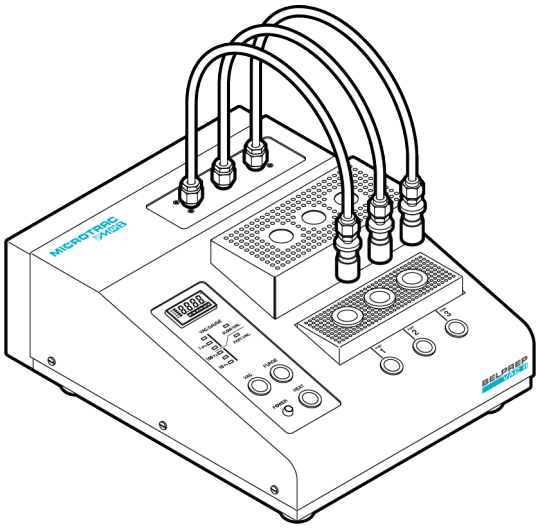
MICROTRAC MRB

Gas/Vapor Adsorption Measurement
Pretreatment Instrument

BELPREP VAC II

USER'S MANUAL



Thank you for purchasing this product.

- Read the user's manual thoroughly, and then use the device correctly and safely.
- **Before use, be sure to read "SAFETY PRECAUTIONS (pages 1 to 4)."**
- After reading the user's manual, store it safely in a location where it can be accessed whenever necessary.

SAFETY PRECAUTIONS

About this product

- **To use this product safely, this product must only be used by people who have mastered the required techniques or by people who have received instructions from instructors who have mastered the required techniques.**
- MicrotracBEL accepts no responsibility for device or optional equipment being damaged due to incorrect usage.
- This product's warranty lasts for 1 year after delivery.

About this manual

- MicrotracBEL accepts no responsibility for any effects resulting from the use of this manual.
- This manual is copyrighted by MicrotracBEL Corp.
- Do not use or copy this manual in whole or in part without permission.
- The contents of this manual may be changed without notification.

Explanation of warning statements

Precautions are expressed in this manual according to the classifications or icons shown below.

Fully understand the precautions written in this manual before using this product.

⚠ **WARNING**	Failure to follow the precautions indicated with this mark may lead to death or serious injury.
⚠ **CAUTION**	Failure to follow the precautions indicated with this mark may lead to injury or damage to peripheral equipment.
	This mark indicates actions that are prohibited.
	This mark indicates actions that must be performed.

During Installation

⚠ WARNING

Do not install the device in a location such as those described below.

Doing so may lead to fire, electric shock, injury, or malfunctions.

- Unstable locations
- Locations close to open flames
- High temperature or high humidity locations
  Installation environment specifications
  Temperature: 10°C to 35°C
  Humidity: 20%RH to 80%RH
- Locations subject to water
- Locations where powerful magnetic fields or radio waves are present
- Locations subject to direct sunlight
- Locations where ventilation equipment is not present
- On a stand that has poor heat resistance

⚠ WARNING

Install the device in a level location with minimal vibrations and implement countermeasures to prevent the device from falling over.

Failing to do so may lead to injury or malfunctions arising from the device or optional equipment tipping over or falling down.

Power Cable and Plug

⚠ WARNING

Do not damage the power cable.

Doing so may lead to electric shock or malfunctions.
Do not damage the power cable or bend it forcefully.
Also, do not use damaged power cables.

Do not replace the power cable with one that has inappropriate ratings.

Doing so may lead to electric shock or malfunctions.
Use the included power cable.

Do not use an unstable power supply.

Doing so may lead to electric shock or malfunctions. Use a power supply with a voltage fluctuation of 10%.

Use the device with the specified power supply voltage and ground the device.

Doing so may lead to electric shock or malfunctions.
Use the device or optional equipment with the single-phase AC power supply displayed on the back of the device and ground the device with the included power cable with grounding wire.

Fix the power cable and plug it in place securely to ensure that they do not fall out.

Failing to do so may lead to a fire.
The power cable has its own weight, and tension acts on the connection, so fix the power cable in place securely.

When disconnecting the power cable, be sure to pull it from the power plug.

Failing to do so may lead to electric shock or fire.

Before moving the device or optional equipment, turn off the device and remove the power plug from the outlet.

Failing to do so may lead to electric shock or injury.

When the device or optional equipment is not used for a long period of time, turn it off and remove the power plug from the outlet.

Failing to do so may lead to electric shock, electric leakage, or fire arising from insulation degradation.

⚠ WARNING

If you detect a problem, turn off the device and remove the power plug from the outlet.

Using the device while an error has occurred (such as when you detect smoke, a strange odor, or abnormal noises) may lead to fire or electric shock.
Contact MicrotracBEL immediately.

If water spills inside the device or optional equipment, turn off the device and remove the power plug from the outlet.

Using the device or optional equipment in this state may lead to fire or electric shock.
Contact MicrotracBEL immediately.

During Use

⚠ WARNING

Do not disassemble, modify, or repair the device.

Doing so may lead to electric shock, fire, injury, or malfunctions.

Do not touch the device or optional equipment with wet hands.

Doing so may lead to electric shock.

Do not insert conductive objects into the inside of the device or optional equipment.

Doing so may lead to electric shock, short circuits, or fire.

Do not subject the device or optional equipment to water.

Doing so may lead to electric shock or short circuits.

During use and for some time after use, do not touch the heater, Sample cell, or other such parts that are hot.

Doing so may lead to burns.
Before performing operations such as piping work and cleaning, wait for parts such as the heater and sample cell to cool down.
Furthermore, do not allow people who have no knowledge of the device or optional equipment to touch it.

Do not set the temperature controller beyond the maximum operating temperature of the heater.

Normally, the temperature controller will not allow you to set the temperature beyond the maximum operating temperature of the heater. It is very dangerous if you set the temperature beyond the maximum operating temperature by overriding this protective function. You must never override this protective temperature setting function. Never set the temperature above the maximum operating temperature of the heater.

⚠ CAUTION

Do not subject the device or optional equipment to strong impacts.
Doing so may lead to malfunctions or damage.

Do not cover the device's or optional equipment's air intake and exhaust ports.
Doing so will cause heat to build up within the device or optional equipment, which may lead to malfunctions.

Only use accessories and optional products recommended by MicrotracBEL.
MicrotracBEL accepts no responsibility for the device or optional equipment malfunctioning or being damaged due to the use of non-recommended products.

Do not place objects or hands on the top or bottom of the elevator while operating the elevator.
Doing so may lead to injury or malfunctions.

Do not apply pressure higher than 0.2 MPa (G).
The internal parts may be damaged.

Do not use harmful, corrosive, combustible, or poisonous gasses.

Check for any leaks from the tubes. There should not be any leakage.

Please handle to connect the vent of the pump to the air duct appropriately.

Be careful when handling compressed gas, such as found in a gas cylinder.

Be careful not to overshoot the processing temperature.
When the heater temperature increases, the processing temperature may exceed the temperature setting. To prevent overshooting, take appropriate measures, such as inserting the sample cell into the heater only after the heater temperature has stabilised.

If dust or other such debris builds up inside of the device or optional equipment, clean the inside of the device.
Failing to do so may lead to fire or malfunctions.
Contact MicrotracBEL to have the inside of the device or optional equipment cleaned.

Before moving or disposing of the device or optional equipment, contact MicrotracBEL.

CONTENTS

Advantages of BELPREP VAC II

BELPREP VAC II has two different pretreatment functions; the pretreatment of reducing pressure and heating, in which the sample is heated under a reduced pressure to remove the moisture contained in the sample, the pretreatment of flowing inert gas and heating in which the sample is heated under an inert gas flowing to remove the moisture contained in the sample. (Option)

- With BELPREP-vacII, you can select and use the pretreatment of reducing pressure and heating or the pretreatment of flowing inert gas and heating, where applicable.
- With BELPREP-vacII, you can pre-treat three samples at a time.
- With BELPREP-vacII, you can set the heating temperature in a range from room temperature to 430°C according to the sample property.
- When using the pretreatment of flowing inert gas and heating by BELPREP-vacII, you can adjust the inert gas flow rate according to the sample property.
- With BELPREP-vacII, you can determine the sample mass after the pretreatment by measuring the blank sample cell mass.

To Measure the Adsorption Isotherm Accurately

To measure the adsorption isotherm accurately, It is important “to pre-treat the sample under appropriate conditions” and “to determine the exact sample mass.”

Before the Gas/Vapor Adsorption Measurement

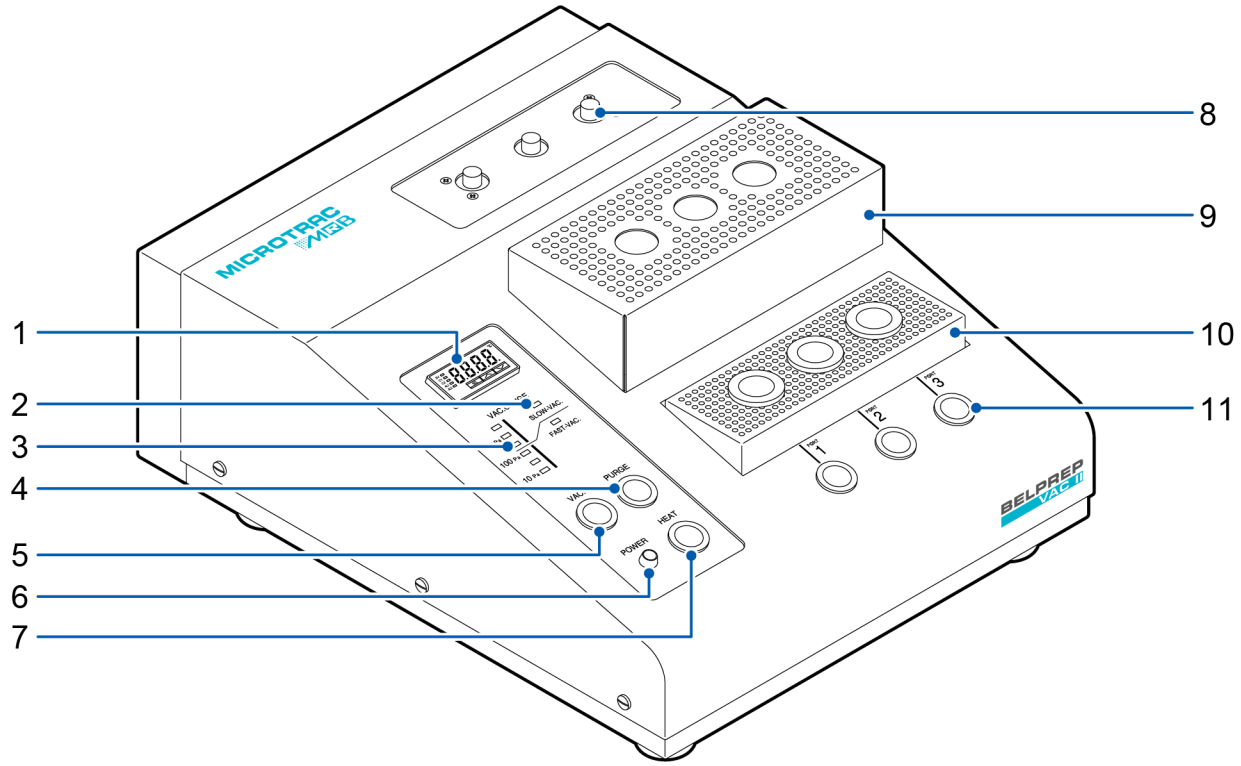
Before the gas/vapor adsorption measurement, it is necessary to pre-treat the sample appropriately. Adjust the heating temperature, the vacuuming rate, and the inert gas flow rate so that the sample surface property may not be affected by the pretreatment, but the gas and/or the moisture adsorbed on the surface can be removed.

