\mu L}\times\frac{\left(P^2-P_0^{\ 2}\right)^2}{\left(P^3-P_0^{\ 3}\right)}\times 10^5$$

Split ratio

The split ratio in the system indicates "split flow / column flow".
The total flow is shown as "total flow = column flow + split flow + purge flow".

Split ratio is shown as $\frac{\text{total flow - column flow - purge flow}}{\text{Column Flow}}$.

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

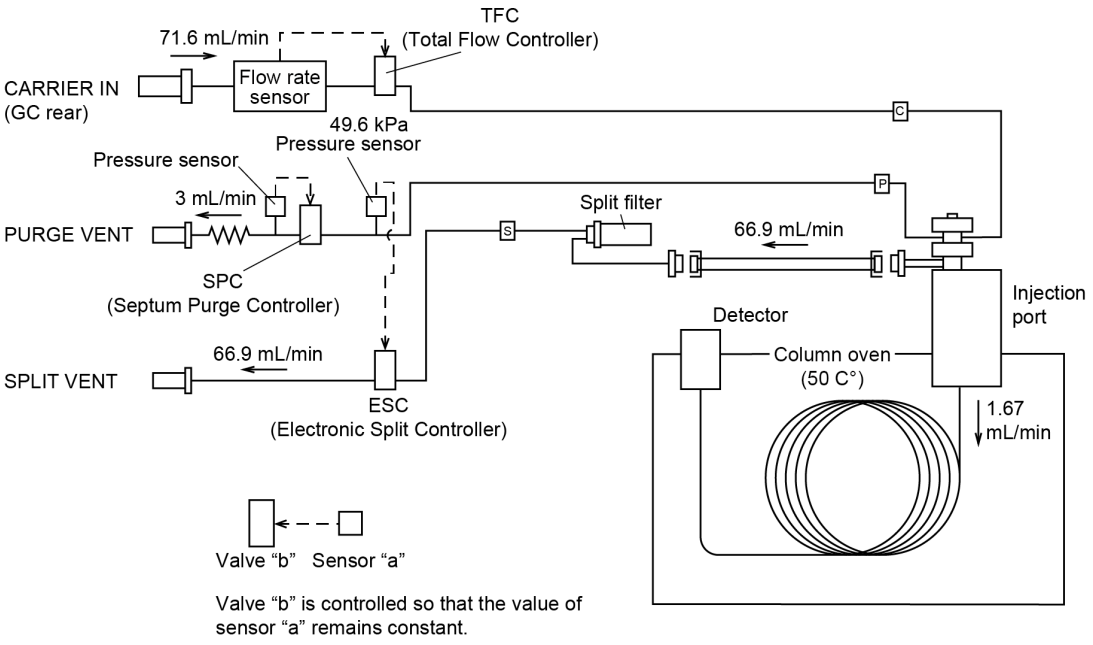
8.6.4 Control by AFC

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 : 0.32mm
Column length : 25.0m
Film thickness : 0.50µm
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 (≒ 1.67 mL/min + 1.67 mL/min × 40 + 3 mL/min (= purge flow rate)).

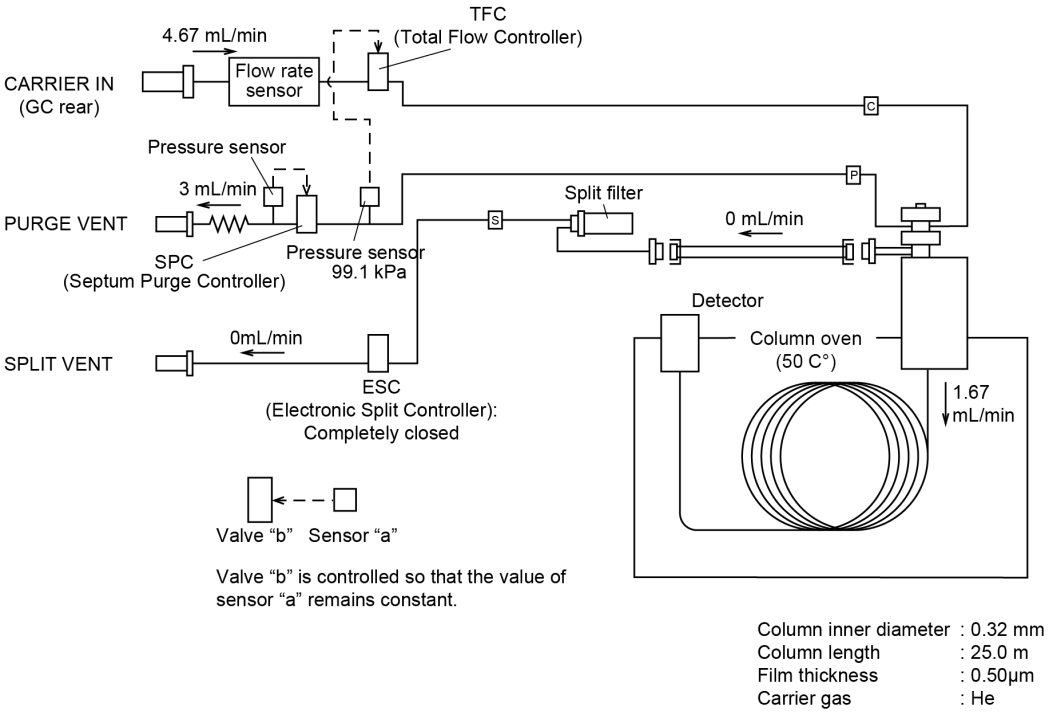
- When [Flow Control Mode] is set at [Press]
  The column inlet pressure is controlled to remain at 49.6 kPa regardless of the column oven temperature.
- When [Flow Control Mode] is set at [Velocity]
  The pressure is set to a value which keeps the linear velocity constant despite changes in the column 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.



