



Sampling pump
SP209-100Dual / 1000Dual

Instruction Manual

GL Sciences Inc.

No Text

Introduction

Thank you for purchasing this product. This manual contains information regarding accurate usage of the product, as well as details and precautions required for safely using the same.

Request

To ensure safe and proper use of the product, read this manual before use. In addition, the manual must be carefully kept for quick reference when needed.

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Safety Instructions

In this manual, following alert marks and signal words are used for important information and precautions to enable safe and proper use of the product.

Read the text after understanding these contents properly in order to prevent harm or damage to users and surrounding workers.

Symbol	Meaning
 WARNING	Indicates that inappropriate handling may lead to user's death or serious injuries.
 CAUTION	Indicates that inappropriate handling may cause minor to moderate injury to the user or may lead to physical damage.
Attention	Indicates important information for the user and things needed to maintain the product performance.
Notes	Indicates useful information for the handling and operation of the product.

Safety information

■ Installation and mounting precautions

 WARNING	<p>Do not use in the presence of flammable and combustible gases May lead to serious injuries due to ignition and fire.</p>
	<p>Do not use in the presence of organic solvents with a flash point of less than 70°C May lead to serious injuries due to ignition of solvent vapors.</p>
	<p>While attaching and detaching the AC adaptor, hold the adaptor along with the plug part Cables may get cut from inside leading to fire or major injury.</p>
	<p>Ensure that the plug and DC plug are inserted deep Inappropriate connection may cause severe damage due to spark or ignition.</p>
 CAUTION	<p>Do not install in unstable areas Failure to do so may cause damage or injury due to fall.</p>
	<p>Do not use in the presence of corrosive gases May lead to electrical leakage or electrical shock due to electrical insulation destruction.</p>
	<p>Do not use in oil mist, dust, moist areas Contact sparks may cause electrical leakage or electric shock.</p>
	<p>Take measures to prevent fall when used while standing Fall may cause fault or injury.</p>
<p>Attention</p>	<ul style="list-style-type: none"> • Do not use the product in places where air conditioning or other wind comes into direct contact. • Do not use in places exposed to direct sunlight. • Do not use in places with severe temperature changes or vibrations.

■ Precautions concerning the transport and storage

 CAUTION	<p>Hold the handle or hold the device with both hands when transporting Failure to do so may cause damage or injury.</p>
<p>Attention</p>	<ul style="list-style-type: none"> • Do not store in places exposed to direct sunlight. • Do not store in places where dust, high temperature, humidity and vibrations are high. • Do not store in places where corrosive or flammable gases are present.

■ **Precautions concerning product use and handling**

 WARNING	<p>Do not place combustibles or flammables around the unit May lead to serious injuries due to ignition and fire.</p>
	<p>Do not suck-in flammable gases May lead to serious injuries due to ignition and fire.</p>
	<p>Do not use the AC adapter which does not satisfy the following requirements Fault or ignition may cause serious injuries. AC adapter requirements : DC plug ; EIAJ RC5320A TYPE4 (Center pin: 1.0φ) Output Voltage ; DC12V Output Current ; 1.5 A or more Center pin ; positive</p>
	<p>Do not place objects on the AC adapter cable Cables may get cut from inside leading to fire or major injury.</p>
 CAUTION	<p>Do not suck-in corrosive gases or substances Defect or short circuit may cause fire.</p>
	<p>Avoid contact with water, rain, snow, etc. when used outdoors May lead to defect.</p>
	<p>Do not add pressure from the suction port (IN) or block the outlet (OUT) Tube may get disconnected leading to defect and injury.</p>
<p>Attention</p>	<ul style="list-style-type: none"> • Turn off the power before attaching or detaching the connectors or cables. • Replace the filter element regularly. • Do not push the operation keys with sharp objects.

■ **Precautions for maintenance and inspection**

 WARNING	<p>Do not disassemble or remodel Failure to do so may cause unexpected problems such as defect, electric shock, or ignition.</p>
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Product Disposal

Dispose this product as industrial waste.

Make sure to comply with the regulations and laws of the each country

Contents

Introduction.....	i
Request	i
Safety Instructions	i
Safety information.....	ii
Product Disposal	iv
Contents	v
1 Outline and features	1
1.1 Outline	1
1.2 Features	1
2 Names and functions of parts.....	3
2.1 Front.....	3
2.2 Back	4
3 Unpacking and installation	5
3.1 Unpacking.....	5
3.2 Check the contents of the package	5
3.3 Installation	6
3.3.1 Installation environment	6
3.3.2 Installation	6
4 Preparation before use	7
4.1 Connecting the AC adapter	7
4.2 IO cable connection	8
4.3 Pipe Tube Connection	10
5 Operation.....	11
5.1 Operation key functions	11
5.2 Power on.....	12
5.3 Power off.....	12
5.4 Configuration mode.....	13
5.4.1 [LOG Check].....	14
5.4.2 [LOG Setting].....	15
5.4.3 [Clock Setting]	16
5.4.4 [Buzzer Set.].....	16
5.4.5 [Auto Zero].....	16
5.4.6 [Sensor]	16
5.4.7 [Save Mode]	17
5.4.8 [File Lock]	17
5.4.9 [Calibration]	18

5.4.10	[Std. Temp].....	18
5.4.11	[ROM Version].....	18
5.4.12	[Pump Time].....	18
5.4.13	[Offset].....	19
5.5	Manual mode setting	21
5.6	File mode settings.....	23
5.7	Status Display	26
5.8	Pulsating Flow Calibration Function	29
5.9	Temperature and humidity sensor.....	31
5.10	Test mode.....	35
5.11	Suction start.....	36
6	Maintenance.....	39
6.1	Filter element replacement	39
6.2	Calibration.....	40
6.2.1	Preparation.....	41
6.2.2	Calibration Mode selection.....	43
6.2.3	Auto mode (Auto.).....	43
6.2.4	Manual mode (Manu.).....	47
6.2.5	Calibration LOG Display (LOG)	50
7	Errors and troubleshooting.....	51
7.1	Error message	51
7.2	Troubleshooting	53
8	Product specifications.....	55
8.1	Main unit.....	55
8.2	Temperature and humidity sensor.....	56
9	Options and Consumables.....	57
9.1	Options.....	57
9.2	Consumables.....	57

1 Outline and features

1.1 Outline

This product is a pump for suction of gas and chemical substances collected in sample bags into sample tubes or collection cartridges.

1.2 Features

■ Accurate measurement

Dual measurements are a must when it comes to quality control desired in measurement of chemical substances in the air. SP209 enables simultaneous suction through 2 lines by using 2 pumps.

■ Covering wide flow range

The pump corresponds to one sampling cartridge, which has very different suction resistances when collecting formaldehyde and VOCs.

■ Suction load variation

The suction ability of the pump is adjusted to enable suction at a stable flow rate, based on the function of maintaining the set flow rate, even if the suction resistance of the collector or cartridge fluctuates. In particular, when suction takes place in a low flow area with a low suction load, the rotation speed decreases and noise and power consumption to be reduced.

■ Multi-function with the use of a micro-controller

Setting the suction start conditions

Suction start can be selected from any of the following options.

- After elapse of set time (minutes)
- Real Time (Year, Month, Date, Hours, Minutes)
- Immediately

Setting the suction end condition

Suction end condition can be selected from the following:

- Elapse time from the suction start
- Total suction volume
- Continue

Incorporating data log function

Records the suction flow, errors, etc. during the suction operation. Optional temperature and humidity sensors can also be used to record temperature and humidity.



- **Calibrating the pulsating flow for suction under optimal conditions**

Detects the pulsating flow and displays its condition using a three-color LED so that the suction resistances of the sample tubes and/or collection cartridges and the suction capabilities of the pumps are optimal. When the pulsating flow is detected, the flow calibration needle valve can be manually adjusted to get non-pulsating flow.

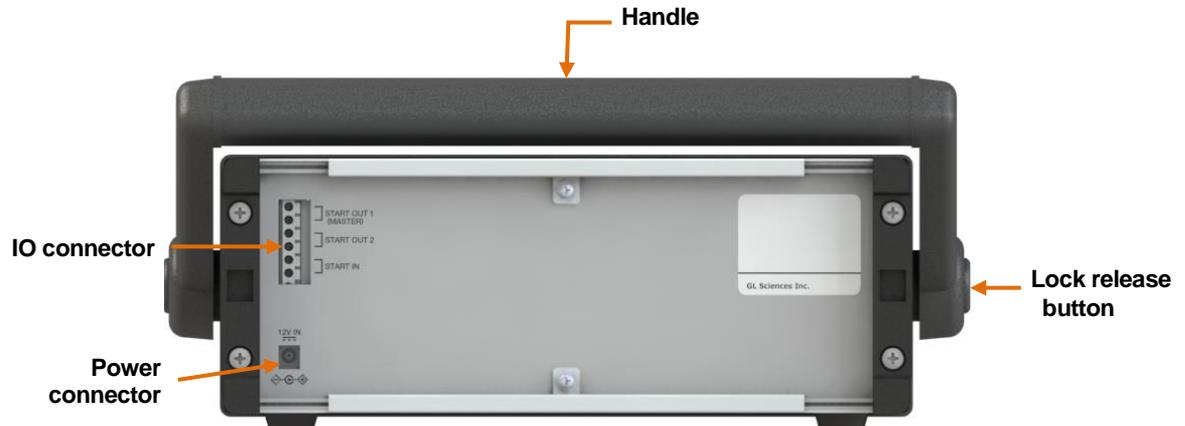
2 Names and functions of parts

2.1 Front



Name	Function
LCD display	Display various set values, current values, and information.
Pulsating Flow Display LED	Pulsating flow state is displayed through 3 colors of LED (Red/Green/Orange).
Suction port	Connect sample tubes and collection cartridges etc..
Exhaust port	Exhaust port of the suction pump.
Operation key	Turn ON/OFF, various settings and operations.
Pulsating flow calibration valve	Calibrate the pumping capability to optimal to prevent pulsating flow.
PC connector	Connect the USB cable to communicate with the PC software.
Flow meter connector	Connect the dedicated cable to communicate with the Film flow meter.
Sensor connector	Connect the cable of the temperature and humidity sensor.

2.2 Back

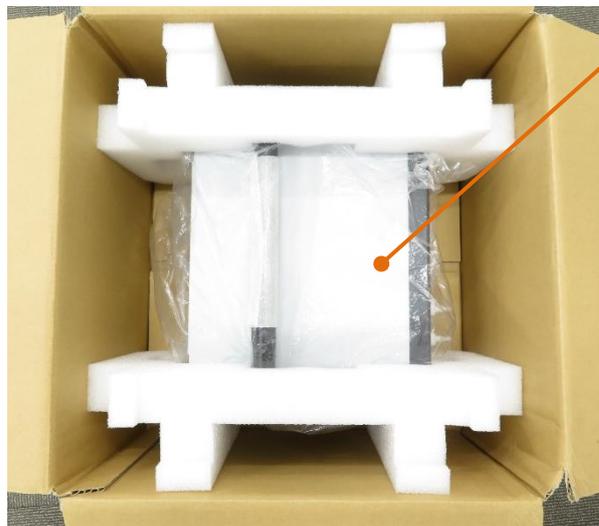


Name	Function
IO connector	Connect the cable to start remotely from outside or starting multiple units simultaneously.
Power connector	Connect the AC adapter.
Handle	Hold the handle while transportation. The unit can be tilted during use.
Lock release button	Press to rotate the handle. The buttons are on both sides.