The Gas/Vapor Adsorption Measurement

The gas/vapor adsorption measurement determines the adsorptions per the sample of 1g. If there is an error of 1% in mass, it will directly affect the measurement accuracy. Determine the sample mass accurately from the sample cell mass after the pretreatment by measuring the blank sample cell mass.

Main Unit

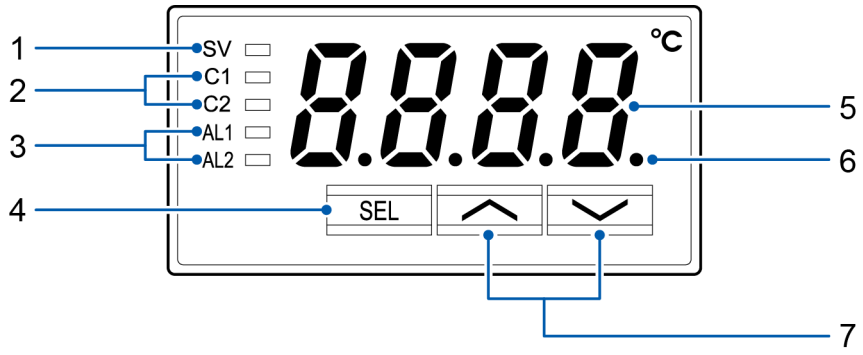
Front



1	**Temperature controller**	This is for temperature control of the pretreatment heater.
2	**Vacuuming speed indicator**	This indicates the vacuuming rate with LED.
3	**Vacuum indicator**	This indicates the vacuum with LED.
4	**Purge switch**	This switch is used to flow inert gas into the sample cell. Flow the purge gas into the corresponding port (1 to 3). Adjust the flow rate before the pretreatment.
5	**Vacuum switch**	By pressing this switch on, the “SLOW VAC” LED is on, and the system is vacuumed gradually. Pressing it for 4 seconds starts vacuuming with “FAST VAC”. • Once vacuuming starts, any port valve cannot be controlled. Open the port valve to vent the system to open air before connecting the sample cell.
6	**Power lamp**	This lamp is on by turning on the power breaker on the unit - back.

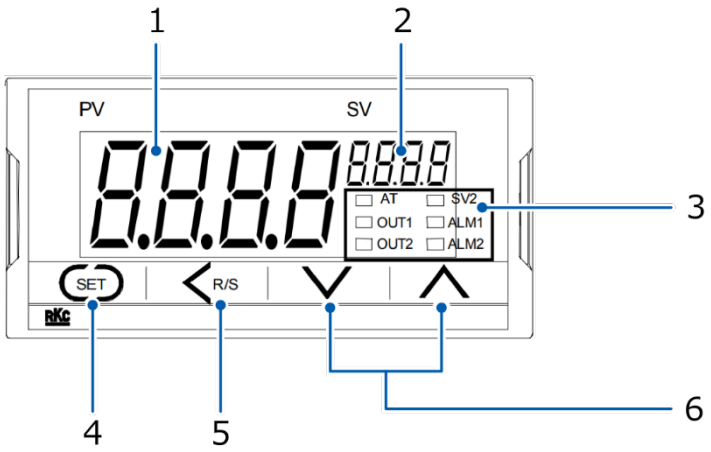
7	**Heater switch**	Press this switch to start temperature control for all ports (1 to 3). Heating is controlled to the temperature that is set by the temperature controller.
8	**Tube connection port**	Sample cell connection tubes are in place. For the pressure-reducing and heating method, connect sample cells to the sample cell connection tubes. For the flow heating method, connect the purge gas flow tubes to the sample cell connection tubes.
9	**Pretreatment heater**	This heats up the sample cell. The treatment temperature can be adjusted in a range from room temperature to 430°C using the temperature controller. • During and immediately after heating with the heater, the sample cell and the heater section may be hot. Carefully handle these parts.
10	**Radiation zone**	Insert the sample cell after heating into this zone to radiate it. • The radiation zone is made of metal. Insert the sample cell slowly so that it may not be broken.
11	**Port valve switch**	These switches operate the corresponding valve. In order to prevent the sample from scattering, any valve will not be operated during vacuuming.

Temperature Controller（Model 041-00000-0-1 and 041-00000-0-2）



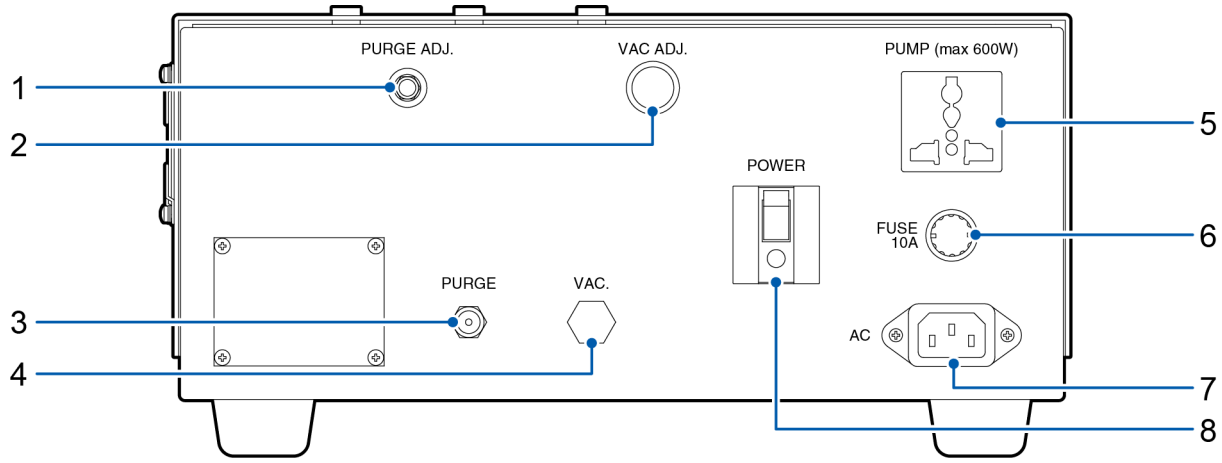
1	**SV lamp**	Normally (while this lamp is off), the PV (measured value) is displayed. Pressing the SEL key lights the SV lamp and displays the SV (setting value). However, this lamp turns off when a parameter or data is displayed. This lamp blinks during standby when the display shows the PV (measured value).
2	**Control output 1 and 2 lamps**	Light when control output 1 or 2 turns on.
3	**Alarm output 1 and 2 lamps**	Light when alarm output 1 or 2 activates. They also blink during delayed operations.
4	SEL **key**	Used to perform operations such as switching the display between PV value and SV value, selecting the parameter block, selecting the parameter, and finalizing the set of parameter values.
5	**Display**	Displays the PV (measured value) or SV (setting value). Displays the parameter name or value when setting parameters.
6	**Auto tuning lamp**	Blinks during auto-tuning.
7	^ v **key**	Used to change the SV value, call parameters, and change parameter values.

Temperature Controller（Model 041-00001-0-1 and 041-00001-0-2）



1	**PV (Measured value) display**	Displays PV or various parameter symbols.
2	**SV (Set value) display**	Displays SV or various parameter set values.
3	**Indication lamps**	AT: Flashes during Autotuning activated. OUT1: Lights when the output is ON. OUT2,SV2,ALM1,ALM2: Not used.
4	**Set key**	Used for calling up parameters and setting value registration.
5	**Shift & R/S key**	Shifts digits when settings are changed. Selects the RUN/STOP function.
6	**Up key, Down key**	Used for changing SV value and parameters.

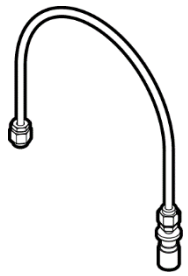
Back



1	**Purge gas flow rate adjustment knob**	This knob is to adjust the needle valve to adjust the purge gas flow rate. Turn the knob counterclockwise to increase the flow rate. • Turning the knob during flowing gas may scatter samples. Adjust the flow rate before the pretreatment.
2	**Vacuuming rate adjustment knob**	This knob is to adjust the needle valve for adjusting the vacuuming rate with "SLOW VAC". Turn the knob counterclockwise to increase the vacuuming rate. • Turning the knob during vacuuming may scatter samples. Adjust the flow rate before the pretreatment.
3	**Purge gas connection port**	Connect the inert gas of 0.1 MPa (G) (nitrogen gas is recommended).
4	**Vacuum rubber tube connection port**	Insert the vacuum rubber tube (ID 9 mm) from the rotary pump.
5	**Service plug for Rotary pump**	Connect the power plug of the Rotary pump. • Do not connect to any pump that has the max. power over 600 W.
6	**Fuse**	If the fuse has blown is replaced.
7	**Power inlet**	Connect the power cable supplied.
8	**Power breaker**	The main unit power is on by pushing this lever up. This is a high-speed shutoff-type ground fault interrupter.

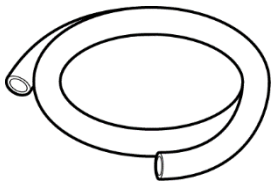
Accessories

Make sure that all accessories are present.

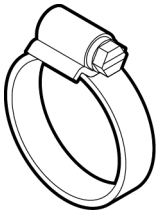


Sample cell connection tubing
3 pcs.

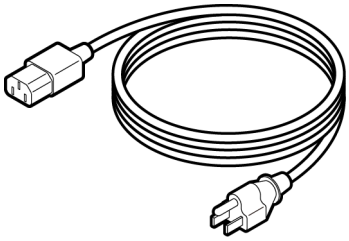
O ring
6 pcs.



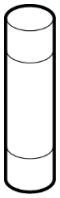
Vacuum rubber tubing
1 pc.



Hose band
2 pcs.



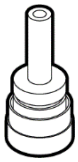
Power cable
1 pc.



Fuse
Size: φ6.35×31.8 mm
250 V – 10A
2 pcs.

Optional Products

Purge gas flow tubing /
Purge gas flow tube holder



Conversion fitting
from φ9 to φ14

Other Requisites

To operate BELPREP VAC II, the following parts are required in addition to the packaged accessories as a standard. Prepare the relevant parts according to the "Requirements" column.

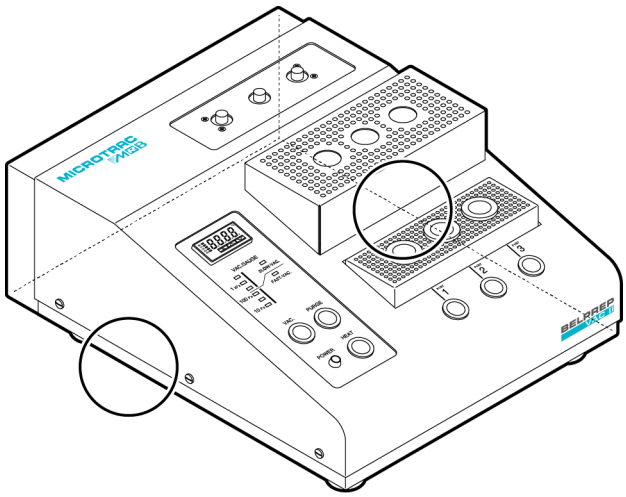
- These parts are available from our company; therefore, please contact us.