Column inner diameter : 0.32 mm
Column length : 25.0 m
Film thickness : 0.50µm
Carrier gas : He

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.

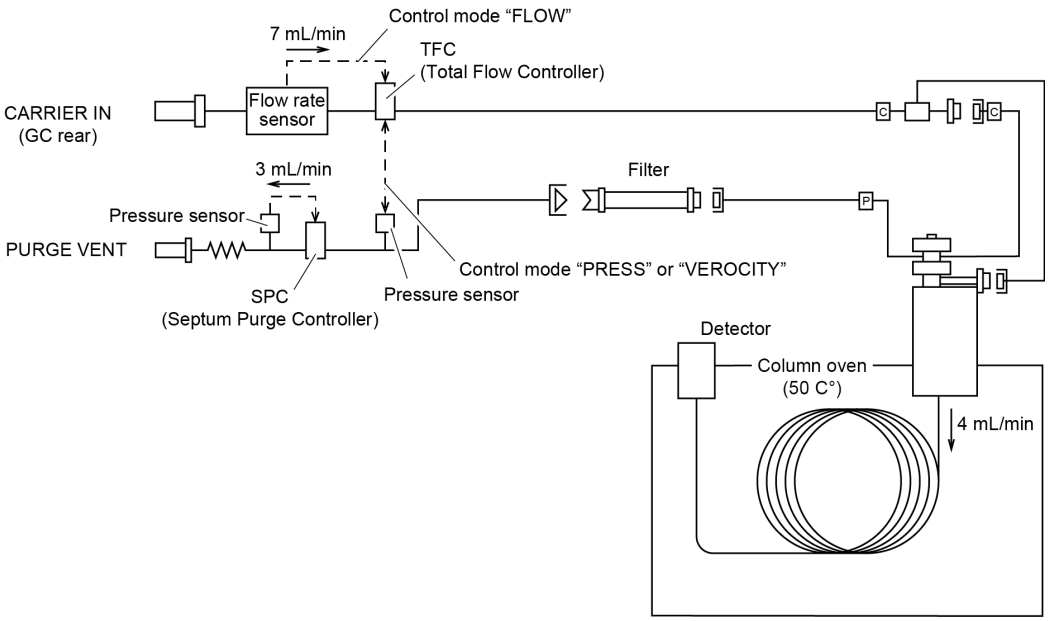
After the sampling time, the AFC controls the total flow rate to keep it at a constant value using the TFC (Total Flow Controller) inside the AFC. As in split mode, the ESC (Electronic Split Controller) is controlled to maintain the column inlet pressure constant. Control status after sampling time is 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

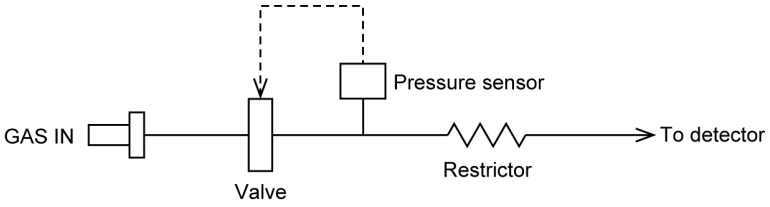
When the injection unite is WBI or OCI, direct mode is selected automatically.



- 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

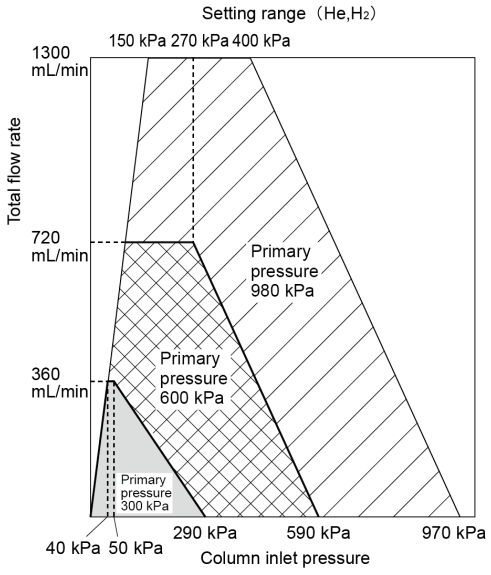
The APC performs its control as illustrated in the figure below.

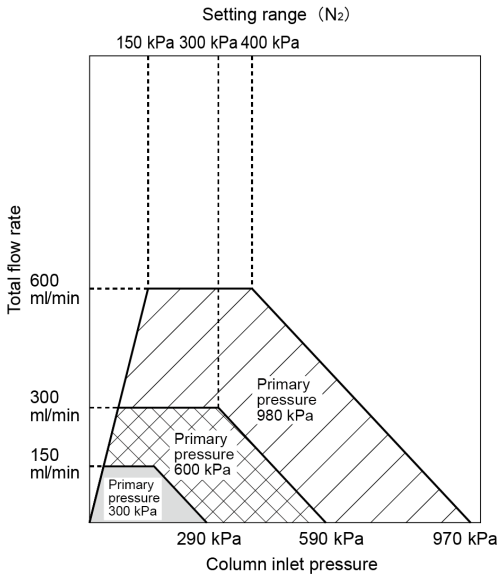


The APC controls only the pressure.
The flow is calculated based on resistance and pressure.