3 Unpacking and installation

3.1 Unpacking

1. Open the upper surface of the packing box.
2. Remove the packet containing the instruction manual.
3. Take out the main unit from the packing box.
4. Remove the cushioning material and take out the device from the packet.



SP 209 Dual Main unit

3.2 Check the contents of the package

Check for defects such as missing items and damage.

- SP 209 Dual Main unit
- Instruction manual (This document)

3.3 Installation

3.3.1 Installation environment

Installation and storage should be indoors as per the following conditions.

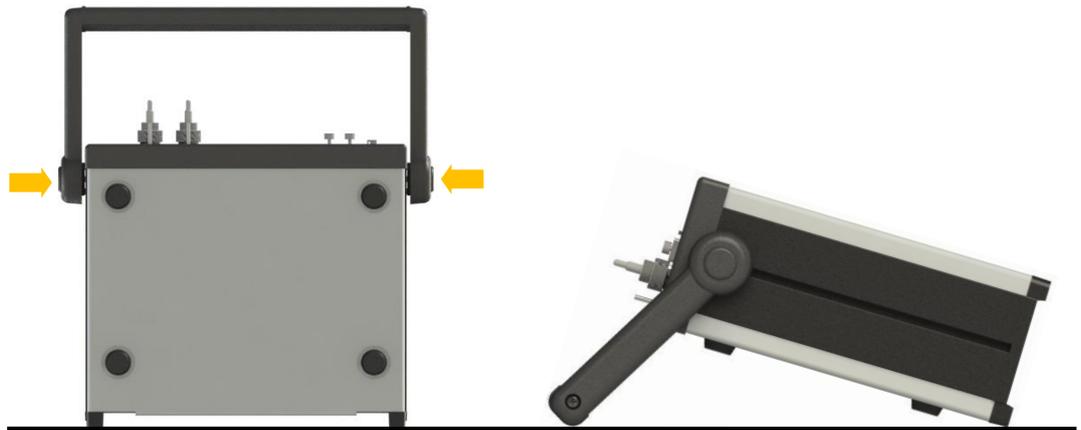
- Avoid direct exposure to direct sunlight or air conditioning.
- Place that meets the temperature and humidity conditions within the performance and operation assurance range
- Low levels of vibration, oil mist, and dust
- Absence of corrosive and flammable gases
- Low electrical and solenoid noise
- Flat and stable place

3.3.2 Installation

After the transportation, the unit can be placed in vertical position temporarily before installation.

Pressing the buttons on both sides of the handle unlocks the handle and locks the handle at 30° angle, so rotate the handle in the appropriate position.

Turning the handle in downward direction enables to tilt the unit as shown in the image.



 **CAUTION**

- Take measures to prevent overturning when using the product in an upright state.
- Failing to do so may lead to damage or injury.

4 Preparation before use

4.1 Connecting the AC adapter

WARNING

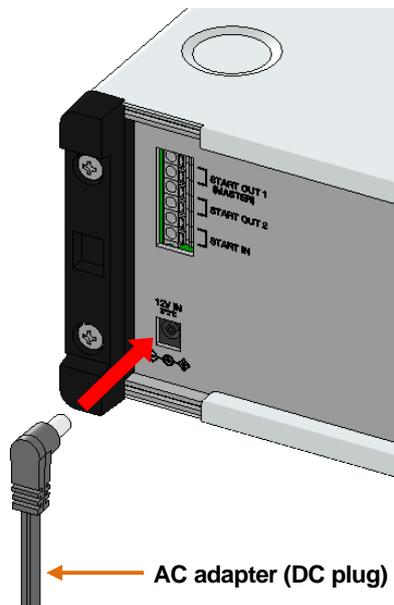
Ensure that the AC adapter satisfy the following requirements before connecting.
The unit may be damaged, cause in fire.

■ AC adapter requirements

- DC plug : EIAJ RC5320A TYPE4 (Center pin: 1.0φ)
- Output Voltage : DC12V
- Output Current : 1.5 A or more
- Center pin : positive

Connect the DC plug of the AC adapter to the power connector "12V IN" on the back of the main unit.

Next, connect the AC adapter to a power outlet.



CAUTION

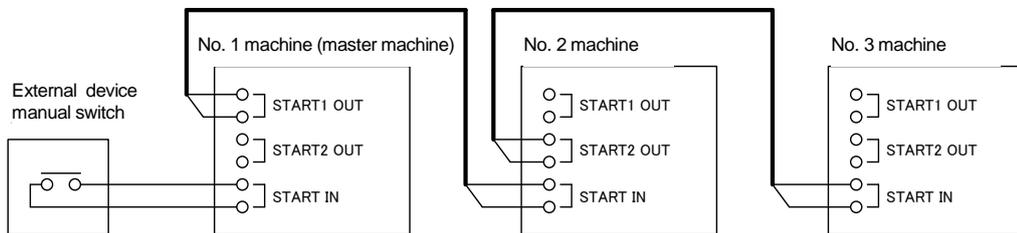
- Do not pull out the connector by pulling the cable.
To do so may cause disconnection of the cable.
- Ensure that the plug and DC plug are inserted deep
Failure to do so may lead to operation malfunction.
- Do not place anything on the cables.
Failure to do so may cause disconnection of the cable.

4.2 IO cable connection

IO connector

Name	Function
START OUT1	Outputs as soon as the suction starts.
START OUT2	Outputs simultaneously with the input of START IN.
START IN	Start signal input terminal. Enter at a voltage-free contact point, such as a relay or switch.

Connection example



Operation detail

1. The No. 1 machine (master machine) starts with the start signal of the external device/manual switch or the  key of the main unit.
2. When the suction operation of No. 1 (master machine) starts, the start signal is output from the START OUT1 of No. 1 and then No. 2 machine starts.
3. As soon as the start signal is entered on the START IN of No. 2 machine, start signal is output from START 2 OUT of No. 2 machine and then No. 3 machine starts.

Attention

- There are no restrictions on the number of connections. However, if the number of units are too many, there may be difference between the start time of the 1st and the later units.
- If you start by entering a START IN, you cannot enter the sample number.

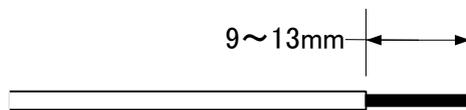
Make sure the power is OFF and connect the wire or cable to the IO connector at the back of the unit.

1. Use the electrical wires with below specifications.

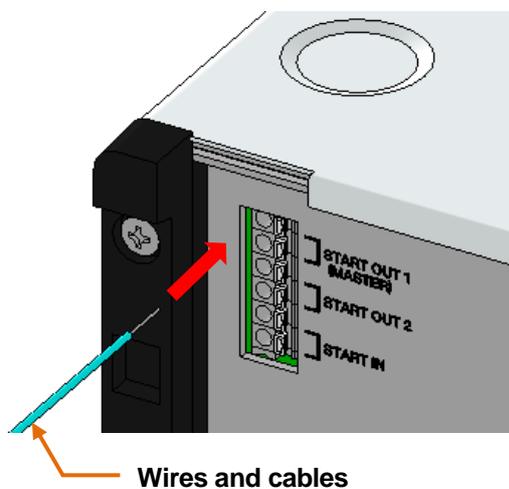
Single lines: $\phi 0.4$ mm (AWG26) ~ $\phi 1.2$ mm (AWG16)

Bunched wires: 0.2 mm² (AWG 24) ~ 1.25 mm² (AWG 16)

2. Remove the wire coating to about 9-13 mm.
For bunched wires, remove the coating and twist the core wire with finger.



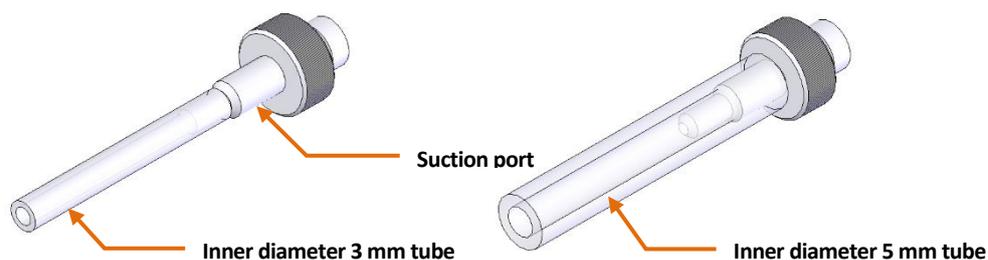
3. Insert the wire into the round hole while pushing the white button on the connector with a flathead screwdriver of blade tip 2.6mm. Return the button to normal once the wire is inserted till the end.



4.3 Pipe Tube Connection

While using soft tubes such as silicone tube etc. for connection, use a 3 mm or 5 mm inner diameter tube matching with the sample tube and collection cartridge.

The suction port is a hose port joint with steps. Therefore, if a tube with an internal diameter of 3 mm is used, push the tube into the front step of the tube, and if a tube with an internal diameter of 5 mm is used, push the tube into the inner step of the tube.



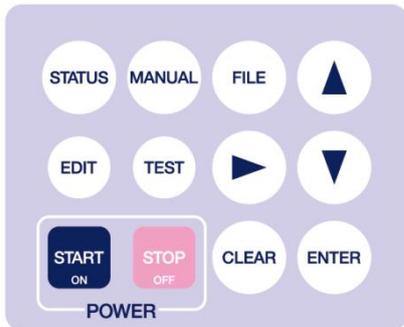
For optional holders and pipe kits, refer to the accompanying instruction manual.