Requisites	Requirements
Rotary pump	Displacement: 20 L/min or more Ultimate pressure: 1 Pa or less Vacuum rubber tube connection port : ID 9mm • Do not connect to any pump that has the max. power over 600 W.
Purge gas	Inert gas • It is recommended to use nitrogen gas. When using another type of gas, the vacuum indicator may not show the correct pressure value.
Gas piping	Main unit connector: 1/8” swage lock

Main unit carrying and installation

When the main unit is taken out of a box or carried, please lift the right and left sides,s which are surrounded in the frame of the chart below, with both hands.

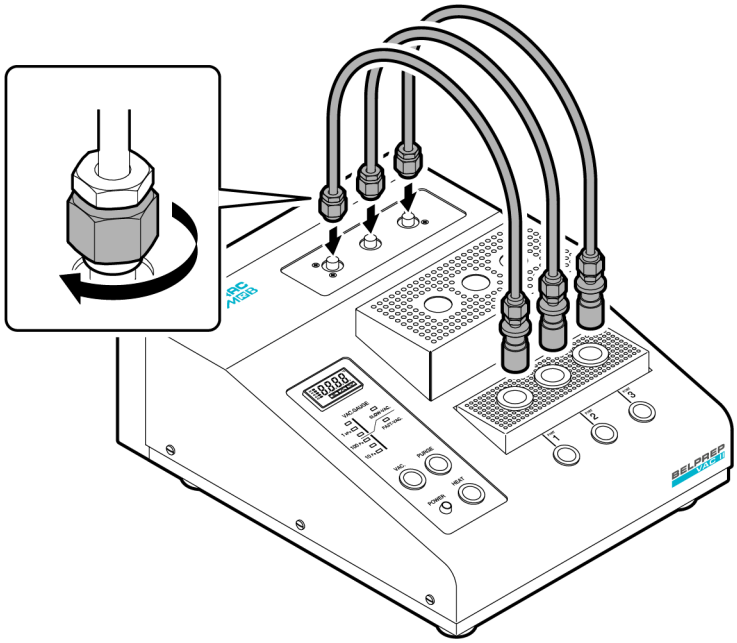
- Install the main unit in a horizontal place, and ensure that it is firmly fixed.



Mounting the sample cell connection tubing

Mount the sample cell connection tubing to the tube connection port on the main unit.

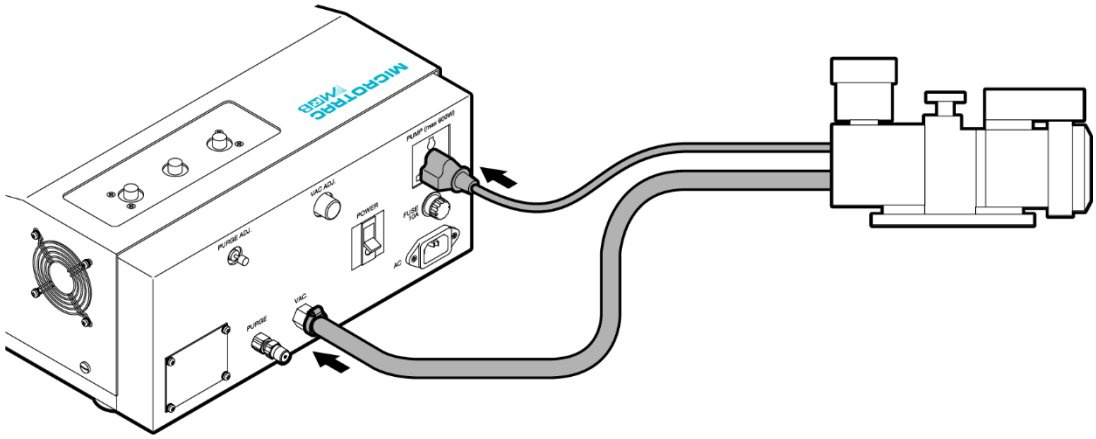
- After tightening by hand, tighten by turning 1/4 turn clockwise using a wrench.



Connecting the Rotary Pump

Connect the power cable and vacuum hose of the rotary pump to the back of the main unit.

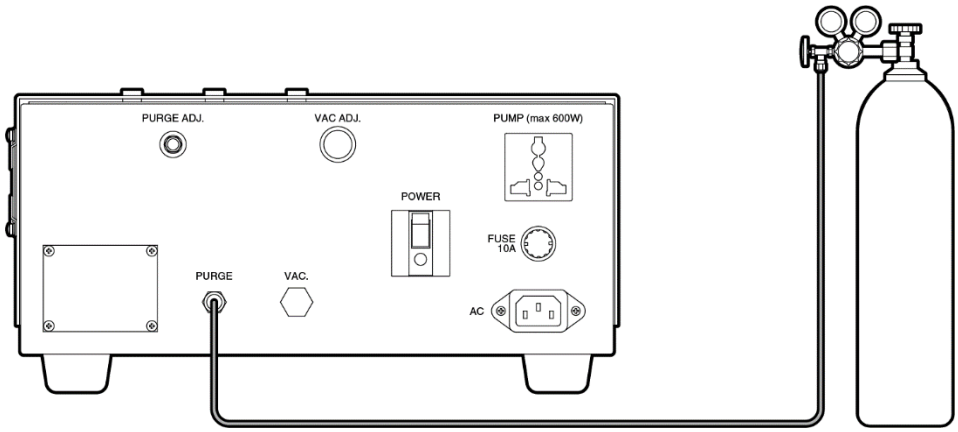
- Surly insert the vacuum rubber tubing to the bottom end, and fasten it firmly with a hose band.
- Be sure to mount it firmly. Otherwise, it may result in leakage.
- The oil mist from the rotary pump is a human hazard. Be sure to connect the exhaust duct to the exhaust port of the rotary pump.



Connecting the Gas Piping

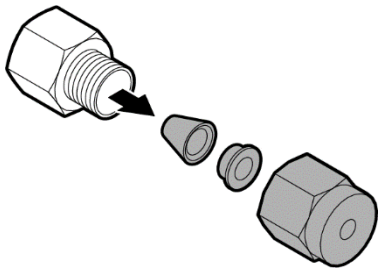
Use gas piping to connect the main unit to the purge gas cylinder.

- Prepare a gas piping for the purge gas, a gas cylinder for the purge gas (inert gas: nitrogen gas is recommended), and a regulator.
- The purge gas connection port uses a 1/8″ swage lock.
- The standard BELPREP VAC II product does not include a gas piping, purge gas source, and regulator. Please contact our company if any questions.



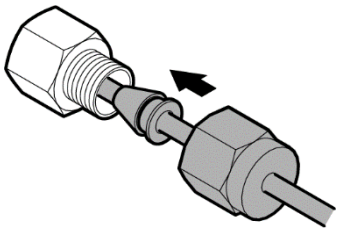
Connecting the Gas Piping

1 Remove the nut, back ferrule, and front ferrule from the purge gas connection port.

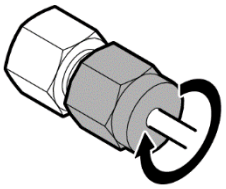


2 Pass the gas pipe through the nut, back ferrule, and front ferrule, and then insert the gas pipe into the purge gas connection port.

- Be sure to finish the cut face flat.
- Securely insert the gas pipe as far as it will go.

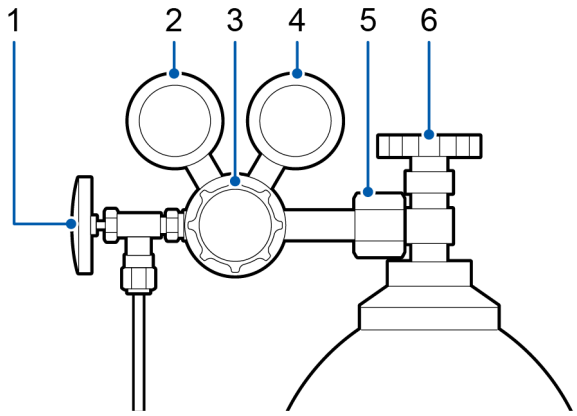


3 Tighten the nut by hand as much as possible. Then, use a tool to further tighten the nut through approximately 3/4 of a turn.



Adjusting the Gas Pressure

Check the gas piping for leakage and adjust the gas pressure.



1	Stop valve	4	Primary pressure
2	Secondary pressure	5	Regulator connection section
3	Regulator valve	6	Main valve

1 Open the cylinder main valve, and then close it again 2 to 3 seconds later.

2 Verify that the primary pressure does not fall for several minutes.

- When the primary pressure decreases, it may possibly be due to leakage from the connection section between the cylinder and the regulator. Reconnect them so that there is no leakage.

3 If there is no leakage, adjust the gas pressure by turning the regulator valve slowly clockwise. Adjust the pressure so that the secondary pressure is 0.1 MPa (G).

- Do not apply pressure higher than 0.2 MPa (G); otherwise, it may damage a valve or a flow meter.

4 Open the stop valve by turning it counterclockwise. Open the cylinder main valve, and then close it again 2 to 3 seconds later.

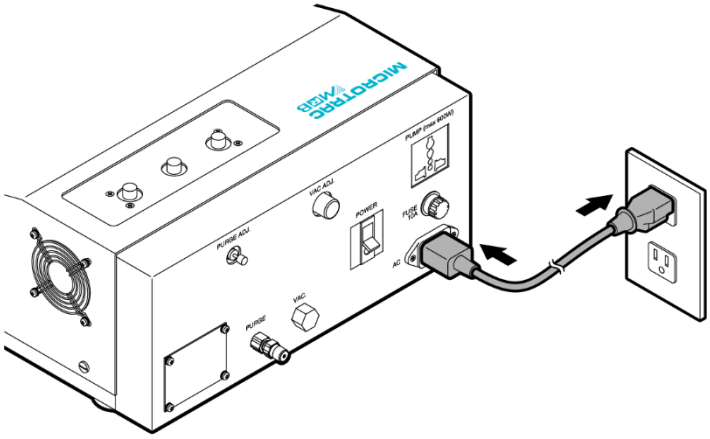
5 Verify that the primary pressure does not fall for several minutes.

- When the primary pressure decreases, it may possibly be due to leakage from the connection section between the cylinder and the regulator. Reconnect them so that there is no leakage.

6 If there is no leakage, open the cylinder's main valve.

Connecting the Power Cable

Connect the power cable to the power inlet on the back of the main unit, and then connect the power plug to an electrical outlet.

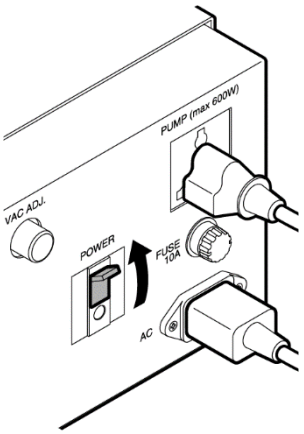


STARTING AND STOPPING

Starting

1 Turn on the main unit's power.

The power lamp lighting power turns on.



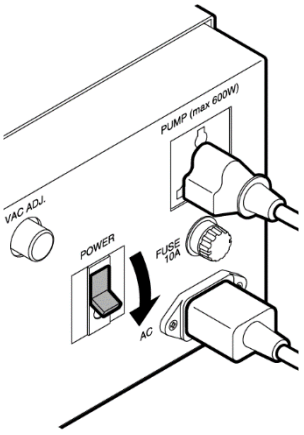
2 Turn on the rotary pump power.

- When the unit has not been used for a long period, check the piping for leakage and adjust the gas pressure.