8.6.6 AFC and APC Control Ranges

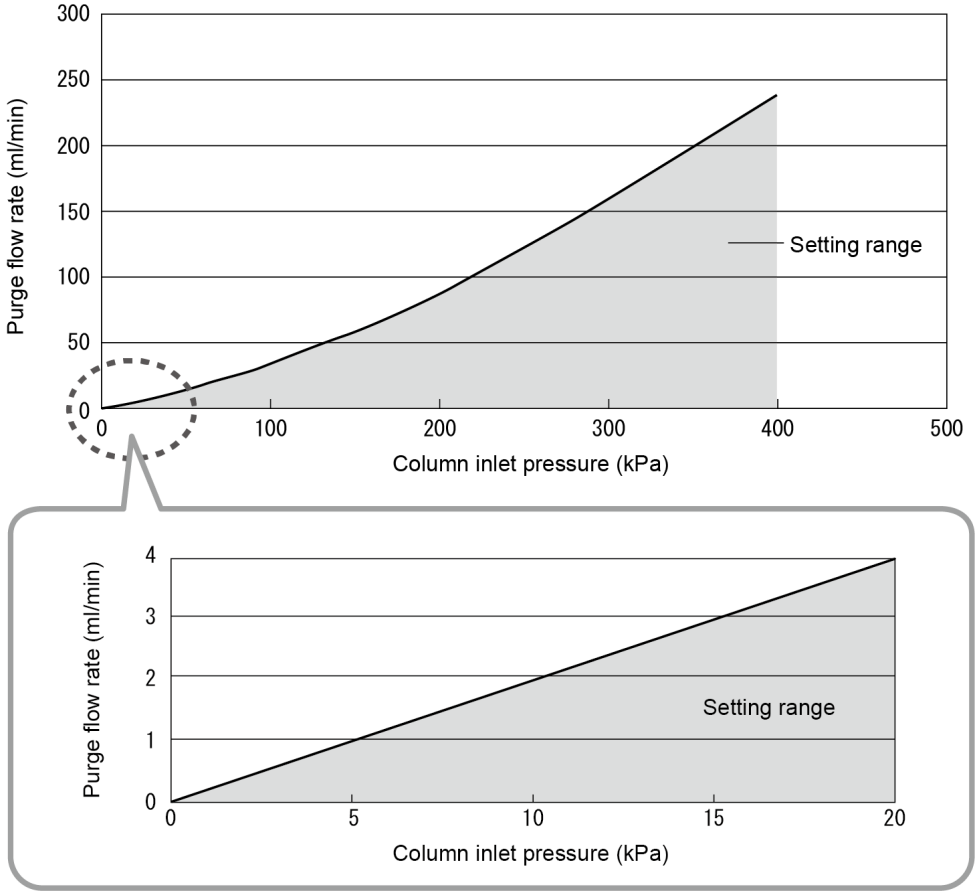
For the AFC, the column inlet pressure can be set from 0 to 970 kPa, and the total flow rate can be set from 0 to 1,300 mL/min.
However, these values are instrument specifications, valid when the primary pressure supplied to the system is 980 kPa.
The allowable pressure and flow rate settings are limited 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).





NOTE You cannot set values higher than 500 mL/min for hydrogen.

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. The maximum flows shown above are achieved when the supply pressure is 500 kPa. When the supply pressure is less than 500 kPa, the available maximum flow decreases proportionally.

NOTE When flow line restrictors or buffers other than optional devices are installed on the flow line, the control range may become narrow.

8.6.7 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 through there is no actual pressure of 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.94

3 **Press** 

(Monitor).

Monitor screen appears.

4 **Wait until the temperatures of the injector 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 system to turn off the system.**

6 **Turn ON the system 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.94

3 **Press** 

(Monitor).
Monitor screen appears.

4 **Wait until the temperatures of the injector 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 system to turn off the system.**

6 **Turn ON the system 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.**

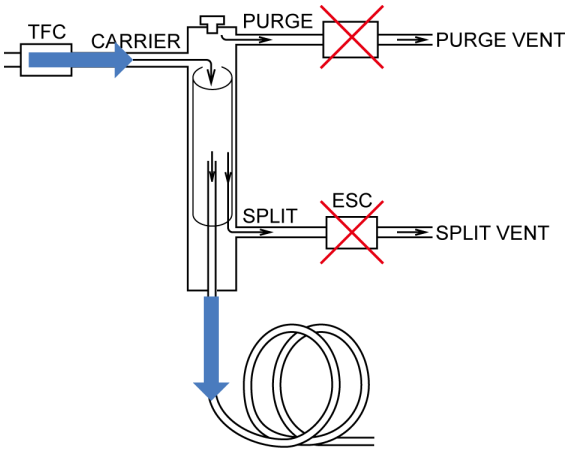
9 **Ensure that the actual value of the detector gas is not fluctuating.**
If fluctuating, wait for a moment.

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.**

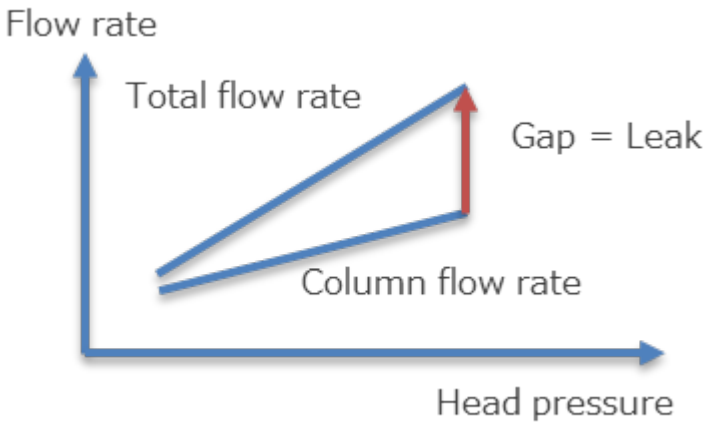
8.6.8 Carrier Gas Leak Check Function

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" P.41.