Attention

If tube is not inserted till deep inside, it might fall out. So, make sure to insert it till as far as possible

5 Operation

5.1 Operation key functions



Operation key	Function description
	<ul style="list-style-type: none"> • Turn on the power supply • Start sampling.
	<ul style="list-style-type: none"> • Turn off the power • Stop sampling
	<ul style="list-style-type: none"> • flow rate zero-point correction • Cancel settings and the operation
	Define the set values and state.
	Edit the sampling conditions.
	Used for flow rate check and leak check
	Display information such as set values and current values etc.
	Shift to Manual Mode.
	Select saved file.
	Select the set item or move the cursor.
	Select the set item or adds up the set values.
	Select the set item or subtracts the set values.
	Move to Configuration Mode

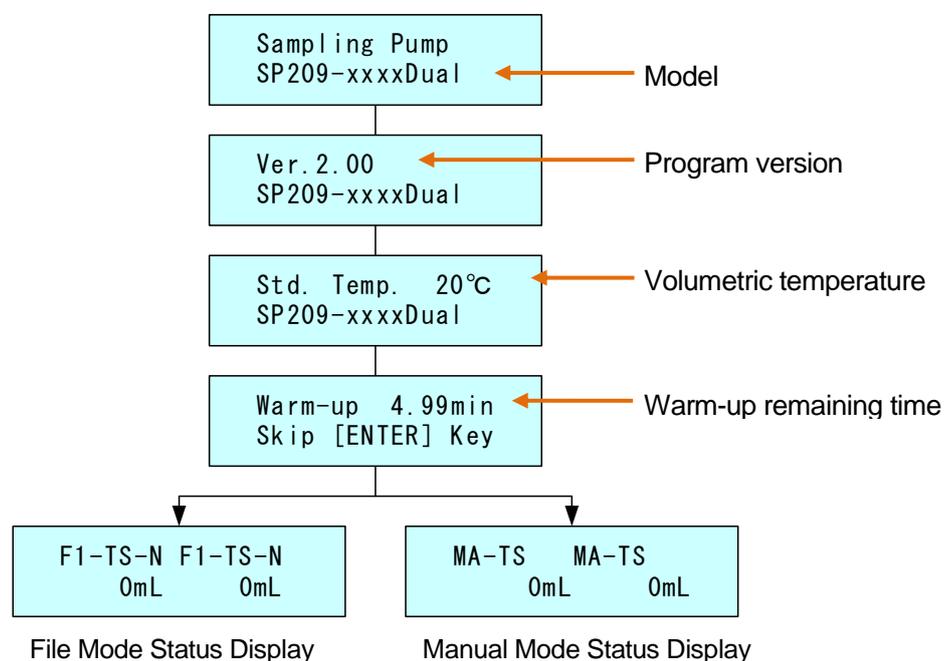
5.2 Power on

Pressing  operation key for 2 seconds or more will trigger the unit with a startup sound.

After displaying various information, warm up starts and countdown begins.

Press  key to skip the warm up stage.

Status screen appears after the elapse of warm up time or once warm up stage is skipped. The status screen displayed after the power supply displays the mode when the power supply was switched off last time.



Notes

In the warm up stage, power is supplied to the flow rate sensor and it is stabilized. For precise collection, it is recommended that the warm up stage is not skipped.

5.3 Power off

When turning off the power, push  key for at least 2 seconds while the operation is stopped.

Attention

Remove the AC adapter from the power outlet if it is not used for a long time.

5.4 Configuration mode

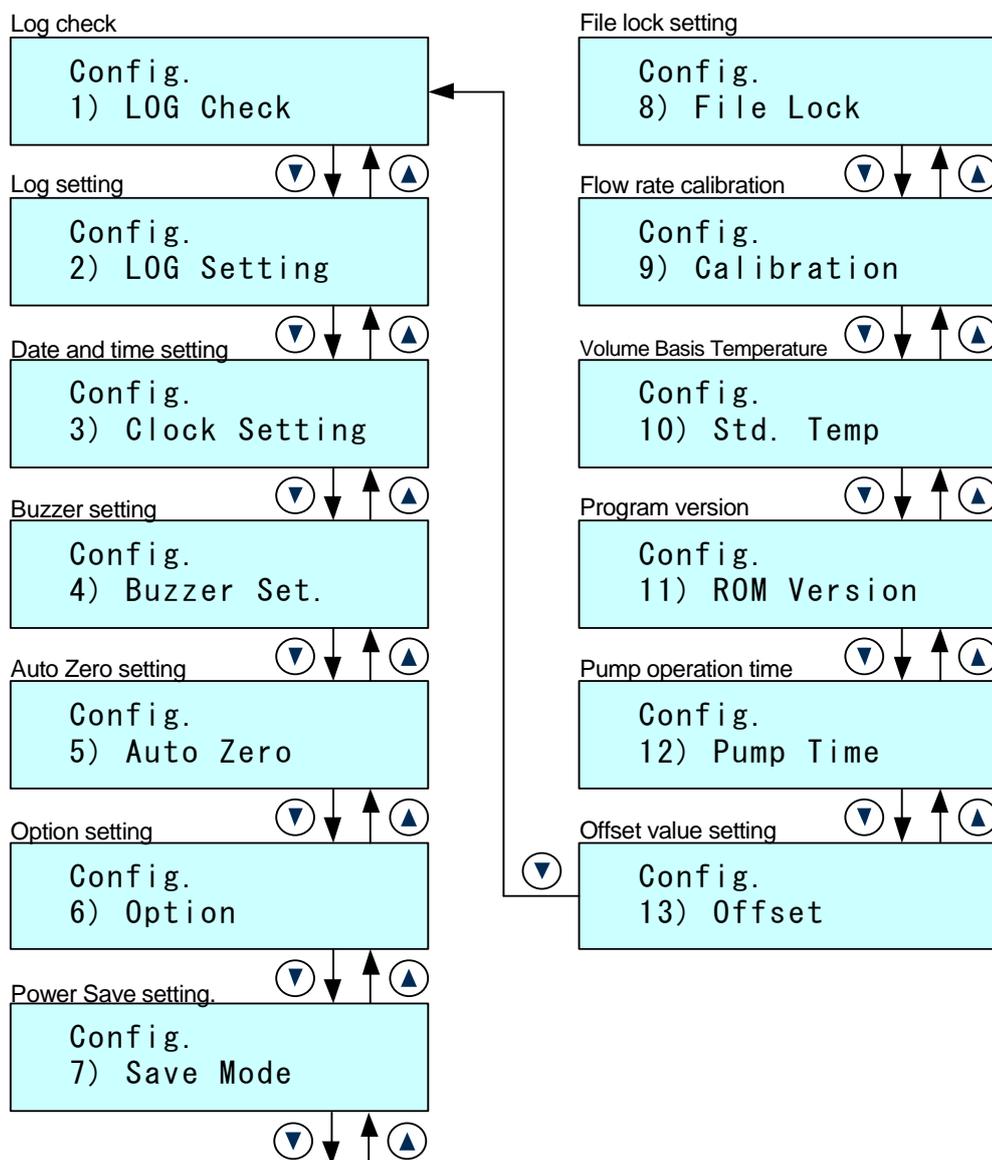
In “Configuration mode”, LOG files are checked and environment of the main unit is set.

To move to “Configuration mode”, press  key followed by  key.

Select an item using   keys, and set with  key.

Press  Key to exit “Config. mode”. Press  key on the item screen to exit the “Config. mode”.

Press  key on each item screen to return to the previous screen.



5.4.1 [LOG Check]

The LOG Check enables to view the content of LOG files.

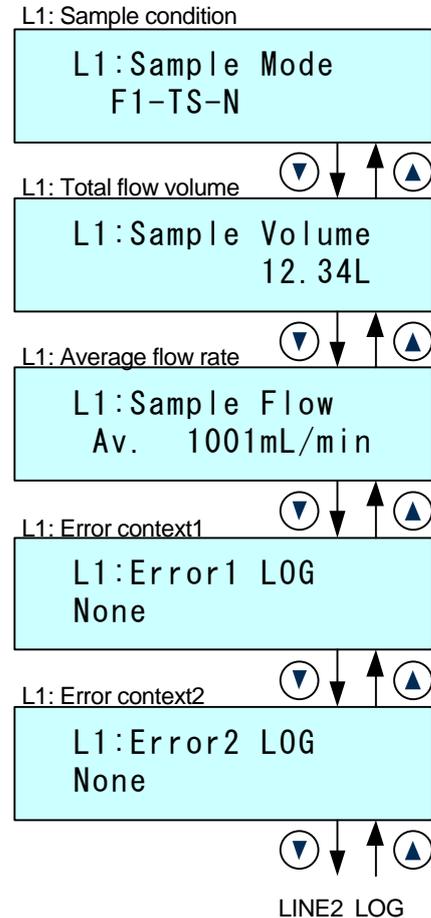
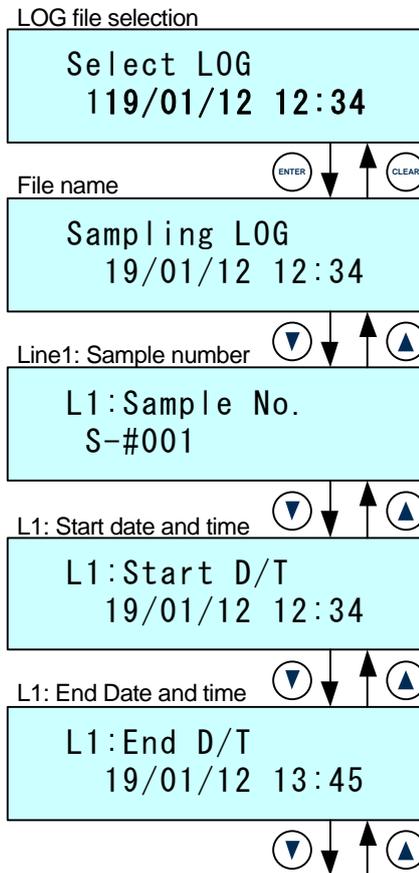
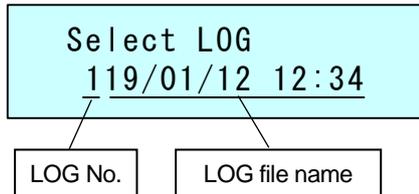
Maximum 30 LOG files can be saved, and suction conditions or results can be recorded.

A LOG file will be created whenever manual/auto mode suction is performed. The LOG file gets automatically named based on the suction start date and time.

If the LOG file count exceeds 30, old LOG files get deleted in sequence and new files are recorded.

Select the LOG file that you want to display with   keys and set using  key.

If LOG file is not available, the LOG file name will appear as "None".



Notes

- In addition to the above items, the Instantaneous flow rate of each line during suction and the temperature in the device housing are recorded at regular time intervals in the log. (If the optional temperature and humidity sensor is connected, its temperature and humidity are also recorded.)

By connecting SP209 to a PC using the separately sold PC setting management software SP209 Assistant, you can check those records on the PC.

- The log recording interval depends on the total suction time determined by the stop condition and the set flow rate.

When the stop condition is "Time" or "Volume":

The interval is 1 minute if the calculated total suction time is within 24 hours. In the case more than 24 hours, the interval increases by 1 minute every 24 hours.

When the stop condition is "Cont":

The interval is 1 minute. However, as the actual total suction time exceeds 24 hours, the Instantaneous flow rate, temperature and humidity are not recorded. (Items on the previous page will be recorded until stopping the suction operation.)

- In case of unintended power down during sampling, the log until that time will be recorded.

5.4.2 [LOG Setting]

The LOG Setting allows to configure LOG files.