Stopping

1 Turn off the main unit's power.

The power lamp turns off when the main unit turns off.



2 Turn off the rotary pump power.

- The rotary pump oil may go up into the system unless the power is off, which may result in failure. Be sure to turn off the main unit power immediately after the rotary pump power is off.

- When stopping the use of the device for a long time (1 month or longer), close the gas cylinder main valve.

Pretreatment flow

The standard pretreatment procedure is as follows. Weigh the sample cell, and determine the sample mass before and after the pretreatment.

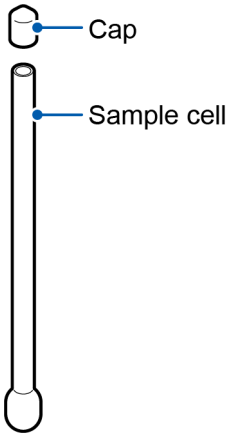
- For the adsorption measurement, use the sample mass after the pretreatment.

Preparation	Preparing the sample cell.
↓	
Measuring the blank sample cell mass	Displace inside the sample cell with the purge gas.
	Weigh the blank sample cell mass [W]. **Pressure-reducing and heating method** ・[W] = Sample cell + Cap + Glass rod + Filter **Flow heating method** ・[W] = Sample cell + Cap
↓	
Measuring the sample mass (Before the pretreatment)	Add the sample into the sample cell.
	Weigh the sample cell mass [Wa]. **Pressure-reducing and heating method** ・[Wa] = Sample cell + Cap + Glass rod + Filter + Sample **Flow heating method** ・[Wa] = Sample cell + Cap + Sample
	Determine the sample mass before the pretreatment [Wb]. ・[Wb] = [Wa] – [W]
↓	
Sample pretreatment	Pre-treat the sample.
	Cool the sample in the radiation zone.
↓	
Measuring the sample mass (After the pretreatment)	Displace inside the sample cell with the purge gas.
	Weigh the sample cell mass [Wc]. **Pressure-reducing and heating method** ・[Wc] = Sample cell + Cap + Glass rod + Filter + Sample **Flow heating method** ・[Wc] = Sample cell + Cap + Sample
	Determine the sample mass after the pretreatment [Wd]. ・[Wd] = [Wc] – [W]

Preparation

Sample cell and cap

Prepare a sample cell and a cap, which have been sufficiently washed and dried.



- Use the same cap from the step "Measuring the Blank Sample Cell Mass" to the step "Measuring the Sample Mass(After the Pretreatment)". If the cap mass changes, the sample mass cannot be obtained accurately.
- For the pretreatment of two or more samples, it is convenient to number the sample cell and the cap and make a list of the blank mass for individual sets.

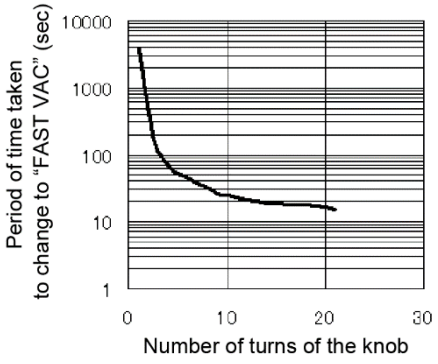
Adjusting the vacuuming rate

Turn on the vacuum switch to vacuum slowly with "SLOW VAC". When it reaches a certain level of pressure (approx. 200 Pa), it changes to "FAST VAC" to vacuum rapidly. How to adjust the vacuuming rate with "SLOW VAC" is described below. To start vacuuming with "FAST VAC", keep pressing the vacuum switch for 4 seconds.

- When vacuuming with "FAST VAC", be careful that the sample does not scatter.

Adjust the vacuuming rate using the vacuuming rate adjustment knob on the main unit - back. Turn this vacuuming rate adjustment knob counterclockwise to increase the vacuuming rate or turn it clockwise to decrease the vacuuming rate. For samples liable to scatter, adjust the vacuuming rate to a lower level to pre-treat the samples. The right figure shows the period of time taken to change the vacuuming rate to "FAST VAC" when slowly opening the vacuuming rate adjustment knob. Refer to this figure as a guideline.

Relationship between the number of turns of the knob and the period of time taken to change to "FAST VAC."



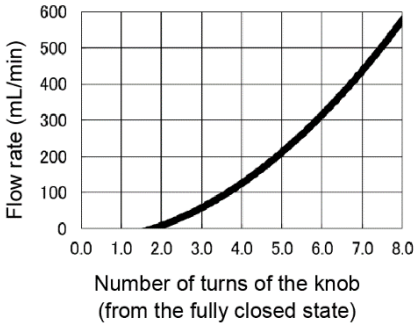
- The figure above shows the period of time taken to change the vacuuming rate to “FAST VAC” when vacuuming the three ports with the blank sample cell. The period of time taken to change it to “FAST VAC” varies with the number of vacuuming ports and samples to be pre-treated.
- In order to adjust the number of turns of the knob, fully close the vacuuming rate adjustment knob before adjusting it.
- For samples liable to scatter, adjust the vacuuming rate on an as-needed basis.
- The period of time taken to change the vacuuming rate varies with slight differences in the adjustment of the vacuuming rate adjustment knob. Refer to the figure above absolutely as a guideline.

Adjusting the purge gas flow rate

For the pretreatment of reducing pressure and heating, it is necessary to purge gas before and after the pretreatment. Before the pretreatment, adjust the flow rate according to the following procedure.

In order to prevent the sample from scattering, adjust the purge gas flow rate using the purge gas flow rate adjustment knob on the main unit - back. Turn this purge gas flow rate adjustment knob counterclockwise to increase the flow rate, or turn it clockwise to decrease the flow rate. If the secondary pressure of the purge gas cylinder is set to 0.1MPa(G), the flow rate will become as shown in the right figure.

Relationship between the number of turns of the knob and flow rate



- The figure above shows the flow rate with an inert gas flown into only one port. To flow the gas into two ports, divide the flow rate shown in the figure above into two equal parts. To flow the gas into three ports, divide it into three equal parts.
- The purge gas flow rate adjustment knob is fixed with a stopper on the purge gas flow rate adjustment knob. Turning the stopper counterclockwise makes it possible to turn the purge gas flow rate adjustment knob. In order to adjust the number of turns of the knob, loosen the stopper to a maximum extent and then fully close the purge gas flow rate adjustment knob before adjusting it.
- For samples liable to scatter, adjust the flow rate on an as-needed basis.
- The flow rate varies with slight differences in adjustment of the secondary pressure of the cylinder or the purge gas flow rate adjustment knob. Refer to the figure above absolutely as a guideline. If optional parts are selected, the actual flow rate is measurable.

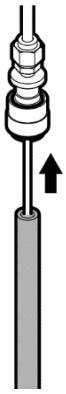
Example of purge gas measurement

1 Connect the purge gas flow tubing to the sample cell connection tubing.

→ "Adjusting the purge gas flow rate and setting the sample cell" on page 30.

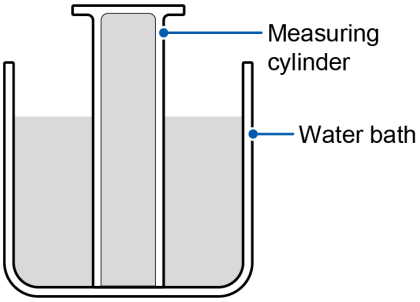
2 Connect rubber tubing to the purge gas flow tubing.

- Suitable rubber tubing is to be prepared.



3 Installing a water bath.

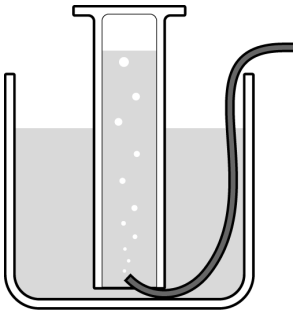
Fill a measuring cylinder with water, and then erect it upside-down in a water bath.



4 Measuring the flow rate.

Insert rubber tubing in the measuring cylinder, and then press the port valve switch to open the port valve.

The measuring cylinder is filled with gas. Calculate a flow rate according to the amount of gas filled for a period of 1 minute.



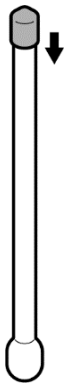
Measuring the Blank Sample Cell Mass

The gas adsorption measurement determines the "adsorption per the sample of 1 g". If there is an error of 1 % in mass, it will directly affect the measurement accuracy. Determine the sample mass accurately from the sample cell mass after the pretreatment by measuring the blank sample cell mass.

- When using nitrogen gas as the purge gas, the difference between the blank sample cell mass (air) and the blank sample cell mass (nitrogen gas) is less than 0.0004 g. When such an error does not become an issue, it is not necessary to displace inside the sample cell with nitrogen gas.

Displacing with the purge gas

1. Start the main unit.
2. Mount the sample cell to the sample cell connection tubing.
3. Open the valve at the pretreatment port to be used, and turn on the vacuum switch to exhaust inside the sample cell.
4. Turn off the vacuum switch, and turn on the purge switch.
5. When the sample cell pressure exceeds atmospheric pressure due to the purge gas, the purge switch is turned off automatically.
6. Remove the sample cell from the tubing and immediately seal it with a sample cell cap.



Weighing the sample cell

1 Remove the sample cell from the radiation zone.

2 Weigh the blank sample cell mass.

- Pressure-reducing and heating method

  Blank sample cell mass = Sample cell + Cap + Glass rod + Filter

- Flow heating method

  Blank sample cell mass = Sample cell + Cap

Measuring the Sample Mass (Before the Pretreatment)

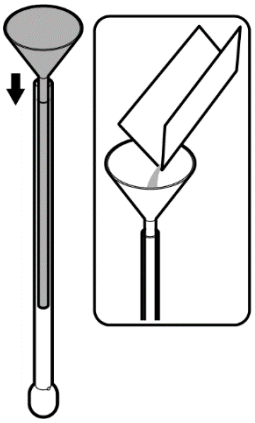
The sample mass before the pretreatment is not used for the sample gas adsorption measurement; however, it may be important data to indicate how much impurity is removed by the pretreatment. It is recommended, therefore, to measure the sample mass before the pretreatment.

Adding the sample into the sample cell

- The sample cells and the liq. bottles are made of glass. Careful attention is required for the handling.

1 Insert a funnel tube into the sample cell, and add the sample from the upper part of the funnel tube.

- Use the sample that has been dried in advance.



Weighing the sample cell

1 Remove the funnel tube while preventing the sample from sticking to the sample cell's inner wall, and attach a cap.

2 Weigh the sample cell mass.

- Pressure-reducing and heating method

  Sample cell mass = Sample cell + Cap + Sample + Glass rod + Filter

- Flow heating method

  Sample cell mass = Sample cell + Cap + Sample

Calculating the sample mass

1 Calculate the sample mass before the pretreatment.

- Sample mass = Sample cell mass - Blank sample cell mass

Sample Pretreatment

Solid surfaces are sensitively influenced by the environment. When the sample has a large specific surface area, in particular, a remarkable influence is observed. For the pretreatment, not only arrange the conditions in accordance with measurement purpose but also be careful not to change the property of the sample surface due to the pretreatment. With BELPREP VAC II, you can select the pretreatment system according to the sample property, from the system of reducing pressure and heating or the system of flowing inert gas and heating; and set the heating temperature in a range from room temperature to 430°C. Pre-treat the sample under appropriate conditions.

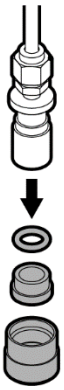
Pressure-Reducing and Heating Method

Setting the sample cell

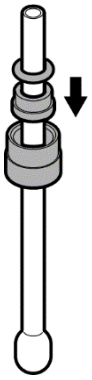
Mount the sample cell to the sample cell connection tubing.