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.97
4. Set [Sleep] at [Disable].
5. Set [Restart] at [Disable].
6. Press [Stop GC].

2 Press Monitor (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.277

If the previous check result is displayed, press [Clear] to delete it.

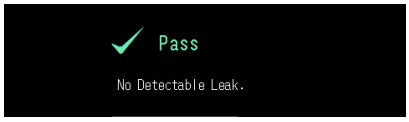
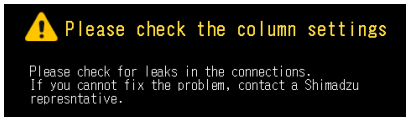
5 Ensure that all items on [Column Information] are set correctly.

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" P.41 and check connections for leaks.
		Check column connection and piping connection, and install them correctly.
		Ensure that the column information is entered correctly. ▶▶ Reference "7.3.2 [Column Information] Screen" P.122

8.7 Peripherals

8.7.1 CRG CO_2/CRG N_2

CRG is a device to cool the column oven with coolant to perform analysis at low temperatures.

Reference
- "Precautions on Using CRG" P.xx
- "7.6.2 [CRG] Screen" P.210

■ 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.**

CO_2 gas or N_2 gas blows into the column oven and the system starts to keep the temperature at low.

7 **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

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 "7.6.6 [Relay Control] Screen" P.216

■ To switch event

1 **Press (HOME) - [Function] - [Direct Operation].**

[Direct Operation] screen appears.

Reference "7.8.5 [Direct Operation] Screen" P.239

2 **Set event No. to be used in [Event].**

Reference "8.10 Event No." P.359

3 **Press [Run].**

Set event is executed.

■ PCB for PRG-2030

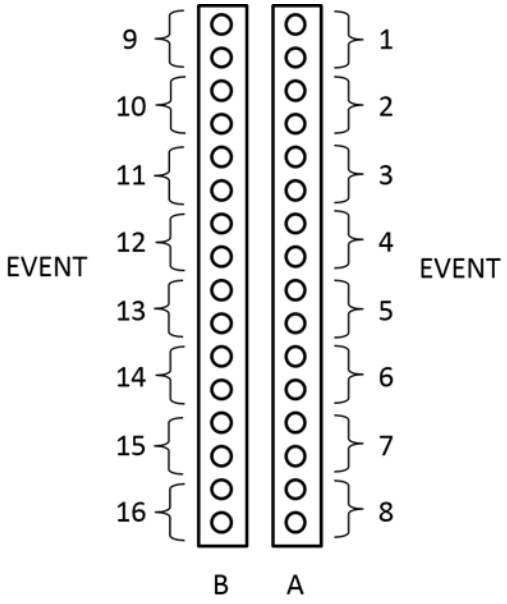
PRG-2030 should be incorporated into GC-2030 to use.

Three types of PCB for PRG-2030 are available:

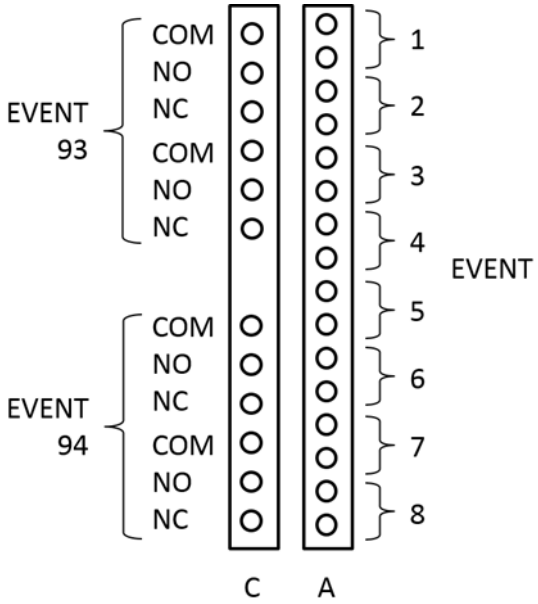
- PCB A : Outputs 24 V (the maximum: 100 mA) in EVENT1 to 8.
- PCB B : Outputs 24 V (the maximum: 100 mA) in EVENT9 to 16.
- PCB C : Turn on the relay in EVENT93 and EVENT94.

Choose from PCB A+B or PCB A+C.

Insert cables of the devices to be used in the order of Event No.



For PCB A+B



For PCB A+C

■ PRG box

PRG box can output AC 100 V or 230 V 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) is an optional unit to detect concentration of hydrogen gas in the column oven.

The pump installed on the rear of the system aspirates atmosphere in the column oven and the sensor installed on INJ/DET top cover detects the concentration of hydrogen.

When the concentration of hydrogen in the column oven reaches 0.4 %, an error message appears, and the system stops all temperature control and fully opens the oven flap.

When the concentration of hydrogen in the column oven reaches 2 %, the system will be forcibly turned off.

■ Switching active views button

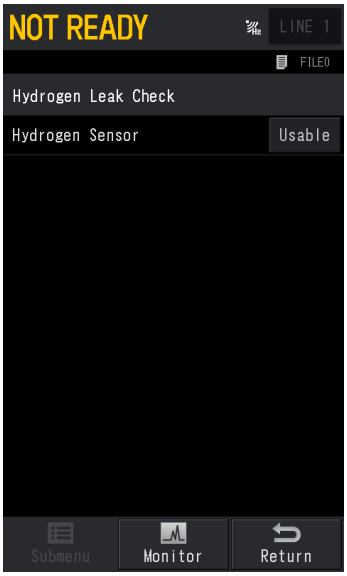
1 **Press (HOME) - [Peripherals] - [Hydrogen Leak Check Function].**

[Hydrogen Leak Check Function] screen appears.