Select item using   keys and set with  key.

1. Samp.No.Input

Specify whether the sample number will be entered at suction start timing.

Samp. No. Input
ON / OFF

Select ON/OFF by  key and set using  key.

2. LOG All Clear

Delete all the recorded LOG files.

LOG All Clear
YES/NO

Select ON/OFF by  key and set using  key.

5.4.3 [Clock Setting]

Adjust the date and time.

Clock Set				
19/01/23-12:34				
Year	Month	Date	Hours	Minutes

- Enter the last two digits of western calendar for year.
- Enter the time in the 24-hour format.

The changed part will blink. Change the numeric value using   key.

 key moves the changed part. Set using  key.

5.4.4 [Buzzer Set.]

Set the buzzer ON/OFF.

Buzzer Setting
ON / OFF

Select ON/OFF by  key and set using  key.

5.4.5 [Auto Zero]

Set whether to perform zero calibration of flow rate automatically at suction start.

To set the start condition [Start Option] in the file-mode, set it to ON.

Auto Zero
ON / OFF

Select ON/OFF by  key and set using  key.

5.4.6 [Sensor]

Specify whether or not to use optional temperature and humidity sensor.

Sensor
ON / OFF

Select ON/OFF by  key and set using  key.

5.4.7 [Save Mode]

Settings for LCD backlight.

In the case of Power Save ON, the backlight will always be OFF, while in case of Power Save OFF, the backlight will always be ON. Setting the time (1 min to 10 min) automatically turns off the backlight after the elapse of the specified time from the last key operation. The backlight turns ON as soon as the keys are used.

Power Save Time
Power Save OFF

Select Power Save ON / OFF or set the time using   key and then set with  key.

5.4.8 [File Lock]

Set the file lock function to ON/OFF.

When the File Lock function is ON, suction cannot be performed except in the mode displayed on the Status screen. Also, various settings of Config Mode will be disabled.

File Lock
ON / OFF

Select ON/OFF by  key and set using  key.

The following screen is displayed when suction mode is changed or edited, or various settings of configuration mode are performed while File Lock Function is ON.

File Lock
Press ENTER Key

Pressing  or  key returns the status screen.

Notes

- Set the suction mode (manual mode, file mode) and turn ON the File Lock function.

5.4.9 [Calibration]

Adjust the flow rate.

Refer to "6.2 Calibration" for method to adjust flow rate.

5.4.10 [Std. Temp]

Set the standard temperature of the flow rate display.



Std. Temp
0/ 20/ 25°C

Select 0°C/20°C/25°C using  key and set with  key.

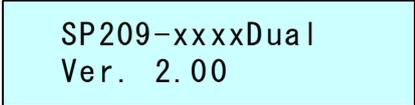
After setting, the set temperature and the volumetric flow of 1 atmospheric pressure.

Attention

- In case the temperature is set to 0°C, the target flow rate may not be reached if the resistance of the sample tube or the collection cartridge is high.

5.4.11 [ROM Version]

Displays the version information of the built-in program.



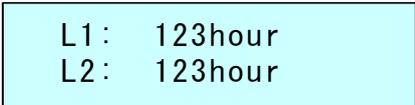
SP209-xxxxDual
Ver. 2.00

Return with  key.

5.4.12 [Pump Time]

Indicates the time of suction pump operation.

Resetting time is not possible.



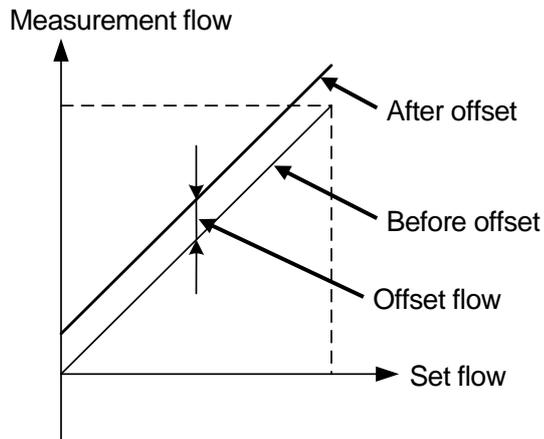
L1: 123hour
L2: 123hour

Return with  key.

5.4.13 [Offset]

Set the offset flow.

The set flow can be increased or decreased.



1. Select the line for editing offset flow.

```
Offset Line  
Line1 / Line2
```

Select Line1/Line2 using  key and use key to determine. 

2. Menu is displayed.

```
Menu  
Offset / Clear
```

Select Offset /Clear using  key and set with  key.

Offset : Enter offset flow.

Clear : Return offset flow to zero.

- 3.** Tap Offset to open the Offset Flow Entry window.

L1:Offset
0.0mL/min

Set the numeric value using   keys and set with  key.

Setting range

SP209-100Dual : -8.0~8.0mL/min

SP209-1000Dual : -80.0~80.0mL/min.

- 4.** Selecting 'Clear' in the above given Menu screen returns the offset flow rate to 0.
The Offset Clear Check screen will be displayed.

Offset Clear OK?
YES/NO

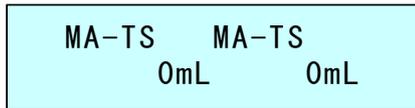
Select YES and NO using  key and set with  key.

Select YES to return the offset flow rate to 0.

5.5 Manual mode setting

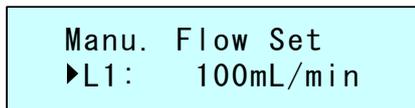
Manual mode is the mode in which only flow rate and stop conditions are set and suction is performed.

1. Press  key to display the Status Screen and then press  key.



```
MA-TS  MA-TS
      0mL  0mL
```

2. Pressing  key at the top of Status screen displayed the Settings screen.



```
Manu. Flow Set
▶L1: 100mL/min
```

Select the line to be set using  key.

3. Set the suction flow rate of each line.

Set the flow using   keys and press  key.

Setting range

SP209-100Dual : 2~100 mL/min

SP209-1000Dual : 20~1000 mL/min.

Holding down  key displays [STOP] next to the set minimum flow rate and STOP state occurs.

Following STOP condition settings cannot be done for the line set to STOP.



```
Manu. Flow Set
▶L1: STOP
```

4. Specify the stop conditions for each line.

```
Manu. Stop Mode
L1:      Time
```

Select the stop mode using   keys and press  key.

Time : Stops after operating for the set time.

Volume : Stops when the set cumulative volume is reached.

Cont : Operates until  key is pressed. There is no set item.

- Time

```
Manu. Time Set
L1:      001:00
```

The changed parts will blink, so set the numeric value using   keys.

 key switches between 'Hours' and 'Minutes'. When the setting is finished, set using  key.

Setting range : 000:01 to 999:59 (1 minute to 999 hours 59 minutes)

Notes

The minimum setting time is 1 minute. To set time such as 001:00, set the "Hours" and then change the "Minute" part to "00".

- Volume

```
Manu. Stop Volume
L1:      10.0L
```

Set the numeric value using   keys and set with  key.

Setting range

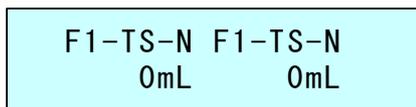
SP209-100Dual : 0.1~999.9 L

SP209-1000Dual : 0.1~9999.9 L.

5.6 File mode settings

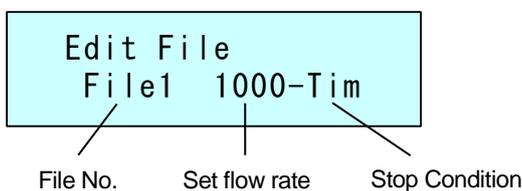
The file mode allows to save the suction conditions as a file. Further, suction can also be started at the set date and time or after the set time.

1. Press  key to display the status screen and press  key.



F1-TS-N F1-TS-N
0mL 0mL

2. Pressing  key at the top of Status screen displayed the Settings screen.

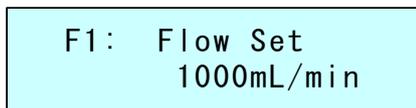


Edit File
File1 1000-Tim

File No. Set flow rate Stop Condition

Select the files to be set   keys (File1 ~ 5) and press  key.

3. Set the suction flow rate.



F1: Flow Set
1000mL/min

Set the flow rate using   keys and press  key.

Setting range

SP209-100Dual : 2~100mL

SP209-1000Dual : 20~1000mL.

Holding down  key displays [STOP] next to the set minimum flow rate and STOP state occurs.

Following STOP condition settings cannot be done for the line set to STOP.



F1: Flow Set
STOP

4. Set the stop condition.

F1: Stop Mode
Time

Select the stop mode using   keys and press  key.

Time : Stops after operating for the set time.

Volume : Stops when the set cumulative volume is reached.

Cont : Operates until  key is pressed. There is no set item.

- Time

F1: Time Set
001:00

The changed parts will blink, so set the numeric value using   keys.

 key switches between 'Hours' and 'Minutes'. When the setting is finished, set using  key.

Setting range : 000:01 to 999:59 (1 minute to 999 hours 59 minutes)

Notes

The minimum setting time is 1 minute. To set time such as 001:00, set the "Hours" and then change the "Minute" part to "00".

- Volume

Manu. Stop Volume
L1: 10.0L

Set the numeric value using   keys and set with  key.

Setting range

SP209-100Dual : 0.1~999.9 L

SP209-1000Dual : 0.1~9999.9 L.

5. Specify the start conditions.

F1: Start Option
Timer

Select the start mode using   keys and press  key.

- Timer** : Starts suction at the set date.
- Delay** : Starts suction after elapse of the set time.
- None** : Press  key to start suction.

• Timer

F1: Start option
19/12/23 15:00

Year Date Minutes
Month Hours

- Enter the last two digits of western calendar for year.
- Enter the time in the 24-hour format.

The changed part will blink. Change the numeric value using   key.

 key moves the changed part. Set using  key.

• Delay

F1: Delay time
30min

Set the numeric value using   keys and set with  key.

Setting range : 1~60min

6. Once the start conditions have been set up, confirmation screen for saving the file will appear.

F1: Store
Yes/No

Select Yes/No using  key and set with  key.

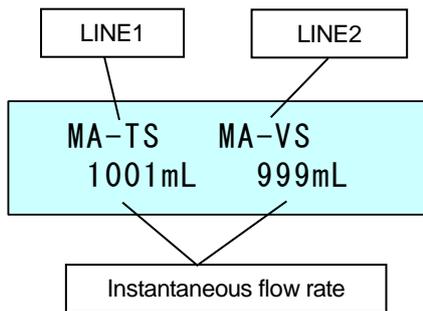
5.7 Status Display

Check the settings and the current status.

Press  key to toggle the display.