- Remove the fittings and the O-ring, and then mount the sample cell. Connecting the sample cell with the assembled fittings may deform the O-ring, which may result in leakage.

1 Remove the nut, sleeve, and O-ring from the sample cell connection tubing.



2 Pass the nut, sleeve, and O-ring onto the sample cell.



3 Insert the sample cell into the sample cell connection tubing, and then tighten the nut to fix it in place.

Heating with the heater

Set the heating temperature according to the sample property. When selecting no-heating, jump to the next section, "Pre-treating the sample".

- At heating, the heater temperature may exceed the setting temperature (overshoot). To avoid overshooting, heat up to the pretreatment temperature first, stabilize the heater temperature, and then insert the sample cell into the heater.
  "Heating with the heater" => "Adjusting the purge gas flow rate" => "Setting the sample cell"
- Once the temperature controller's set temperature is changed, it is controlled by the self-tuning function while calculating the PID parameters. At heating, after the set temperature is changed, therefore, overshooting may occur to a large extent.

Model 041-00000-0-1 and 041-00000-0-2

1 When power is supplied to the main unit, the current temperature is indicated on the display.

2 Press SEL key to indicate the current setting value, where the setting value can be updated. Now, the SV lamp is on.

3 Press [∧][∨] key to change the setting value. Use [∧] key to increase the current setting value, whereas use [∨] key to decrease it. Keep pressing [∧][∨] keys to change the speed of increasing/decreasing the setting value.

4 About 3 seconds after the setting value is changed, the setting value is registered automatically, and the display returns to indicate the measured value.

5 Turn on the heater switch to start heating up to the set temperature.

Model 041-00001-0-1 and 041-00001-0-2

1 When power is supplied to the main unit, the current temperature is indicated on the display.

2 In the PV/SV display mode, press the SET key to switch to the SV setting mode.

3 Press [∨][∧] key to change the setting value. Use [∧] key to increase the current setting value, whereas use [∨] key to decrease it. Press the R/S key shifts digits when settings are changed.

4 Press the SET key to register the set value.

5 Turn on the heater switch to start heating up to the set temperature.

Pre-treating the sample

1 Pre-treat the sample for an appropriate time period according to the sample property, the sample quantity, etc. Remove the moisture contained in the sample by heating, where applicable.

2 After the sample pretreatment, move the sample cell from the heater to the radiation zone.

- The sample cell and the heater may be hot. Be careful not to be suffered from burn injury.

3 Turn off the heater switch.

4 Cool the sample in the radiation zone while vacuuming.

Flow Heating Method

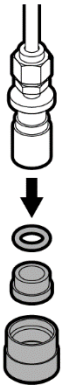
- Since the edge of purge gas flow tubing is sharp, be careful to avoid any injuries when inserting the holder.
- If purge gas flow tubing is inserted into the sample, the sample can be easily dispersed. Make sure the purge gas flow tubing does not touch the sample.

Adjusting the purge gas flow rate and setting the sample cell

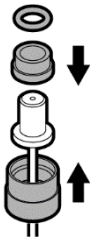
1 Verify that the end of the purge gas flow tubing is clean.

- Wipe it off with a dry cloth, etc., if it is contaminated.
- Remove the sample stuffed in the tubing, if any.

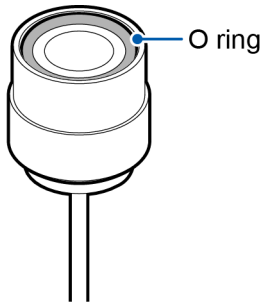
2 Remove the nut, sleeve, and O-ring from the sample cell connection tubing.



3 Pass the nut, sleeve, and O-ring onto the purge gas flow tubing.



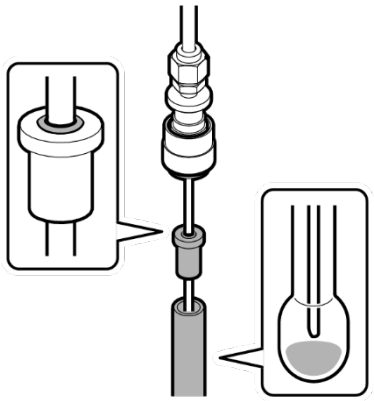
- Mount the purge gas flow tubing, as shown above, to the sample cell connection tubing.



4

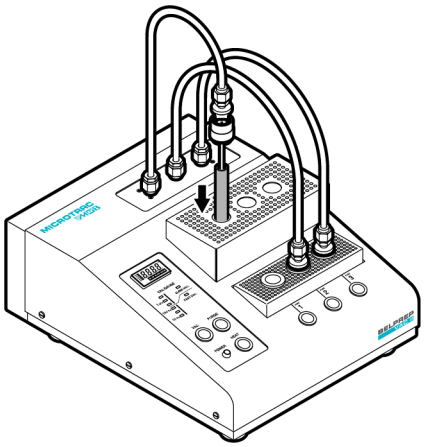
Insert purge gas flow tubing into the holder.

- Make sure the O-ring is fitted in the groove of the holder.
- Adjust the height of the purge gas flow tubing to avoid the sample.



5

Set the sample cell to the main unit.



6

Adjust the purge gas flow rate according to the sample property. When the sample is liable to scatter, adjust the purge gas flow rate low. Turn the flow rate adjustment knob counterclockwise to increase the flow rate or turn it clockwise to decrease the flow rate.

→ “Adjusting the purge gas flow rate” on page 22.

7

The purge gas flow rate adjustment knob is fixed with a stopper on the purge gas flow rate adjustment knob. Turn the stopper counterclockwise to loosen the purge gas flow rate adjustment knob. After the flow rate adjustment, by turning the purge gas flow rate adjustment knob, turn the stopper clockwise to fix the adjustment knob.

8 Turn on the purge switch, insert the purge gas flow tubing to the bottom of the sample, and then set the sample cell to the heater.

Heating with the heater

Follow the same procedure as for the pressure-reducing and heating method.

→ “Heating with the heater” on page 28.

Measuring the Sample Mass (After the Pretreatment)

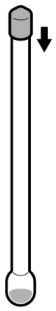
Use this "sample mass after the pretreatment" in the adsorption measurement.

After the pretreatment

Pressure-reducing and heating method

1 When the sample cell is sufficiently cooled, turn on the purge switch to fill the sample cell with the purge gas.

2 When the cell pressure exceeds atmospheric pressure, purging stops automatically. Remove the sample cell from the tubing and seal it with a cap.



3 Stop the main unit.

Flow heating method

1 When the sample cell is sufficiently cooled, remove the gas flow tubing and then seal it with a cap.

2 Turn off the purge switch.

3 Stop the main unit.

Weighing the sample cell

1 Weigh the sample cell mass.

- Pressure-reducing and heating method

  Sample cell mass = Sample cell + Cap + Sample + Glass rod + Filter

- Flow heating method

  Sample cell mass = Sample cell + Cap + Sample

Calculating the sample mass

1 Calculate the sample mass after the pretreatment.

- Sample mass = Sample cell mass - Blank sample cell mass

This manual explains the basic operation and setting methods for the temperature regulator.

To perform more advanced operations, you need to read the user's manual (a separate manual) for the temperature regulator.

For details on the user's manual for the temperature regulator, contact MicrotracBEL.

⚠ WARNING

Do not set the heater to a temperature that exceeds its maximum usage temperature (430°C).

In the factory default settings, an upper limit is applied to the set temperature to prevent it from exceeding the maximum usage temperature of the heater. Do not clear the upper limit setting, as doing so and setting a temperature that exceeds the maximum usage temperature of the heater is extremely dangerous.

⚠ CAUTION

Exercise caution to prevent treatment temperature overshooting.

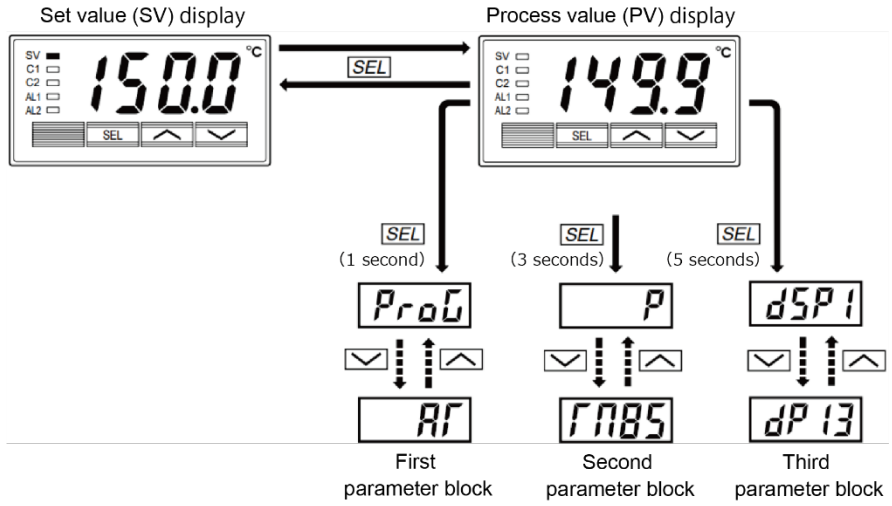
Overshooting (the treatment temperature exceeding the setting temperature) may occur when the heater temperature rises. To prevent overshooting, implement countermeasures such as inserting Sample cells into the heater after the heater temperature has stabilized.

Model 041-00000-0-1 and 041-00000-0-2

Main Operation

Switching Between the Parameter Blocks

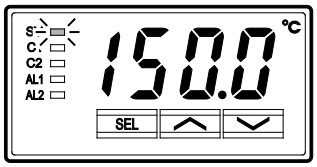
The BELPREP VAC II（041-00000-0-1、041-00000-0-2）has three parameter blocks of the temperature controller. The parameter blocks can be switched by pressing the SEL key.



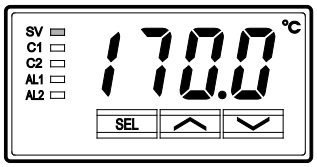
Changing Temperature Setting Values

1 With the current temperature displayed, press the SEL key to light the SV lamp and display the current setting value.

- Press the SEL key again to turn off the SV lamp and return to the current temperature display.



2 Press the ∧ ∨ keys to change the setting value.
Hold down the ∧ ∨ keys to increase or decrease the setting value quickly.

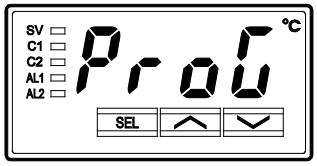


3 After changing the setting value, if you perform no operations for approximately 3 seconds, the setting value is automatically registered, the SV lamp turns off, and you are returned to the current temperature display.

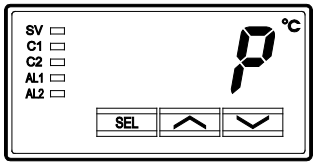
Changing Parameter Values

1 Hold down the SEL key for approximately 1, 3, or 5 seconds to switch to the first, second, or third parameter block, respectively.

Press the SEL key for approximately 1 second.
↓
Switch to the first parameter block.

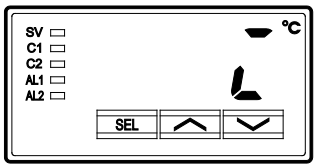


Press the SEL key for approximately 3 seconds.
↓
Switch to the second parameter block.