Reference "7.6.4 [Hydrogen Leak Check] Screen" P.214

2 **Set [Hydrogen Sensor] to [Usable].**

(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.

8.8 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.

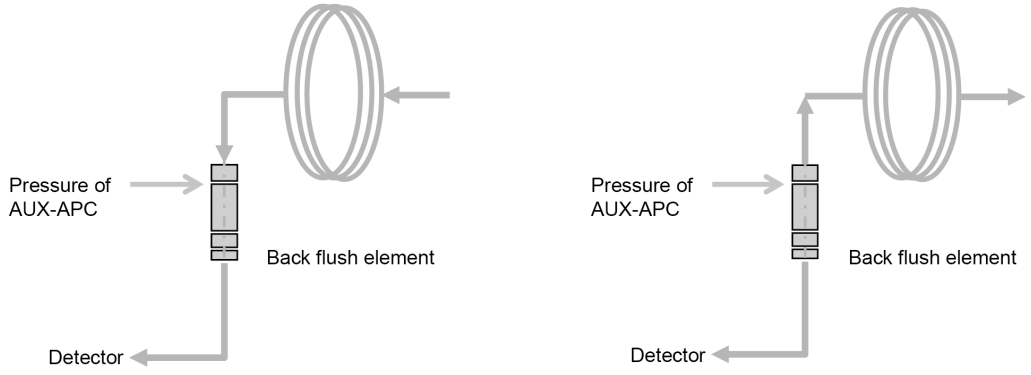
For back flush analysis, pressure program in GC-2030 is used.

In normal mode to detect the target component, the system 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 system 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.



Normal Mode　　Back Flush Mode

Reference "7.4.9 [Back Flush Settings] Screen" P.151

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.

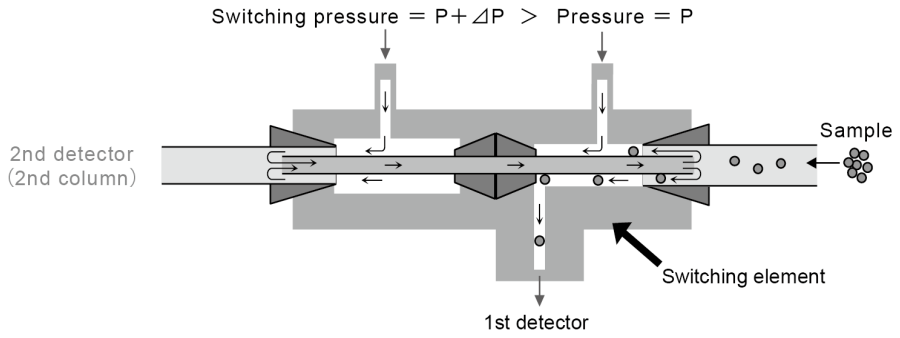
Detector switching is a system to analyze components eluted from the column with two detectors depending on your purpose.

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.

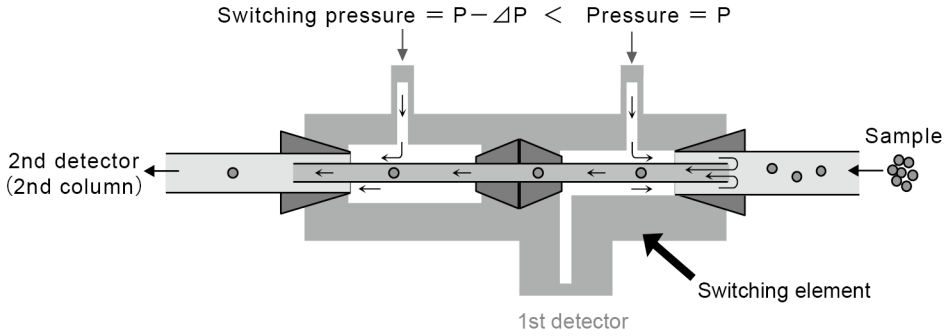
For switching element, multi-Deans type is adopted. By using this, several heart-cuts can be performed precisely because retention time after heart-cut fluctuates very little.

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.

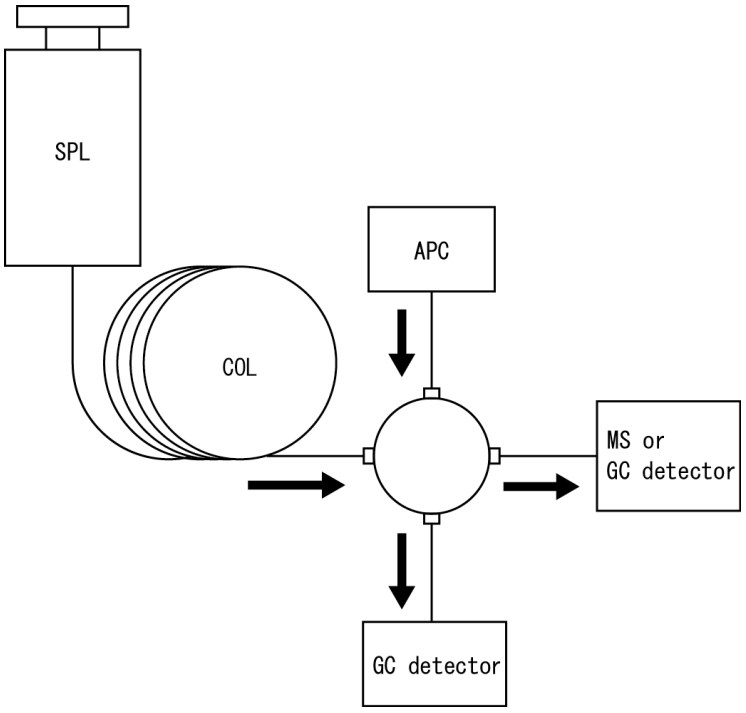
8.8.3 Detector Splitting System

Detector splitting is a system to split the column outlet to obtain information from several detectors in one sample injection.