- Status top screen

Top screen during Manual Mode

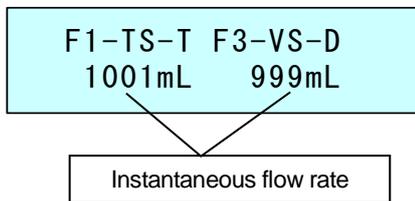


MA-TS

Stop Condition
 TS: Time Stop
 VS: Volume Stop
 CO: Continuous operation

Manual mode

Top screen during File Mode



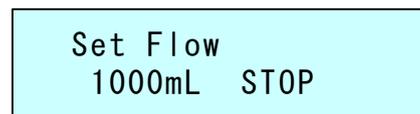
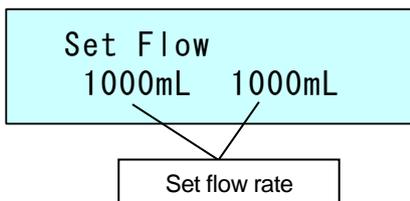
F1-TS-D

Starting condition
 T: Time
 D: Delay
 N: No setting

Stop Condition
 TS: Time Stop
 VS: Volume stop
 CO: Continuous operation

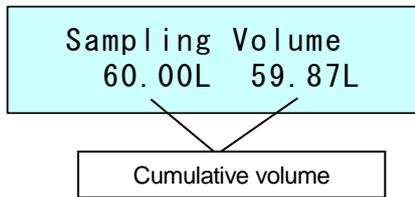
Selected File No.

- Set flow rate display

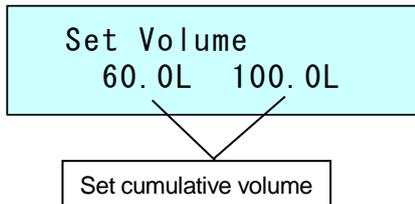


When [STOP] is set in set Flow rate, STOP is displayed.

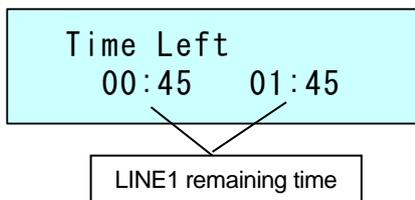
- Display of cumulative volume



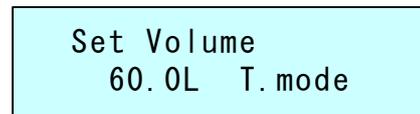
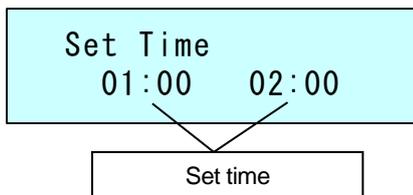
- Display of set cumulative volume



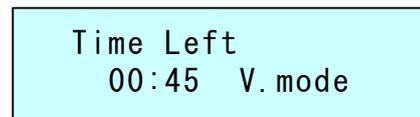
- Display of remaining suction time



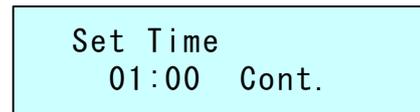
- Set Time Display



If the stop condition is set to any condition other than 'Volume', 'T. mode' or 'Cont.' will be displayed.

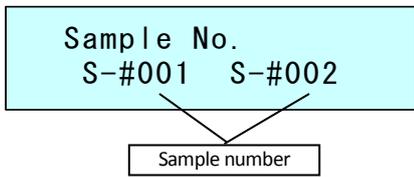


If the stop condition is set to a condition other than 'Time', 'V. mode' or 'Cont.' will be



If the stop condition is set to any condition other than 'Time', 'V. mode' or 'Cont.' will be displayed.

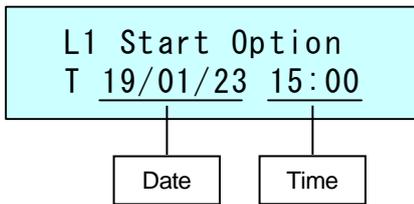
- Sample number display



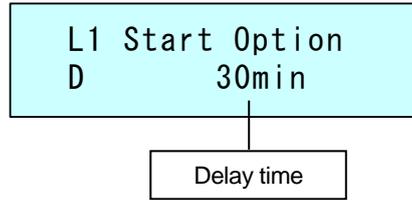
If Config Mode-LOG Setting-Samp. No. Input is OFF, the sample number will not be displayed.

- Start Condition Display

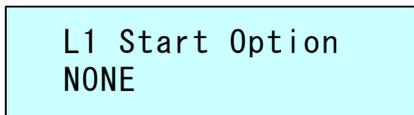
For Start Option Timer



For the Start Option Delay

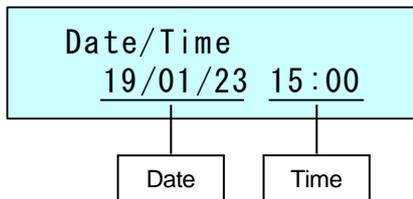


Without the start option



In Manual-mode, 'None' will always be displayed.

- Suction start date and time display



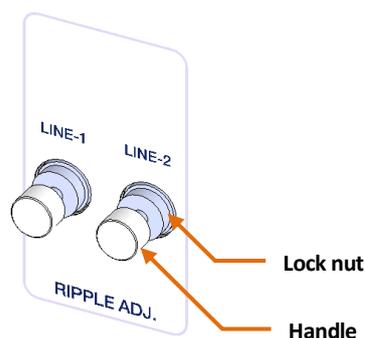
The date and time displayed here gets set as the LOG file name.

5.8 Pulsating Flow Calibration Function

Suction pumps with high suction capacity and high exhaust volumes are required to enable suction using high resistance sample tubes or collection cartridges in high-flow rate. However, if the same suction pump has a low load resistance or suction is performed at low flow rate, the reciprocating motion of the suction pump will cause pulsating flow leading to fluctuation of flow rate and hence hampering accurate collection.

The Pulsating flow calibration function of SP209Dual enables collection with less pulsating flow in any condition.

The Pulsating Flow Display LED displays the current pulsating flow state by color, based on suction flow rate and the speed of the pump. Turn and adjust the handle of the pulsation calibration needle valve so that the pulsating flow display LED is green. Turn the lock nut till the end to secure the handle.



Color and State of Pulsating Flow Display LED

LED color	Condition
Red	Pump rotates slowly, indicating a high pulsating flow.
Green	Pump rotations and pulsating flow are in optimal state.
Orange	Pump rotates fast, indicating low pulsating flow.

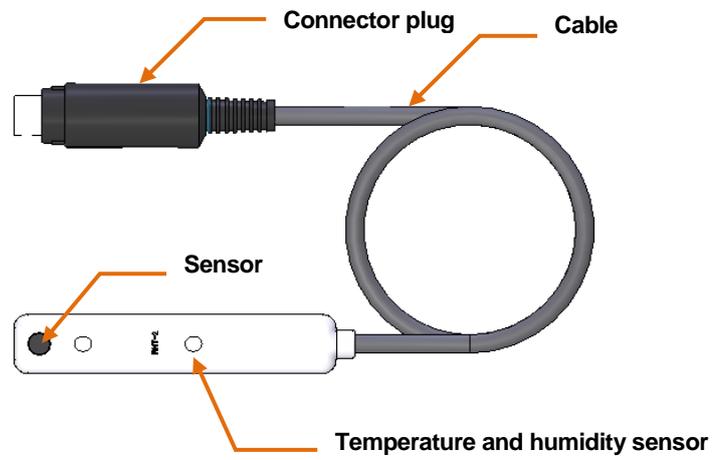
Notes

- Turning the pulsating flow calibration needle valve to the left (counterclockwise) speeds up the pump rotation and lowers the pulsating flow. However, if the valve is turned in excess, the set flow rate may not be attained.
- Turning the pulsating calibration needle valve to the right (clockwise) increases the suction capability, but the flow rate might fluctuate and not get stabilized if a sample tube or collection cartridge with low suction resistance is used.
- If a sample tube or collection cartridge with high suction resistance is used, the set flow rate may not be reached even when the pulsating calibration needle valve is completely turned to the right. In such cases, replace it with a sample tube or collection cartridge with low suction resistance, or reduce the suction flow rate.
- If it is necessary to collect a specified volume, either decrease the suction flow rate and increase the collection time or use "Volume" as Stop Condition setting.
- If the LED color cannot be changed to green, turn the pulsating calibration needle valve to the left and then turn it to the right slowly.
- For sample tubes or collection cartridges that are used first time, it is recommended that the pulsating flow calibration is done in advance using "test mode" prior to collection.

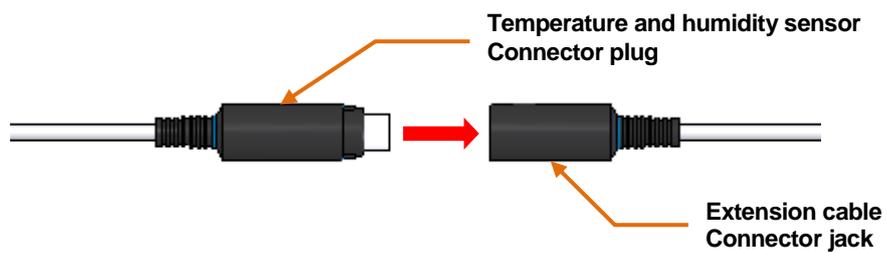
5.9 Temperature and humidity sensor

Connecting SP209 dedicated temperature/humidity sensor (optional) enables simultaneous sampling of temperature and humidity in the LOG function.

The temperature and humidity changes recorded in the log can be displayed as chart at the same time as the flow rate, through computer-management software SP209 Assistant (optional).



1. Use an extension cable in case the temperature and humidity sensor mounting location and unit are at a distance (provided with a temperature and humidity sensor).



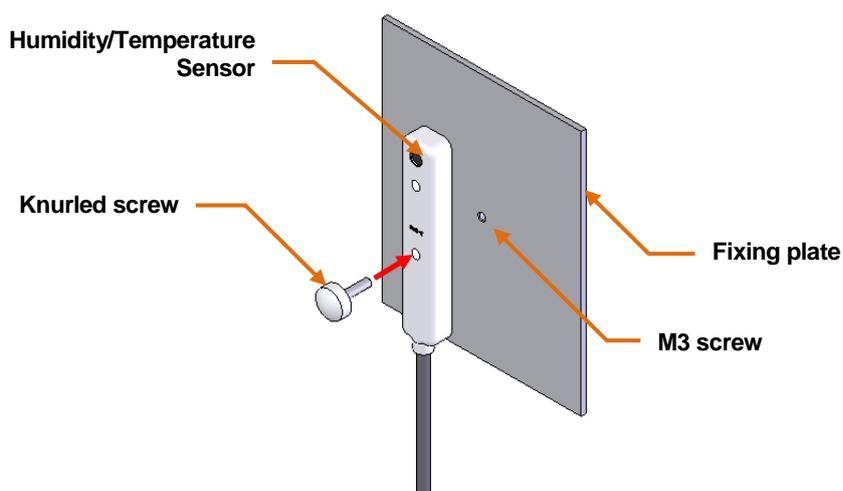
2. Make sure that the power is OFF and connect the temperature/humidity sensor connector plug or extension cable connector plug to the sensor connector "SENSOR" in the front of the unit.