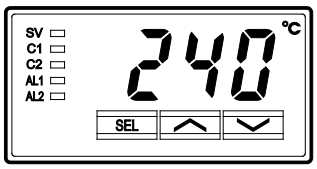
Press the SEL key for approximately 5 seconds.
↓
Switch to the third parameter block.

2 Press the ∧ ∨ keys to select the parameter to set.

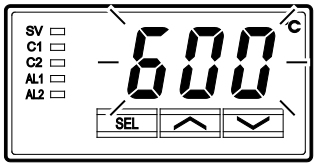


3 Press the SEL key to display the setting value of the selected parameter.

- Press the SEL key again to return to the parameter selection.

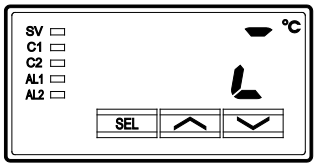


4 Press the ∧ ∨ keys to change the setting value.
The display blinks.



5 After changing the setting, press the SEL key to register the setting value and return to the parameter display.

- To check the registered setting value or to change this value again, repeat steps 3 to 5.



6 To display the operating status, hold down the SEL key for approximately 2 seconds. The current setting temperature is displayed.
If you perform no operations for approximately 30 seconds, you are returned to the current temperature display.

Parameters

First parameter block	Description	Setting range (*: factory default setting)
Ramp and soak control ProG	Starts/stops/holds the ramp and soak operation.	oFF: Stop* rUn: Start hLd: Hold End: End
Auto tuning AT	Use this parameter when setting the P, I, and D constants with auto-tuning. After auto-tuning is finished, the setting value automatically becomes "0"	0: None* (When auto-tuning has been cleared or is not being executed) 1: Execute (Standard: Execute auto-tuning with the SV value.) 2: Execute (Low PV: Execute auto-tuning with the SV value − 10%FS.)

Second parameter block	Description	Setting range (*: factory default setting)
Proportional band P	To switch to on/off control (two-position control), set this to "0.0" This parameter can be set to a value within the input range.	0 to 999.9% *: 5.0
Integral time I		0 to 3200 seconds *: 240
Derivative time d		0 to 999.9 seconds *: 60.0
First to eighth target temperatures SV-1~SV-8	Sets the target value (SV value) for each ramp segment.	0 to 100%FS *: 0.0
First to eighth ramp segment times rMIr~rM8r	Sets the ramp time of each segment.	0 to 99 hours and 59 minutes *: 0.00
First to eighth soak segment times rM1S~rM8S	Sets the soak time of each segment.	0 to 99 hours and 59 minutes *: 0.00

Third parameter block	Description	Setting range (*: factory default setting)
Parameter skip dSP1~dSP9 dP10~dP13	Sets whether to show/hide each parameter. Unnecessary parameters are masked so that they cannot be set.	0 to 255 * dSP1: 245 dSP2: 255 dSP3: 241 dSP4: 255 dSP5: 255 dSP6: 7 dSP7: 0 dSP8: 0 dSP9: 248 dP10: 255 dP11: 255 dP12: 255 dP13: 31

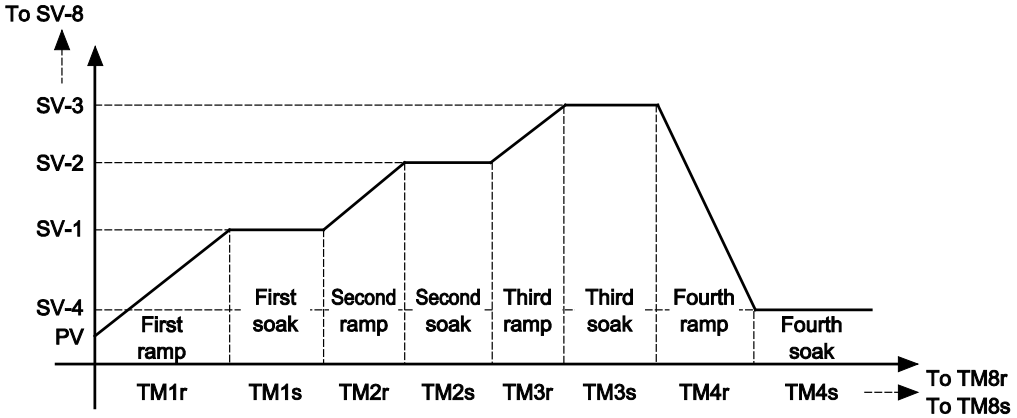
Example of Setting to Create a Program for Raising Temperature

The BELPREP VAC II（041-00000-0-1、041-00000-0-2）is available to create a program for raising the temperature and making settings according to the program. The following section describes an example of temperature control.

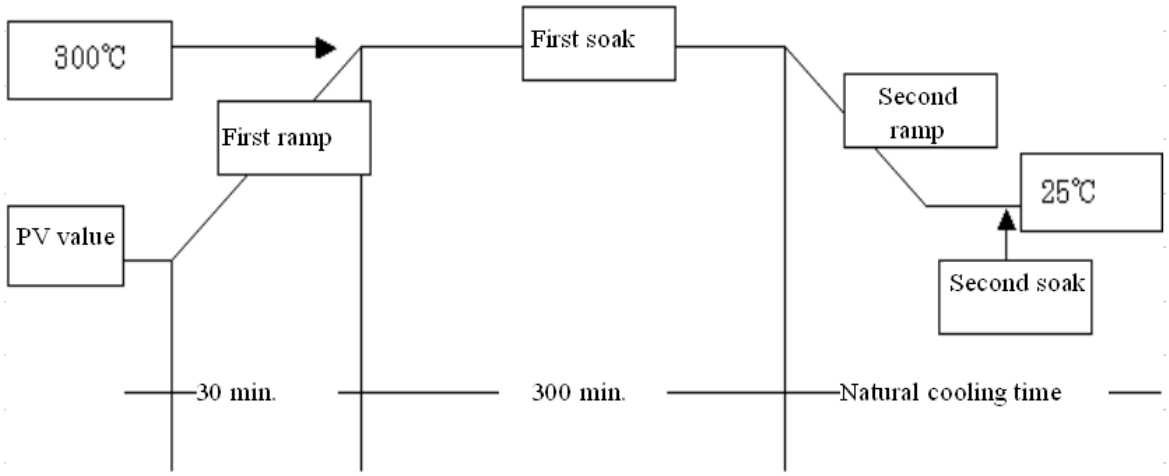
- This function automatically changes the time and the setting value (SV) according to the pattern that has been set in advance.
  Up to eight ramp and soak programs can be set.
- The first ramp starts from the measured value (PV) directly before the program is executed.

Ramp: A segment in which the setting value is changed to bring it toward the target value

Soak: A segment in which the setting value does not change from the target value.



The following section describes an example of temperature control.



Setting for raising the temperature and lowering the temperature

Set the pretreatment temperature, temperature raising time, and heating time first.

1 The setting of the target temperature (first ramp temperature)

Keep pressing the SEL key (for approximately 5 seconds / 2nd block of parameters) to display "ProG".

Press the ∨ key to display "Su - 1".

Press the SEL key to set the target temperature to "300", and then press the SEL key.

2 The setting of temperature raising time (first ramp time)

Press the ∨ key once to display "rn1r".

Subsequently, press the SEL key to set the temperature raising time to "0.30", and then press the SEL key.

3 The setting of heating time (first soak time)

Press the ∨ key once to display "rn15".

Subsequently, press the SEL key to set the holding time to "5.00" and then press the SEL key.

Then, make a setting to return the temperature to room temperature after the pretreatment.

4 The setting of the target temperature (second ramp temperature)

Press the ∨ key to display "Su - 2".

Press the SEL key to set the target temperature to "25", and then press the SEL key.

5 The setting of temperature lowering time (second ramp time)

Press the ∨ key once to display "rn2r".

Press the SEL key to set the temperature lowering time to "0.01", and then press the SEL key.

6 Setting of holding time (second soak time)

Press the ∨ key once to display "rn25".

Press the SEL key to set the holding time to "0.01", and then press the SEL key.

- The temperature controller exits temperature control while holding the last set temperature. Make this setting so that the temperature will finally return to room temperature without fail.
- Set all subsequent parameters ("Su - 3" to "Su - 8", "rn3r" to "rn8r", and "rn35" to "rn85") to "0".

Procedure for starting temperature control

1 Keep pressing the SEL key (for approximately 3 seconds / 1st block of parameters) to display " P".

2 Subsequently, press the SEL key again, and then press the ∨ key to display " rUn".

3 At this time, if C1 of the temperature controller blinks, the temperature controller has already started the temperature control.

Procedure for exiting temperature control

Even if the temperature controller exits temperature control, it holds the last set temperature (25°C in this case). Consequently, finish the ramp soak sequence according to the following procedure.

1 Keep pressing the SEL key (for approximately 1 second / 1st block of parameters) to display "ProG".

2 Press the SEL key once. Press the ∧ or ∨ key to display " oFF".

- If the program is terminated or no program has been set, " End" is displayed.
- In the " End"state, the heater cannot be controlled. To use it again, go back to step 3 and select " oFF".

3 Press the SEL key once. The ramp soak sequence will be finished.

4 "ProG" will be displayed. C1 will turn off.

5 Turn off the heater switch. The heating will be finished.

PID Control

AT Auto Tuning

- This function automatically determines the proportional band, integral time, and derivative time parameters for temperature control.
  The parameter values are determined according to the current set temperature.
- If the power is turned off during auto-tuning, auto-tuning will be disabled, and the proportional band, integral time, and derivative time parameters will not be changed.
  To restart auto-tuning, set this parameter to "1" or "2" again.
- To cancel auto-tuning, set this parameter to "0" auto-tuning will stop. In this situation, the proportional band, integral time, and derivative time parameters will not be changed.
- If auto-tuning is used to automatically set the proportional band, integral time, and derivative time values once, they will be recorded within the device, so there is no need to perform auto-tuning again even if the power is turned off.
- Set this parameter to "1" or "2" to start auto-tuning. After auto-tuning is finished, the value automatically becomes "0".
- During auto-tuning, the decimal point in the one digit of the SV display blinks.
- The two types of auto-tuning shown below are available.
  Setting code "1": SV standard (on/off operation using SV as the reference)
  Setting code "2": Low PV (on/off operation using SV − 10%FS as the reference)

- On/off control is performed during auto-tuning, so SV overshooting may occur. To suppress overshooting, perform low PV auto-tuning with setting code "2".

- With auto-tuning, the control state and the steady state are both possible immediately after the operation starts.
- Set the [HEAT] button to ON to perform adjustments while applying heat.

- Overshooting can be suppressed by calculating the proportional band, integral time, and derivative time parameters with auto-tuning at the set temperature.

P Proportional Band

- To switch to on/off control (two-position control), set the proportional band setting value to "0.0"
  You do not have to set the integral time and derivative time.
- This parameter can be set automatically with auto-tuning.
- Generally speaking, setting the proportional band too small makes control unstable.
  On the other hand, setting it too large makes the response slow.
- If you perform auto-tuning after setting the on/off control, the on/off control will be disabled. So, do not perform auto-tuning if you want to use on/off control.

I Integral Time

- This parameter can be set automatically with auto-tuning.
- If you set the integral time setting value to "0", the integral operation will not be performed.
- If the proportional band setting value is "0.0", the integral time setting is disabled.

d Derivative Time

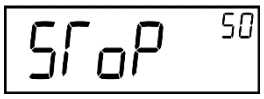
- This parameter can be set automatically with auto-tuning.
- If you set the derivative time setting the value to "0", the derivative operation will not be performed.
- If the proportional band setting value is "0.0", the derivative time setting is disabled.