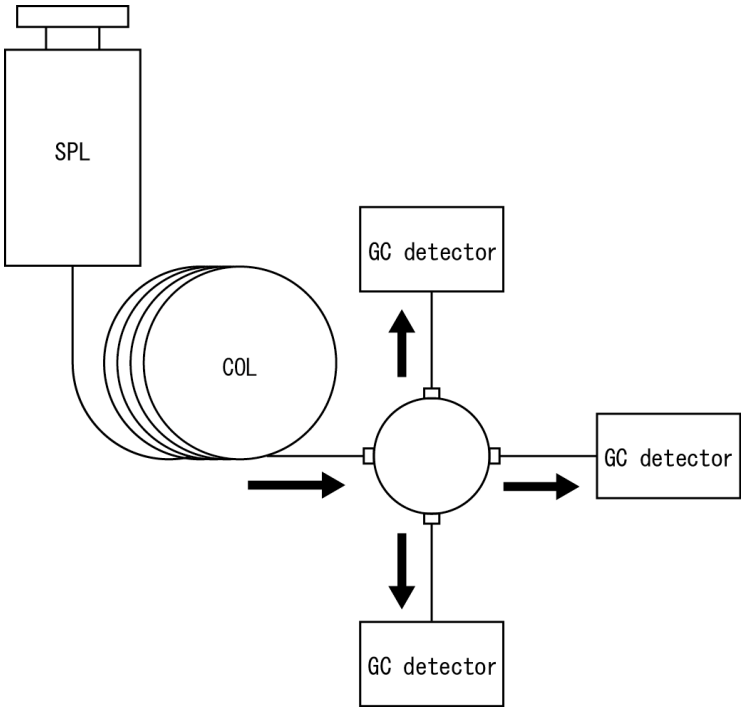
The amount of the sample introduced into the detectors is smaller than analysis using single detector because this system splits the sample component. You need to adjust split ratio so that each detector can detect the sample component. Split ratio can be adjusted by resistance ratio (inner diameter, length) of restrictor connected to each detector.

Optional splitting units are required to use detector splitting function.

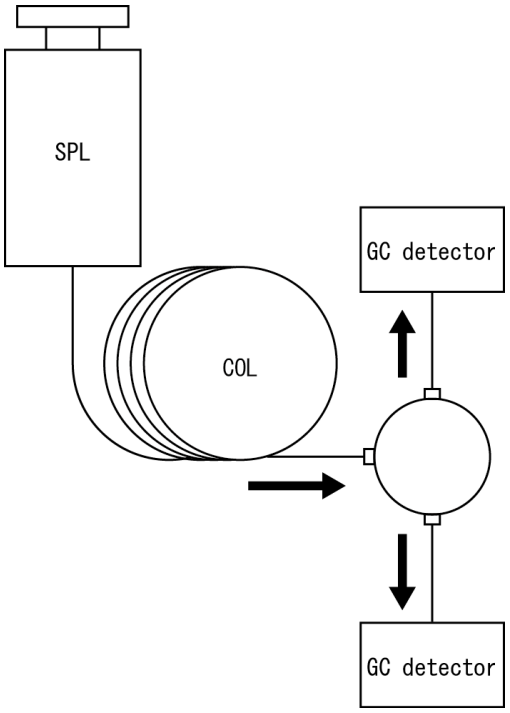
• 2-way splitting unit with AUX-APC (P/N: S221-78810-41)



• 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 system.

Reference "5 Trouble Shooting" P.40

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.48 • FPD: P.54	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 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.

8.9 Connecting to External Devices

8.9.1 Connecting to LabSolutions

To control the system with LabSolutions, connect the USB or Ethernet cable to the connector on the rear of the system.

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.244

The settings are updated and the system 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.244

4 **Press [Apply].**

The settings are updated and the system is connected with LabSolutions.

8.9.2 Connecting to CHROMATOPAC

After you connect the system with CHROMATOPAC (C-R8A, C-R7A/C-R7A plus), set the transmission settings at equivalent values between the system 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 system 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 (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 system.

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 (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 system.

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 COMMAND M, and then ENTER.

- For C-R7A/C-R7A plus
  Press "F" key on [Win1] screen.

8 Press Monitor (Monitor).

Monitor screen appears.

9 Press (Auto Zero).

The baseline moves to zero point (0 µV).

Reference "7.2.1 Monitor Screen" P.107

10 Check the displayed range on CHROMATOPAC.

- When [Analog Signal Type] is [Wide]
  The signal level is within "±50 µVe", the calibration has done correctly.
- When [Analog Signal Type] is [Linear]
  The signal level is "±0 µVe", 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 system, the maximum difference of displayed values between the system and CHROMATOPAC (FREE) is ±50 µV 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.