CAUTION

- Hold the connector while inserting or pulling out the cable.
- Make sure the connector is inserted till the back.

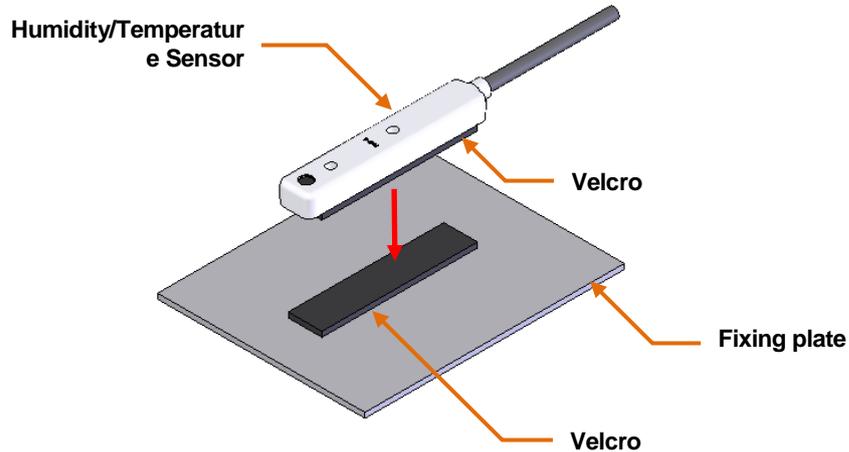
3. Secure the temperature and humidity sensor near the sample tube or collection cartridge.
- When fixing with screws
Use a knurled screw (provided with temperature and humidity sensor) to secure the screws.



NOTE

Make sure the screw is not too much tightened as it may damage the temperature and humidity sensor.

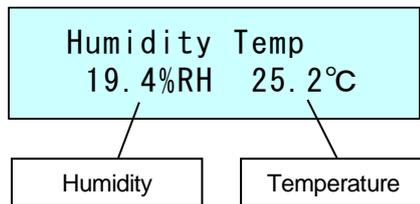
- When securing with Velcro
Cut the Velcro (provided with temperature and humidity sensor) to appropriate size, attach it to the back of the temperature and humidity sensor as well as at the fixing plate. Then stick the Velcro of the sensor and fixing plate together.



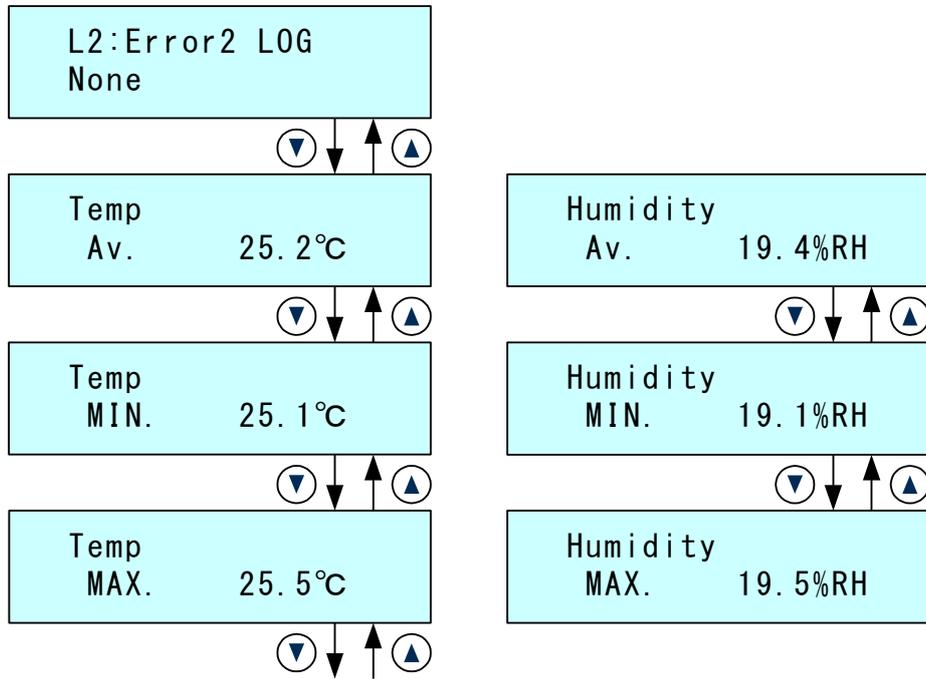
Attention

Note that correct temperature may not be measured if the temperature of fixing plate rises or the temperature increases due to direct sunlight.

4. Temperature and humidity sensor is turned ON automatically if it is connected. The use of this sensor can be set by using [Sensor] in Config Mode.
5. Pressing  key in mode other than Edit and Config mode displays the current temperature and humidity.



6. Maximum, minimum, and mean values can be checked using 1) LOG Check of Config. mode.



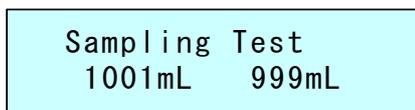
* If the LOG is not using a temperature and humidity sensor, the details will not be displayed.

5.10 Test mode

Used for checking flow rate and pipe leakage as well as for pulsating flow calibration. In the test mode, suction is performed at the flow rate which is set currently in the suction mode.

In the test mode, flow rate integration and LOG file creation will not take place.

1. Press  key to start suction.



Sampling Test
1001mL 999mL

2. To stop, press  key. Stop check screen will appear so press and press  key to stop. Press  key to continue suction.



Stop?
Press ENTER key



Now Stopping
Stop, All Line..

Pipe leakage check

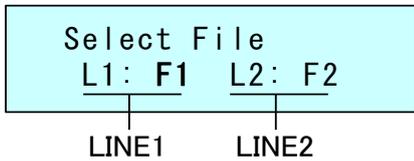
When checking for pipe leakage, block the suction port or pipe tip with finger and turn the pulsating flow calibration needle valve to the right to close.

The current flow rate display might not be 0 mL/min depending on the pumps' Pulsating flow. However, there is no leakage in case the flow rate is 3 mL/min or less.

5.11 Suction start

1. Press  key to display the Status Top screen.
2. Switch the suction mode using  key or  key.
3. In case of file mode, the files can be specified for each line.

File Selection screen appears on pressing  key while Status top screen of File Mode is displayed.



```
Select File
L1: F1  L2: F2
  |      |
  |      |
LINE1   LINE2
```

Select the file using   key.  key switches the line.

Press  key to apply and go back to Status top screen.

4. Pressing  key starts the suction.

If the Auto Zero function is ON in Config mode, suction starts automatically after zero calibration.

If the Auto Zero function is OFF and you want to do zero calibration, Press 

key before  key,

5. If settings are to enter sample number in Config Mode, then Enter Sample Number screen will appear.

Sample No.	
000000	000000
LINE1	LINE2

Six characters can be entered for each line. The input part blinks, so input location can be selected using  key and sample number can be entered using   keys.

Characters that can be entered are alphanumeric characters between 0-9 and A-Z and symbols @.!"#\$%&'()*+,-/;<=>?.

Pressing  key starts suction.

6. When the start conditions are set in file mode, suction starts at the set date and time or after elapse of the set time.

If the start condition is Timer

F1-TS-T	F1-TS-T
14:00	14:00

If the start condition is Delay

F1-TS-D	F1-TS-D
54.3min	54.3min

7. Adjust the pulsating calibration needle valve so that the pulsating flow display LED is green.
Refer "5.8 Pulsating flow calibration Function" for the pulsating flow calibration function.

8. When the stop condition is [Time], suction stops after elapse of the set time. When the stop condition is [Volume], the suction stops after reaching the set cumulative volume.

Buzzer sounds to intimate the end of suction.

Manual mode

MA-TS	MA-TS
Fin.	Fin.

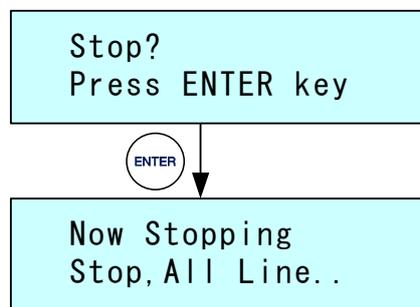
Files mode

F1-TS-N	F2-TS-N
Fin.	Fin.

9. If the stop condition is [Cont] or you want to stop the suction operation immediately, press  key when Status top screen is displayed. (If the Status top screen is not displayed, press  key.)

Stop confirmation screen will appear, so press  key to stop. Press  key to continue suction.

The LOG file until the time suction is stopped will remain, even if it is stopped somewhere in between.



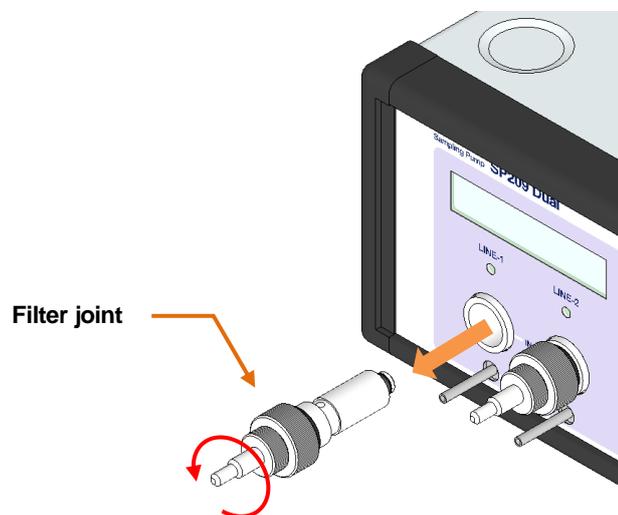
6 Maintenance

For maintenance and safe use of the device, make sure to carry out periodic maintenance and inspection tasks as given in this document.

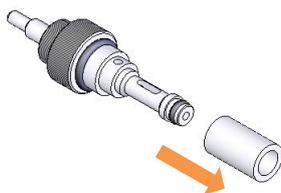
6.1 Filter element replacement

Replace the filter element as per the following procedure in case the filter element becomes dirty or the target flow rate is not achieved.

1. Hold the filter joint with the fingers and rotate it to the left (counterclockwise) to pull it forward.



2. Remove the filter element and replace it with a new filter element.



3. Attach it to the device by following the reverse procedure.

Attention

- If the trapping agent etc. gets sucked in, there are chances that powder of them is present in the filter case, so clean using a cotton swab. Note that the powder might get sucked in if air etc. is used.
- Tighten the O-ring properly. Excessive tightening, however may damage the screws.
- After replacing the filter element, check for leakage using "5.10 Test Mode".