Model 041-00001-0-1 and 041-00001-0-2

Main Operation

RUN / STOP Transfer

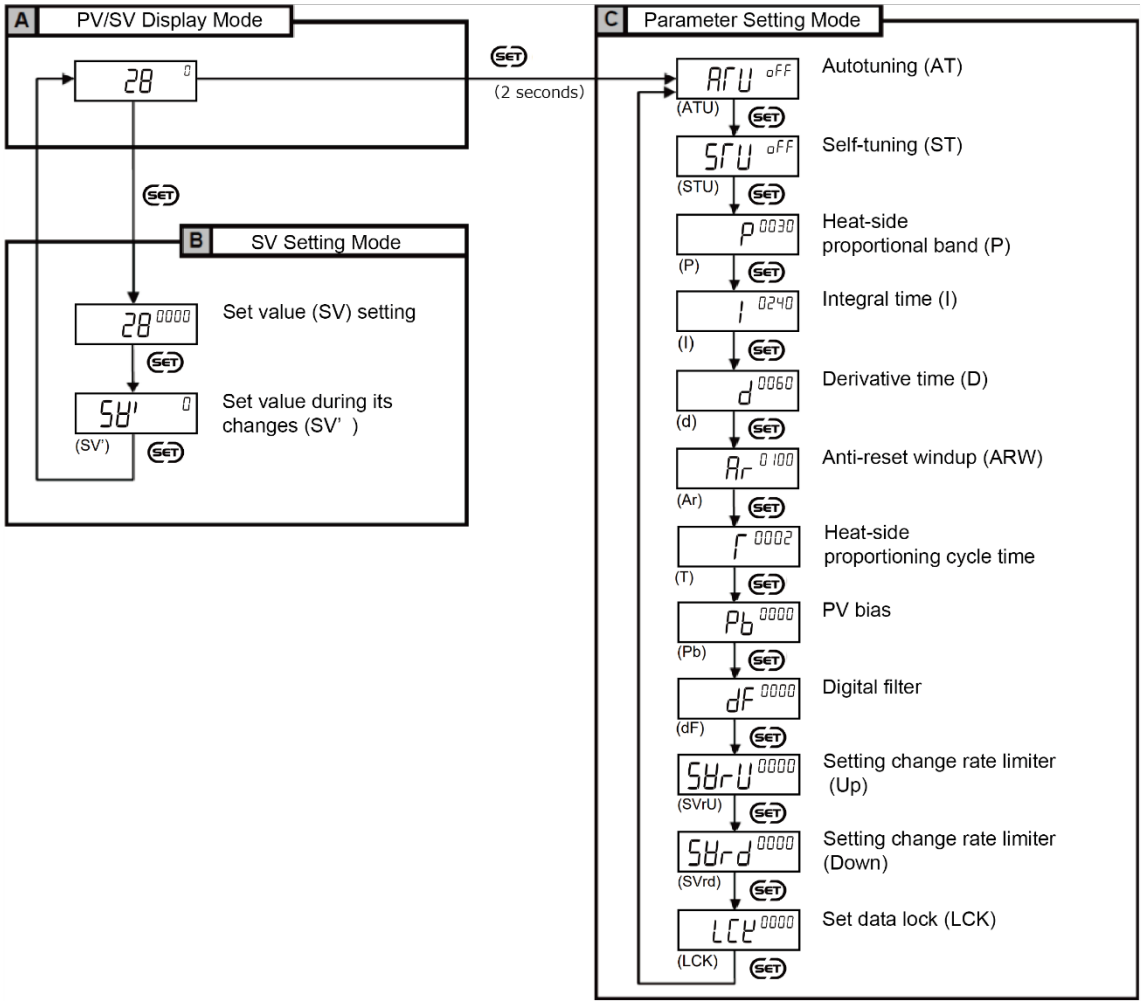
1 In the PV/SV display mode, hold down the R/S key for about a second; the control stops temporarily.



2 Hold down the R/S key for about 1 second to go back to the PV/SV display mode.

Switching Between Modes

0The temperature controller has three different modes. Modes can be switched through the key operation of the SET key.



Changing Temperature Setting Values

1 In the PV/SV display mode, press the SET key to switch to the SV setting mode.

2 Press ▽ | △ key to change the setting value. Use △ key to increase the current setting value, whereas use ▽ key to decrease it. Press the R/S key shifts digits when settings are changed.

3 Press the SET key to register the set value.

Changing Parameter Values

1 In the PV/SV display mode, hold down the SET key for about 2 seconds to switch to the parameter setting mode.

2 Press the SET key to select the parameter to set.

3 Press ▽ | △ key to change the setting value. Use △ key to increase the current setting value, whereas use ▽ key to decrease it. Press the R/S key shifts digits when settings are changed.

4 Press the SET key to register the set value.

5 In the parameter setting mode, hold down the SET key for about 2 seconds to go back to the PV/SV display mode.

Setting for temperature raising or lowering the rate

The BELPREP VAC II is available to set the temperature raising or lowering rate. The following section describes how to set the temperature raising rate and heating.

Procedure for starting temperature control when setting the temperature raising rate

1. Hold down the R/S key for approximately a second to display the 「StoP」.
2. Hold down the SET key for approximately 2 seconds to display the 「ArU」.
3. Press the SET key to display the 「SUrU」 and set the desired temperature raising rate. The unit of setting is °C/min.
4. Hold down the SET key for approximately a second to display the 「StoP」.
5. Press the heater switch and hold down the R/S key for approximately a second to start the temperature control.

Procedure for exiting temperature control

After the desired pretreatment time has elapsed, turn off the heater switch to finish heating.

Parameters

Function and symbol	Description	Setting range (*: factory default setting)
Auto tuning AT U	Use this parameter when setting the P, I, and D constants with auto-tuning. After auto-tuning is finished, the setting value automatically becomes "oFF".	oFF: Stop * on: Auto-tuning Start
Self-tuning ST U	Self-tuning is a function that determines control disturbances and automatically calculates and sets appropriate PID constants. • Use with self-tuning turned off. Operating the heater switch may cause improper values to be calculated	oFF: Self-tuning OFF * on: Self-tuning ON
Heat-side proportional band P	To switch to on/off control (two-position control), set this to "0.0". This parameter can be set to a value within the input range.	0～430.0 *: 30.0
Integral time I		0～3600 seconds *: 240
Derivative time d		0～3600 seconds *: 60
Anti-reset windup Ar	This function limits the effective range of the integral action with respect to the range of the heat-side proportional band (P).	0～100%（0: Integral Operation OFF） *: 100
Heat-side proportioning cycle time T	Control cycle for heating.	1～100 seconds *: 2
PV bias Pb	Adds a correction to the measured value (PV).	-199.9～999.9 ℃ *: 0.0

Function and symbol	Description	Setting range (*: factory default setting)
Digital filter dF	The filter at a set time can reduce fluctuations in the measured value (PV).	0～100 seconds（0: Function OFF） *: 0
Setting change rate limiter (Up) SbrU	The temperature raising rate to the set value (SV) can be set.	0.0～999.9 °C /minutes *: 0.0
Setting change rate limiter (Down) Sbrd	The temperature lowering rate to the set value (SV) can be set.	0.0～999.9 °C /minutes *: 0.0
Set data lock LCY	Restrict display functions. • Do not change the settings.	*: 0010

PID Control

ATU Auto tuning

- This function automatically determines the proportional band, integral time, and derivative time parameters for temperature control.
- The parameter values are determined according to the current set temperature.
- If the power is turned off during auto-tuning, auto-tuning will be disabled, and the proportional band, integral time, and derivative time parameters will not be changed.
- To restart auto-tuning, set this parameter to "on" again.
- To cancel auto-tuning, set this parameter to "oFF" auto-tuning will stop. In this situation, the proportional band, integral time, and derivative time parameters will not be changed.
- If auto-tuning is used to automatically set the proportional band, integral time, and derivative time values once, they will be recorded within the device, so there is no need to perform auto-tuning again even if the power is turned off.
- Set this parameter to "on" to start auto-tuning. After auto-tuning is finished, the value automatically becomes "oFF".
- During auto-tuning, the AT lamp blinks.
- Auto-tuning can be performed immediately after the start of the operation, in the control state or in the stable state.
- Turn on the [HEAT] button ON and adjust it while heating.

• Overshooting can be suppressed by calculating the proportional band / integral time / derivative time at

the set temperature by auto-tuning.

P Heat-side proportional band

- To switch to on/off control (two-position control), set the proportional band setting value to "0.0". You do not have to set the integral time and derivative time.
- This parameter can be set automatically with auto-tuning.
- Generally speaking, setting the proportional band too small makes control unstable. On the other hand, setting it too large makes the response slow.
- If you perform auto-tuning after setting the on/off control, the on/off control will be disabled. So, do not perform auto-tuning if you want to use on/off control.

I Integral time

Ar Anti-reset windup

- This parameter can be set automatically with auto-tuning.
- If you set the integral time or anti-reset windup setting value to "0", the integral operation will not be performed.
- If the heat-side proportional band setting value is "0.0", the integral time setting is disabled.
- The anti-reset windup setting limits the effective range of integral operation to suppress overshooting or undershooting due to integral operation.

d Derivative time

- This parameter can be set automatically with auto-tuning.
- If you set the derivative time setting the value to "0", the derivative operation will not be performed.
- If the proportional band setting value is "0.0", the derivative time setting is disabled.

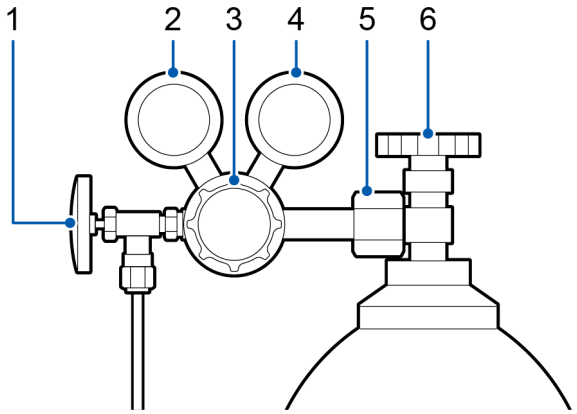
Daily Inspection

To perform accurate measurements, carry out daily inspections each day before starting measurement.

Inspection location	Inspection details
When turning on the power	・Check that the power lamp is lit. ・Check whether the vacuum pump operates normally. ・Check that the rotary pump's exhaust noise becomes quiet within 1 to 2 minutes after the power turns on. When a vent line or oil mist trap is connected, the amount that the exhaust noise changes become small. ・If you detect an error, turn off the device immediately, and then remove the power cable from the electrical outlet.
Rotary pump	・Perform appropriate maintenance on the rotary pump according to its user's manual. ・If you detect an abnormal sound or smoke, turn off the main unit immediately, and then remove the power cable from the electrical outlet. ・Properly handle the exhaust port of the rotary pump, such as by connecting it to an exhaust duct. ・The rotary pump is a consumable product. Periodically replace its oil and its parts.
Power cable	・Check the power cable for deterioration and check whether these cables are connected to the device and the PC correctly. ・If you detect an error, turn off the main unit immediately and then handle the issue in an appropriate manner, such as by replacing the power cable.
Main unit cleaning	・If the surface of the main unit is covered in dust or grime, wipe it clean with a piece of dry, soft cloth such as an eyeglass cleaning cloth.

Replacing the Gas Cylinder

Replace the cylinder when the purge gas cylinder pressure falls to 1 MPa or less.