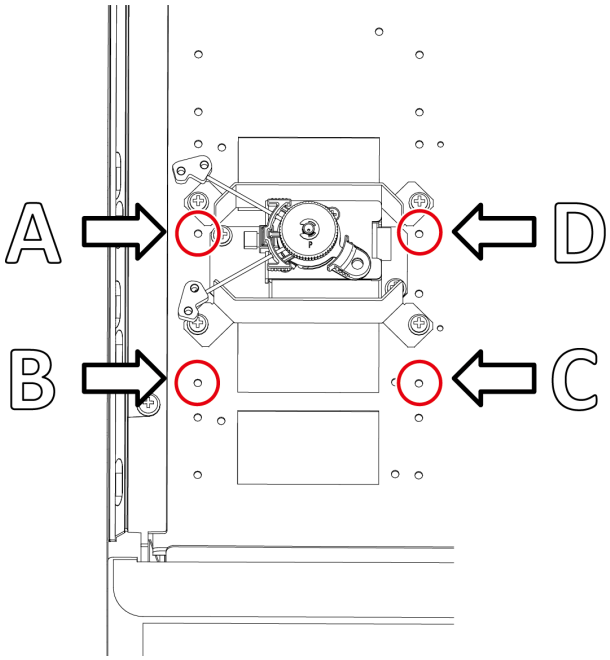
8.9.3 Connecting to Auto Injector AOC-20i.

Reference For details about AOC-20 series, refer to the User's Manual for AOC-20i/AOC-20s and the User's Manual for AOC-20 Dual Injection System.

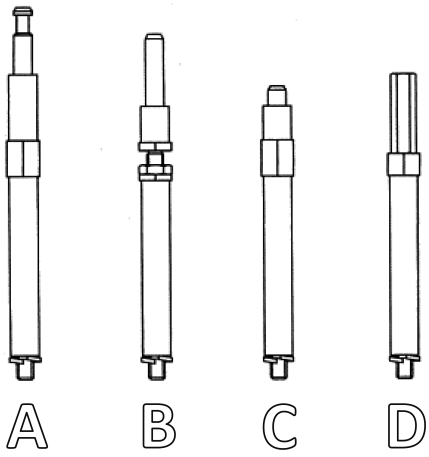
1 **Attach spacers for auto injector to the system.**

Fix spacers for auto injector to A to D shown in the following figure using the wrench supplied with AOC.

Adjust the height of the spacer attached to B so that auto injector can be installed in a horizontal position.



Connections for spacer



Spacer

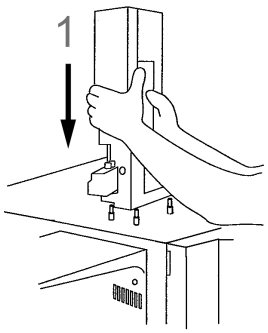
2 Attach the auto injector.

⚠ CAUTION

Instruction

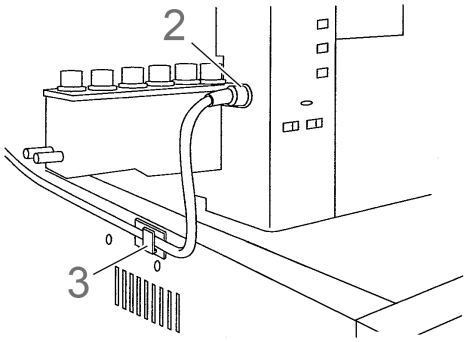
Always turn off the auto injector while you connect and disconnect AOC cable.
If you connect and disconnect cables while the auto injector is turned on, it may cause malfunction or failure.

1 Slide auto injector over spacers for auto injector.
Install the auto injector securely until it is engaged in inlet fin.



2 Insert AOC cable to connect between auto injector and the system.

3 Fix AOC cable using supplied hook.
Fix it so that it does not prevent turret operation.



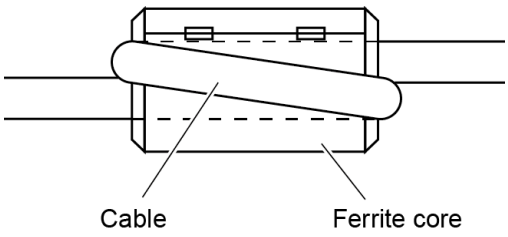
NOTE
- If the installation is not appropriate, "-11" error appears on the display when you turn on AOC. If the error is displayed, check the installation status and engage them securely.
- You can connect/disconnect auto injector although AOC cable is kept connected.
  To move the main unit of auto injector to a place where AOC cable cannot reach the unit, disconnect AOC cable.

Hint Pull the main unit of auto injector straight up to remove auto injector.

3 Connect AOC cable to the connector on the rear of the system.

Reference "2.2.5 Rear" P.11

When you use AOC in single configuration, connect AOC power cable to INJECTOR1 connector for AOC-20i.
When you use AOC in dual configuration, connect AOC power cable of the main one to INJECTOR1 connector for AOC-20i, and the secondary one to INJECTOR2 connector for AOC-20i.
When using power supply for 230 V, wrap the cable around Ferrite core near the connector (power source side) as shown below.

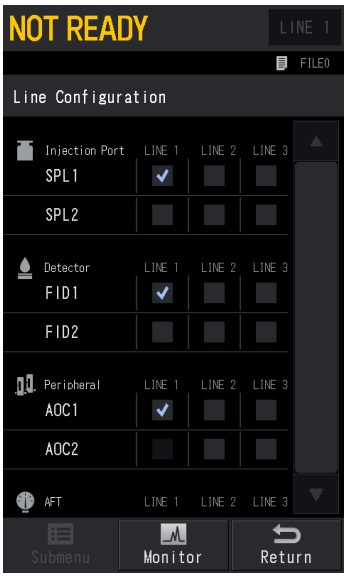


4 Set up the system.

1 Press (HOME) - [Settings] - [Submenu] - [Line Configuration].

[Line Configuration] screen appears.