6.2 Calibration

If calibrated standard flowmeter is available, customer can calibrate on his/her own. Connecting your available sample tubes or collection cartridges and calibrating the flow rate allows more precise collection. However, flow rate calibration shall be done after understanding the following precautions.

Attention

- If the sample tubes and collection cartridges used are not limited, do not perform calibration.
- If calibrated standard flowmeter is not available, do not carry out calibration.
- If the load resistance of sample tubes and collection cartridges is highly variable, the flow rate accuracy may also vary.
- Flow accuracy cannot be guaranteed if calibration is performed by the customer.

Calibration includes auto mode and manual mode.

Auto mode (Auto.)

Calibrate with a Film flow meter, SF-2U manufactured by HORIBA STEC. (Not automatic)

Calibration is performed at all calibration points in sequence from low flow rate.

* SF-1U cannot be used in this mode.

Manual mode (Manu.)

Calibrate while manually entering flow rate value measured with standard flowmeter.

Any calibration point can be selected.

Calibration point	SP209-100Dual	SP209-1000Dual
P1	10 mL/min	100 mL/min
P2	20 mL/min	200 mL/min
P3	30 mL/min	500 mL/min
P4	50 mL/min	1000 mL/min
P5	100 mL/min	

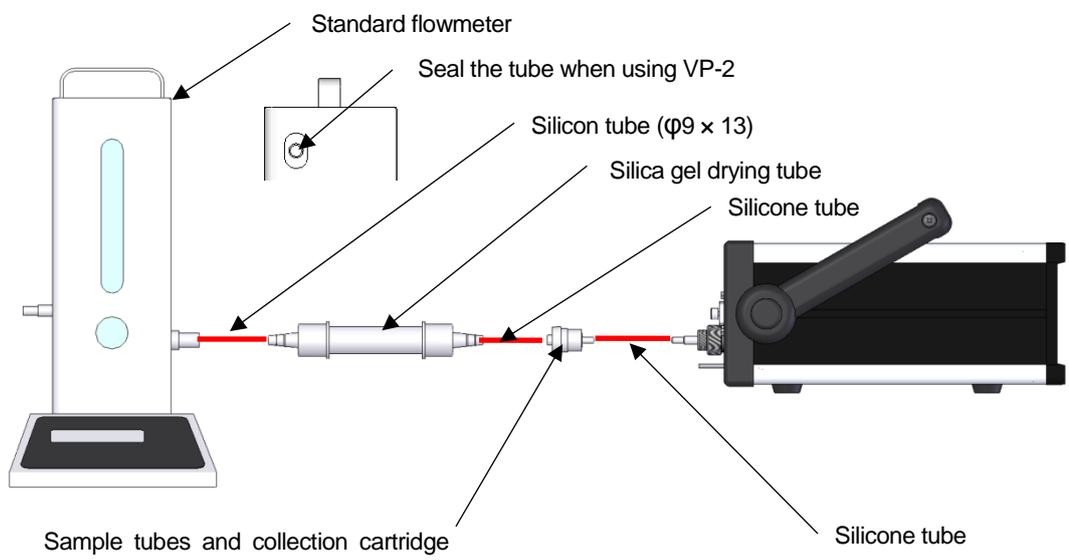
6.2.1 Preparation

When using a Film flow meter manufactured by HORIBA STEC.

- Use the SP209Dual calibration drying kits (sold separately, Cat No. 3001-11540) and connect the outlet of the Film flow meter to the SP209Dual suction port as shown in the figure below.
- Between the suction port and the sample tube or collection cartridge, use a silicone tube suitable with the tube diameter.
- When using the volume tube VP-2 of the Film flow meter, seal the exhaust port above the volume tube with the silicone stopper provided with the SP209Dual calibration drying kits.
- Set the standard temperature of a Film flow meter at 20°C.
- When performing calibration in auto mode, make sure that the power supply for the main unit and the precise membrane flowmeter is OFF, and connect the unit to the Film flow meter using the flowmeter communication cable (sold separately, Cat.No. 2702-35457).
- Connect the [SP209] connector to the [FLOWMETER] connector on the front of the main unit and the other connection to the [SERIAL] connector on the back of the Film flow meter.
- Be careful as the shape of connectors is same. After connecting the connector, turn and secure using connector fixation screws.
- For handling of the Film flow meter, refer to the dedicated instruction manual.

For other standard flowmeters

- Please refer to the diagram below to connect the outlet of the standard flowmeter to the suction outlet of the SP209Dual.
- If the standard flowmeter has a temperature setting function, set the temperature to 20°C.
- If the standard flowmeter does not have the temperature setting function, use 20°C for setting "Config. Mode" -10) Std. Temp. after calibration.
- Refer to the dedicated instruction manual for handling the standard flowmeter.



6.2.2 Calibration Mode selection

Proceed to Config Mode and select 9) Calibration.

Flow Calibration
Auto. /Manu. /LOG

Select Auto. /Manu. /LOG using  key and set with  key.

- Auto.** : Perform calibration in auto mode.
- Manu.** : Perform calibration in manual mode.
- LOG** : Calibration date and time will be displayed.

6.2.3 Auto mode (Auto.)

1. Select Auto. as Calibration Mode and perform communication test.

Wait...
Communication

Error will be displayed in case there is failure in communication test. Make sure the cable is connected properly and the Film flow meter is ON.

Not Connection
Press ENTER key

2. Set whether or not to perform Dampness operation.

Dampness
ON / OFF

Select ON/OFF using  key and set with  key.

If Dampness is set to ON, then inside of the volumetric tube of the Film flow meter is moistened before measuring the flow rate of each calibration point.

3. Set the flow rate measurement frequency.

Frequency
1-2-3-4-5

Select the frequency using  key and set with  key.

Measurement will be taken the number of times it is specified, and the average flow rate value will be entered and displayed.

4. Select the line to be calibrated.

Calibration Line
Line1 / Line2

Select Line1/Line2 using  key and set with  key.

5. Confirmation screen for Zero Point calibration will appear.

Zero Reset
Y/N 0.1mL/min

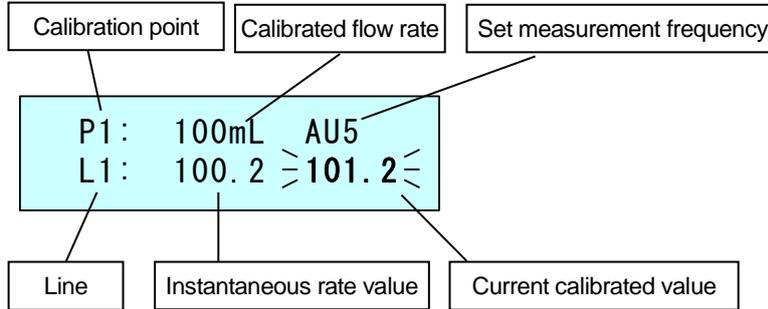
Wait until the flow rate value is stabilized.

Select Y/N using  key and set with  key.

Select Y for zero calibration. Normally, zero calibration is performed.

6. The pump is activated, and suction starts.

The current calibration value blinks.



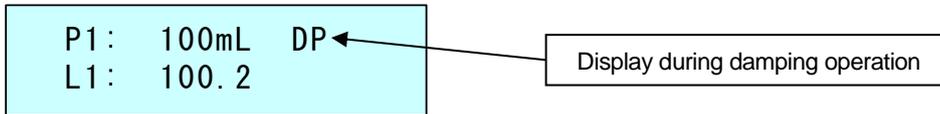
Turn and calibrate the pulsating flow calibration needle valve so that the pulsating flow display LED is green.

To reduce pulsating flow, adjust the pulsating flow calibration needle valve so that the color changes from orange to green.

If the load resistance of the sample tube and collection cartridge is large, the LED may not turn from orange to green. In that case, carry out suction in orange color.

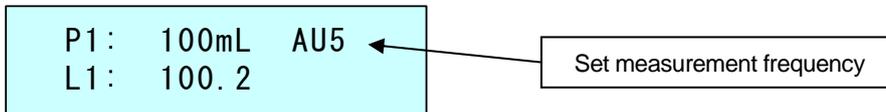
7. Press  key when the flow rate is stable.

8. If Damping operation is set to ON, then Damping operation will take place.



9. The flow measurement starts once the Damping operation finishes or if the Damping operation is set to OFF.

10. The set frequency will be displayed on screen.



- 11.** After measurement is done for the set number of times, the resulting flow rate value will be entered and automatically the next calibration point will appear.

P2: 200mL AU5
L1: 200.3 \Rightarrow 202.3 \Leftarrow

Once again, turn the pulsating flow calibration needle valve to make the pulsating flow display LED Green, and press  key once the flow is stable.

- 12.** When the flow measurement for the last calibration point is finished, the pump stops, and a screen confirming to save the adjusted values is displayed.

Data Save OK?
YES/NO

Select YES and NO using  key and set with  key.

Select YES to return to the selection screen of the line after saving the calibrated value. Perform the same steps for the other line.

- 13.** To stop calibration, press  key.

The screen confirming the cancellation is displayed.

Carib. Cancel OK?
YES/NO

Select YES and NO using  key and set with  key.

- 14.** If the membrane is broken during measurement, stop the calibration and perform calibration from the beginning. Error is displayed if the membrane breaks and the measurement is not possible.

Error Calib. Stop
Press ENTER key

Attention

- Do not disconnect the communication cable during auto mode calibration.
- Accurate measurements are not possible in high pulsating flow. Note that the membrane gets damaged and measurements cannot be taken.
- In the auto mode, flow rate check for each calibration point is not possible. Therefore, flow rate check should be performed in the manual mode after calibration is done.

6.2.4 Manual mode (Manu.)

1. Select the line to be calibrated.

Calibration Line
Line1 / Line2

Select Line1/Line2 using  key and set with  key.

2. A menu is displayed.

Menu
Calib. / Init.

Select Calib. / Init. Using  key and set with  key.

Calib. : Perform calibration.

Init. : Return the calibration value to factory settings.

3. Tap Calib. to open the Zero Calibration Confirmation screen.

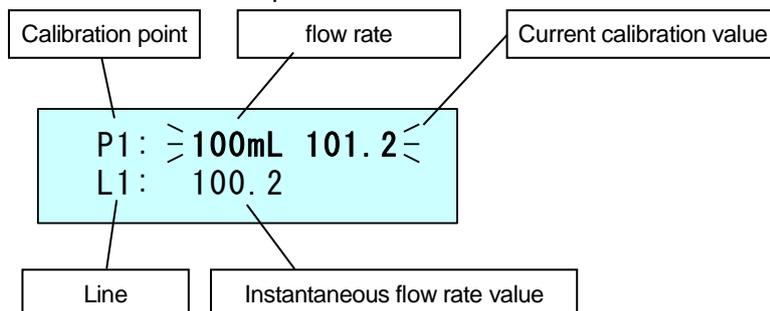
Zero Reset
Y/N 0.1mL/min

Wait until the flow reading is stabilized.