1	Stop valve
2	Secondary pressure
3	Regulator valve
4	Primary pressure
5	Regulator connection section
6	Main valve

Exhausting the Purge Gas in the Piping

1. Close the gas cylinder main valve by turning it clockwise.
2. Turn on the main unit's power.
3. Open the sample cell port, turn on the purge switch, and then exhaust the purge gas in the piping.
4. Turn off the main unit's power.

Replacing the Purge Gas Cylinder

1. Close the regulator valve by turning it counterclockwise.
   - The regulator valve closes by turning counterclockwise to loosen it.
2. Close the stop valve by turning it clockwise.
3. Remove the connection section between the gas cylinder and the regulator.
4. Connect a new gas cylinder and a new regulator.
   - Replace the gasket with a new one when it is damaged.

Adjusting the Gas Pressure

1. Open the cylinder main valve, and then close it again 2 to 3 seconds later.
2. Verify that the primary pressure does not fall for several minutes.
   - When the primary pressure decreases, it may possibly be due to leakage from the connection section between the cylinder and the regulator. Reconnect them so that there is no leakage.
3. If there is no leakage, adjust the gas pressure by turning the regulator valve slowly clockwise. Adjust the pressure so that the secondary pressure is 0.1 MPa (G).
   - Do not apply pressure higher than 0.2 MPa (G); otherwise, it may damage a valve or a flow meter.
4. Open the stop valve by turning it counterclockwise. Open the cylinder main valve, and then close it again 2 to 3 seconds later.
5. Verify that the primary pressure does not fall for several minutes.
   - When the primary pressure decreases, it may possibly be due to leakage from the connection section between the cylinder and the regulator. Reconnect them so that there is no leakage.
6. If there is no leakage, open the cylinder's main valve.

Replacing the Fuse

⚠ WARNING

Before replacing the fuse, be sure to first disconnect the power cable.
Performing this work without disconnecting the power cable may lead to an electric shock.

⚠ CAUTION

If the fuse is blown, eliminate the cause and then replace the fuse.
If you replace the fuse without eliminating the cause, the device may be damaged.

1 Push the cover of the fuse holder on the back of the instrument and then turn it counterclockwise.

2 Remove the fuse from the fuse holder cover that has been removed, and replace it with a new fuse.

- Use a fuse with the correct specifications.

3 Reinstall the cover on the fuse holder.
When installing the cover on the fuse holder, push the cover toward the bottom and then turn it clockwise.

When a Problem Occurs

According to the problem symptoms, check the locations listed below.

- If you cannot find any problems in the location to check, if the problem symptoms are not fixed even after you make the improvements listed here, or if other problem symptoms occur, contact MicrotracBEL.

Problem symptom	Location to check
The vacuum degree does not rise.	・Make sure the tube used to mount the sample pipe is properly connected to the equipment. ・Make sure the sample pipe is properly connected. ・Make sure the Rotary pump switch turns ON. ・Make sure the rubber vacuum tube is properly connected. ・Make sure the port valve is closed. ・Make sure the exhaust rate control knob is open.
Gas does not flow.	・Check if the cylinder is empty. If the cylinder is empty, replace it. ・Check for the valve. If the valve is closed, make adjustments to the gas pressure. ・Check if the gas distribution tube is clogged with something. ・Make sure the purge gas flow control knob is open.
Heating is not initiated, or temperature drops during heating.	・If the heater switch lamp located on the front of the equipment turns ON during heating, heating will be discontinued. The equipment may have caused the following trouble depending on the manner in which the switch lamp turns ON. In this case, contact us. Blinking at intervals of 0.5 sec.: Activation of the overheating temperature detection function (When heater temperature drops, the switch lamp will stop blinking.) ON: Broken wire in the overheating temperature detection thermocouple
The Vacuum degree indication LED blinks to disable heating.	・The revolutions of the cooling fan located on the side of the equipment have dropped. If there are any foreign matters in the cooling fan, remove them, and then turn ON the power supply again. If not, the cooling fan may have caused trouble. In this case, contact us.
Temperature does not become stable.	・Conduct auto-tuning at the set temperature to update the PID value.

When a Safety Mechanism Activates

This product is equipped with safety mechanisms. When a safety mechanism activates, this main unit handles the issue automatically. After you eliminate the cause, restore the main unit.

- If the safety mechanism is activated again or you sense the symptom of any abnormality even after resetting the system, please contact us.

Safety mechanism	Automatic handling	Restoration method
Detection of abnormal pressure in the system (Check valve)	If the pressure in the system exceeds 20 kPa (G), the check valve will be activated to ensure safety, releasing excess pressure to open air.	Since the check valve closes when the pressure reduces, continue operating the system.
Overheat prevention function 1	If the overheat sensor exceeds a given temperature (i.e., 430°C), the temperature controller will detect an abnormality to stop the heating operation, and the heater switch lamp will blink at intervals of 0.5 seconds.	Cool the temperature device. After that, turn off the power breaker on the main unit - back once, and then turn it on again. The system will be reset.
Overheat prevention function 2 (Detection of a broken wire in the overheating sensor)	If any wire in the overheating sensor is broken, the heating operation will stop, and the heater switch lamp will turn on.	Please contact us.
Mechanism of preventing temperature rise in the system (Fan revolutions)	In order to prevent abnormal temperature rise in the system, if the cooling fan revolutions fall below the specified value, all LEDs of the vacuum indicator will turn on.	Make sure that the cooling fan is not clogged. If it is clogged, remove the causes, and turn off the power breaker once, and then turn it on again. The fan will be reset. If the fan is not still reset, please contact us.

Moving/Disposing

Moving

Before moving the main unit or optional equipment, be sure to consult with MicrotracBEL.

Disposing

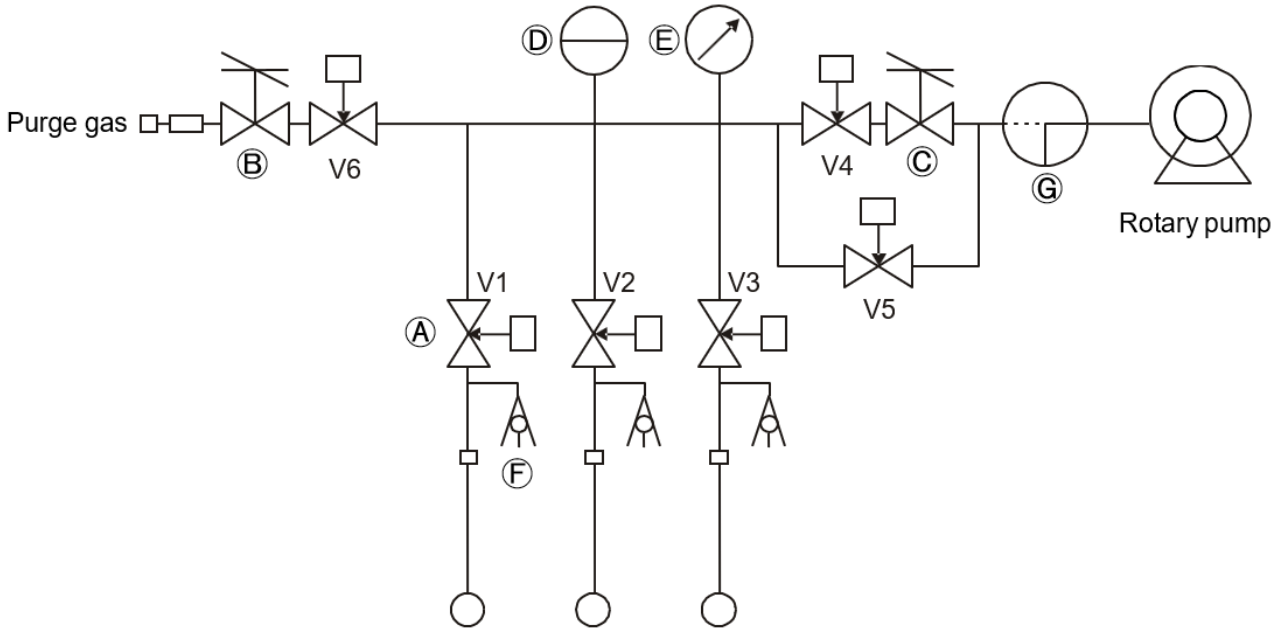
Dispose of this device and optional equipment as industrial waste in an appropriate manner in accordance with the regulations of your local government. Also, contact MicrotracBEL to notify us that you have disposed of the main unit.

SPECIFICATIONS

Main Unit

Model		041-00000-0-1	041-00000-0-2	041-00001-0-0	041-00001-0-2
Pretreatment		・Pressure-reducing and heating method ・Flow heating method (option)			
Ultimate vacuum		About 2 Pa			
Gases used		・N_2 ・Other inert gases • It is recommended to use nitrogen gas. When using another type of gas, the vacuum indicator may not show the correct pressure value.			
Number of treatment ports		3 ports			
Temperature range		Room temperature to 430 °C			
Temperature control accuracy		±5°C			
Temperature control system		PID control using a temperature controller			
Control mode		・Fixed value Mode ・Fixed value Mode + Ramp setting		・Fixed value Mode ・Programmed Mode (8 ramp and soak programs)	
Utility		・Inert gas 0.08 to 0.12 MPa(G) (1/8" swage lock connector) ・Rotary pump (Vacuum rubber tube connection port, ID 9 mm)			
Dimension and weight		W 321 x H 157.5 x D 397.5 mm, 15 kg			
Power supply	Rated voltage (allowance range)	AC 110 V (±10 %)	AC 220 V (±10 %)	AC 110 V (±10 %)	AC 220 V (±10 %)
	Rated current	10 A (including rotary pump)			
	Frequency	50/60 Hz			
	Service outlet for rotary pump	600 W			
	Power consumption	400 W (for the main unit only)			
	Appliance class	Class I			
Installation environment	Temperature	10 to 35 °C			
	Humidity	20 to 80 % (no condensation)			
	Altitude	2,000 m max.			
	Installation category	Category II			
	Pollution level	Pollution level 2 (must be used indoors)			

Flow Diagram



Ⓐ	**Stop valve (V1 to V3)**	These valves open and close the corresponding sample cell line. Use the port valve switch on the main unit - front to operate the valve.
Ⓑ	**Needle valve for adjusting the purge gas flow rate**	This needle valve is for adjusting the purge gas flow rate. Adjust the purge gas flow rate using the purge gas flow rate adjustment knob on the main unit - back.
Ⓒ	**Needle valve for adjusting the vacuuming rate**	This needle valve is for adjusting the vacuuming rate while the vacuuming speed indication lamp indicates “SLOW VAC”. Adjust the vacuuming rate using the vacuuming rate adjustment knob.
Ⓓ	**Diaphragm pressure gauge**	This detects the pressure at purging and closes V6 to stop purging when the pressure exceeds atmospheric pressure (2 kPa).
Ⓔ	**Pirani pressure sensor**	This measures the vacuum in a system. By pressing the vacuum switch, V4 opens to vacuum slowly (with SLOW VAC). When the system pressure falls to the Pirani pressure switch setting value, V5 opens to vacuum rapidly (with FAST VAC).
Ⓕ	**Check valve**	This is for safety when the sample cell pressure rises. To ensure safety, excess pressure is released to open air when the pressure exceeds 20 kPa.
Ⓖ	**Vent valve**	This is a 3-way valve with a line to a system and a line for a vent. In order to prevent the rotary pump oil from going up, it is vented to open air when the unit power is shut off.

To order consumable products and to request servicing, contact the following offices.

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