2 Configure [AOC1] and injector port to be used in the same analytical line.



3 Press (HOME) - [Peripherals] - [AOC].

[Auto Injector] screen appears.

4 Turn [On] auto Injector control.
You can control AOC-20 series with the GC.

■ When using autosampler

Make the following settings when using the autosampler AOC-20s.

1 **Press (HOME) - [Peripherals] - [AOC] - [Submenu] - [Auto Sampler Setting].**

[Auto Sampler Setting] screen appears.

2 **Check [Use AOC-20s].**

■ When using dual injection system

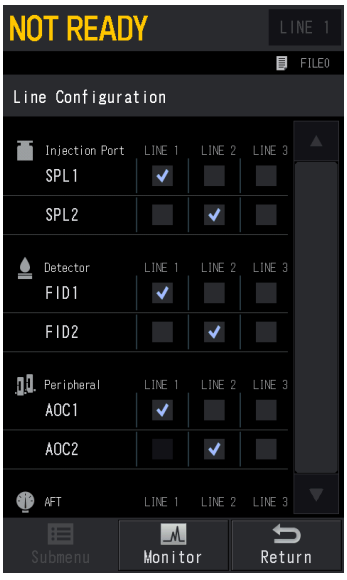
Make the following settings when using dual injection system.

Reference For details about dual injection system, refer to User's Manual for AOC-20 Dual Injection System.

1 **Press (HOME) - [Settings] - [Submenu] - [Line Configuration].**

[Line Configuration] screen appears.

2 **Configure [AOC1] (main) and injector port to be used in the same analytical line. In the same way, configure [AOC2] (sub).**



3 **Press (HOME) - [Peripherals] - [AOC] - [Submenu] - [Auto Sampler Setting].**

[Auto Sampler Setting] screen appears.

4 **Check [Use AOC-20s].**

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 system.

Reference "2.2.5 Rear" P.11

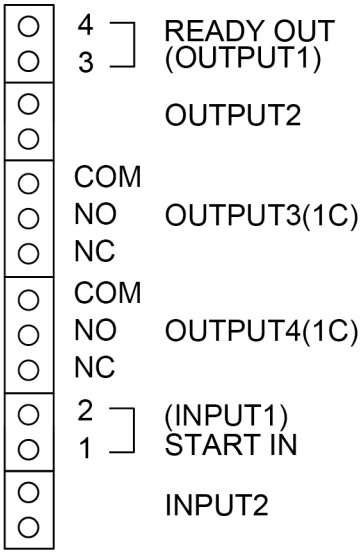
■ Standard relay output/input

Signal type of relay output/input can be set on [Relay Control] screen.

Reference "7.6.6 [Relay Control] Screen" P.216

- 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.

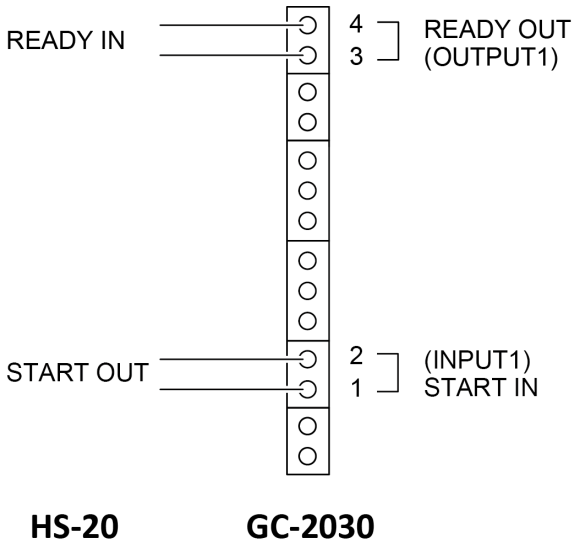
Insert the connector to be used according to your purpose.



■ Connecting to HS-20

Make the following settings when using the HS-20.

1 Connect between HS-20 and GC with start signal line.



2 Set items as below on [Relay Control] screen.

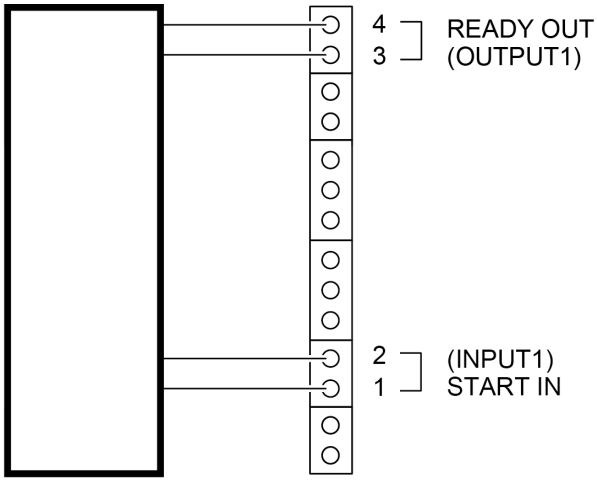
Reference "7.6.6 [Relay Control] Screen" P.216

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.



HS-10 I/O Connector GC-2030

2 Set items as below on [Relay Control] screen.

Reference "7.6.6 [Relay Control] Screen" P.216

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)
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
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
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

No.	Function of Event xx (positive number)	Function of Event -xx (negative number)
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
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

No.	Function of Event xx (positive number)	Function of Event -xx (negative number)
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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