Select Y/N using  key and set with  key.

Select Y for zero calibration. Normally, zero calibration is performed.

4. Select the calibration point.

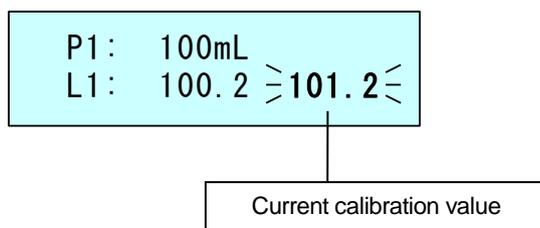


Calibration point flow rate and currently set calibration value blinks.

Select the adjustment point using  key and set with  key.

5. The pump is activated, and suction starts.

The current calibration value moves to the lower level and blinks.



Turn and calibrate the pulsating flow calibration needle valve so that the pulsating flow display LED is green.

To reduce pulsating flow, adjust the pulsating flow calibration needle valve so that the color changes from orange to green.

If the load resistance of the sample tube and collection cartridge is large, the LED may not turn from orange to green. In that case, carry out suction in orange color.

6. Start measurement when the flow is stable.

Taking mean measurement is recommended.

Refer to the dedicated instruction manual for operation and handling of flowmeter.

7. After the measurement of the flowmeter is done, enter the measured value as the calibration value using   keys.

Bringing of the current calibration value stops by pressing  key, and flow rate can be controlled by the entered calibration value.

```
P1 : 100mL
L1 : 100.2  103.5
```

8. Measure the flow rate again when checking the flow rate after calibration. Perform the procedure described in above mentioned 7 for minor calibration.

Press  key to move to the next calibration point.

```
P2 : ≧200mL 202.3 ≦
L1 : 200.2
```

9. After the adjustment of the last calibration point is finished, pressing  key stops the pump and screen confirming to save the calibration value is displayed.

```
Data Save OK?
      YES/NO
```

Select YES and NO using  key and set with  key.

Select YES to return to the selection screen of the line after saving the calibration values. Perform the same steps for the other line.

10. To stop calibration, press  key.

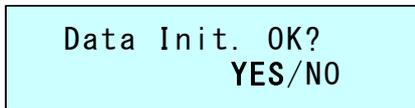
The screen confirming the cancellation is displayed.

```
Carib. Cancel OK?
      YES/NO
```

Select YES and NO using  key and set with  key.

11. To return the calibration values to factory settings, select [Init.] on the menu window in 2 mentioned above.

Screen confirming to reset the Calibration values to factory settings will be displayed.



Data Init. OK?
YES/NO

Select YES and NO using  key and set with  key.

Selecting YES will revert the calibration values to the factory set values.

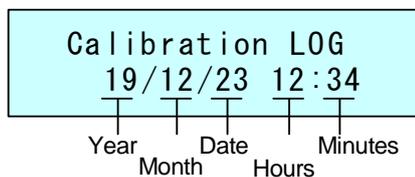
Attention

- Selecting calibration points allows only specific point calibration. However, because multiple points are calibrated, it is necessary to calibrate one point above and below the calibration point if they are collected outside the calibration points. For example, when collecting at 700 mL/min using a SP209-1000Dual, calibrate at P3:500 mL/min and P4:1000 mL/min.
- The calibration operation is terminated when the adjustment of the last calibration point (P5 for SP209-100Dual and P4 for SP209-1000Dual) is finished.
- If only a specific calibration point has been adjusted, move to the last calibration

point and click  key followed by  key.

6.2.5 Calibration LOG Display (LOG)

Date and time when calibration was performed is displayed.



Calibration LOG
19/12/23 12:34

Year Date Minutes
Month Hours

Return with  key.

7 Errors and troubleshooting

When an abnormality is detected in self-check, alarm beeps and error message is displayed. Be sure to check the error code when an error is displayed and take the necessary action.

If the situation does not improve after taking the required measures, or if relevant measures are not available, a malfunction can be suspected. Immediately discontinue use and notify the distributor from where the product was purchased.

7.1 Error message

The meaning of the error codes displayed on the touch panel and relevant counter measures are given below.

If an error message is displayed, check the error code and turn off the power.

Error indication	Error content and details
Err.1 System Error	Abnormal RAM After turning off the main unit power, disconnect the AC adapter from the main unit and turn on the power again. If the error occurs again, there may be a deterioration of the button battery or a malfunction of the board, so contact our distributors or GL Sciences.
Err.2 High temp	High temperature error This error is displayed when the temperature inside the unit is abnormally high. When this error occurs, the pump stops and the buzzer sounds. If the error occurs again after a brief operation, it can be considered as malfunction, so contact our distributors or GL Sciences.
Err.3 Low Battery	Voltage drop This message is displayed when the supply voltage drops while the battery is in use. Replace the battery if battery is being used for power supply. If AC adapter is used, it could be malfunction of the unit or AC adapter, so contact our distributors or GL Sciences.

Error indication	Error content and details
Err.4	High flow rate error
	This message is displayed if the flow of at least 150% of the set flow rate continues for at 1 minute or more. When this error occurs, suction is stopped.
L	Low flow error
	When the flow of 80% or less of the set flow rate continues for 1 minute or more, "L" is displayed next to the instantaneous flow, but suction continues.
Err.5	Low flow error
	This message is displayed when the flow rate of 10% or less of the set flow continues for 1 minute or more. In event of this error, suction is stopped. Check for clogging of filters and tube.
Err.6 Start Time Err	Date and Time Setting Error
	This error appears when the date and time of the Timer Start setting are set prior to the current time. Check the settings.
Err.7 Flash Mem Error	Flash memory error
	This might be board malfunction, so contact our distributors or GL Sciences.
Warning Low Temp	Low temperature warning
	When  key is pressed, this error occurs if the temperature inside the unit is 0°C or less. However, this does not appear if you start using the IO connector START IN. The operation is possible, but the flow accuracy calculation error increases.

7.2 Troubleshooting

1. Product not working (Not turning ON).

Cause and check details	Coping strategies
Faulty connection of the AC adapter	Connect the AC adapter correctly
AC adaptor failure	Replace with a new AC adapter
Power not supplied to the outlet	Check the distribution board, etc. and turn the breaker of the outlet on.
Other cases	Request repair because there is a possibility that the power supply system is faulty.

2. Failure to reach the target flow rate

Cause and check details	Coping strategies
Inlet is closed	Make sure that the inlet of the sample tube and collection cartridge is not capped
Tube breakage/bending	Make sure the tube is not broken/bent
Dirty filter element	Replace with new filter element
High resistance of sample tube and collection cartridge	Use by lowering the flow rates Use sample tubes and collection cartridges with low resistance
The pulsating flow adjustment valve is open	Turn the pulsating flow calibration valve to the right
Standard temperature (Std. Temp) set at 0°C.	Use at lower flow rate Set the Std Temp to 20°C or 25°C.
Pump suction ability drop	Request for replacement of diaphragm pump

3. Unstable flow

Cause and check details	Coping strategies
Pulsating flow calibration valve is closed	Turn the pulsating flow calibration valve to the left
Pump defect	Replace the diaphragm pump
Mass flow meter defect	Request for replacement of mass flow meter

4. Major difference from the standard flow meter

Cause and check details	Countermeasures
Standard temperature not matched	Match the standard temperature
Ambient temperature	Use within the precision and secured range
Mass flow meter defect	Request for replacement of mass flow meter

5. The sample concentration of the analysis result is abnormally low

Cause and check details	Coping strategies
Pipe leakage	Check for gas leakage using test mode.
Major flow error	Measure with a standard flowmeter Ask to check
Specified volume not sucked in	Confirm LOG.

8 Product specifications

8.1 Main unit

Item	Specification	
	SP209-100Dual	SP209-1000Dual
Flow rate display	0 ~ 100 mL	0 ~ 1000 mL
Flow rate display error	Flow rate display ± 1 digit	
Flow rate setting range	2 ~ 100 mL	20 ~ 1000 mL
Cumulative volume display range	0.01 ~ 9999.99 L	
Maximum operating load pressure	Maximum -10 kPa(G) (at STD TEMP. 20°C of 100 mL/min)	Maximum -20 kPa(G) (at STD TEMP. 20°C of 1000 mL/min)
Flow rate accuracy	10 ~ 20 mL/min- $\pm 10\%$ R.D 21 ~ 100 mL/min- $\pm 5\%$ R.D	100 ~ 200 mL/min- $\pm 10\%$ R.D 201 ~ 1000 mL/min- $\pm 5\%$ R.D
Operation Settings	Start conditions: immediately, after setting, real time End conditions: After setting time, after the accumulated volume has been reached, continuous (manual stop)	
Time range	00:01 to 999:59 (hours: minutes)	
Cumulative volume setting range	0.1 ~ 999.9 L	0.1 ~ 9999.9 L
Stored files	5 files	
Data Log count	Record maximum 30 logs	
Suction pump	Diaphragm type pump	
Flow rate detection system	Mass flow sensor Converted to volumetric flow at 20 °C and 1 atmospheric pressure. switchable to 0 °C and 25 °C by STD TEMP.	
Display	LCD with backlight	
Number of channels	Two flow channels	
Connection format	Inlet : 4mm/6mm stepped hose (standard) Outlet : 3 mm SUS tube	
Inlet filter Element	Filtering precision 10 μ m	

Item	Specification	
	SP209-100Dual	SP209-1000Dual
PC communication	USB	
Temperature and humidity range	10 °C to 35 °C (flow rate accuracy assurance: 10 °C to 30°C) 20-80 % RH (No condense)	
Contact gas material	Stainless; Silicone; POM; Byton; PA; EDPM; FKM Polyurethanes, PBTs, BSs, and HNBR	
Power supply	DC12 V	
Power consumption	DC12 V : 0.5 A,	DC12 V : 0.9 A
Weight	About 3 kg	
External dimensions	260(W) × 230 (D) × 99 (H) mm (including handle)	

8.2 Temperature and humidity sensor

Item	Specification
Display humidity range	0 ~ 100 %RH*
Humidity accuracy	At ±3% RH 25 °C (20-80 % RH)
Display temperature range	-30 ~ 80 °C*
Temperature accuracy	±0.5 °C at 25 °C
Case material	Polycarbonate

*This is not the operating temperature or humidity scope of the main body of the pump.

9 Options and Consumables

9.1 Options

Cat. No.	Product name
2702-35470	PC configuration software SP209 Assistant
2702-35475	Temperature and humidity sensors for SP209Dual
3001-11540	SP209Dual calibration drying kits
3001-11541	SP209Dual piping kit
2702-35457	Flow-meter communication cables for SP209Dual

9.2 Consumables

Cat. No.	Product name	Count
2702-37632	SP209Dual filter element	10

Sampling Pump SP209-100Dual / 1000Dual Instruction Manual

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