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EYELA

Vacuum Controller for Condensation Units

NVC-3000

Instruction Manual

This instruction manual is designed to use the product safely with keeping its best performance.

IMPORTANT Be sure to read “Safety precautions” before use.

Please keep this manual in a place easily accessible to every users.

Tokyo Rikakikai Co., Ltd.

IMPORTANT SAFETY INFORMATION

1. Warning signal word

Attempting to carelessly operate the product or to touch the portion not-specified may result in unexpected injury. Improper installation of the product or wrong connection of pipes may prevent from performing its functions or may cause a malfunction.

Most of such accidents can be prevented if such danger is known beforehand.

To ensure the safety, this manual defines the information on such matters as requiring particular care in the safety as follows in terms of the importance and risk and attaches the alert mark and signal word.

It is recommended to follow the instruction to ensure the safe use of the product.

Alert mark Signal word	Definition
Warning	Wrong handling is assumed to cause the possibility of the death or heavy injury of the user.
Caution	Wrong handling is assumed to cause the risk of injury of the operator or physical damages.

We have undertaken thorough verification concerning the possible occurrence of risk in the course of use of the product, but prediction of all and every kind of risk is extremely difficult. Namely, cautions contained in this manual are not necessarily all of possible risks.

However, if the product is operated according to the procedure described in this manual, the safe operation and work is ensured. Be sure to pay utmost care during handling of the product to prevent accident or failure of the product.

Thank you for purchasing our EYELA product.

Introduction

This instruction manual explains installation, operation, troubleshooting, maintenance and inspection, and discarding procedures for the Vacuum Controller for Condensation Units :Model NVC-3000

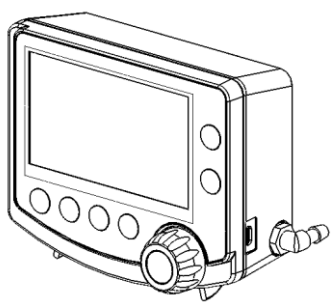
Always read this manual before use to ensure familiarization of the product.

Contents

Details of packaged items

Be sure to check the type and quantity of parts before attempting to set them.

1	Vacuum Controller NVC-3000	1
2	Instruction Manual	1



Optional items listed below are necessary to use this product according to the specific use objectives:

- PBX type diaphragm pump control box
- Decompression unit
- CV-11 CV-12 solenoid valve for NVC control
- Communication cable and connection cable
- Securing clamp and vacuum hose
- Couplers to enable connection to devices
- DC adaptor for NVC3000

1 For safe operation

Take extreme care for safety because this product is not of the explosion-proof structure.

WARNING	Never install in a dangerous atmosphere. This product is not explosion-proof. Using this product in a dangerous atmosphere may result in a fire.
CAUTION	Follow the instructions to connect pipes. Wrong connection of pipes may prevent correct operation of the unit as well as a malfunction or an unexpected accident.

2 Product overview

2-1 Application

Warning

Never attempt to modify the product. Operate the unit for the specified purpose only.

An electric shock or a malfunction may result if the product is modified or used for any purposes other than that specified.

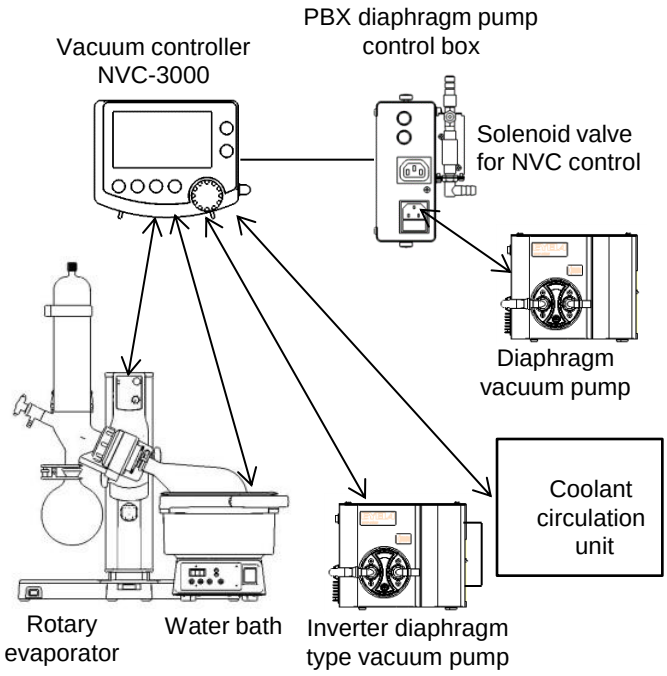
This product is designed to control a vacuum level of a decompression condensation unit by controlling a diaphragm type vacuum pump.
This product has a communication function and can operate interlocked with different units by connecting to a rotary evaporator, a water bath, a diaphragm vacuum pump or a coolant circulation unit equipped with a communication terminal with a communication cable.

* A communication cable and other parts used for connection are sold separately.

※Note that this product is for gas only. Do not flow liquid or solid through the product.

※Control solenoids and pressure sensors are consumable parts.

The pressure sensor is contained in the main body and requires adjustment work for its replacement. Ask your dealer or the nearest service center for replacement.



* Although the product employs anti-corrosion parts, it does not support all types of solvents.

The control solenoid or the pressure sensor may deteriorate depending on the solvent used or operating conditions and control of the product might become impossible.

When such situation may occur, a solvent collector such as a cooling trap will be necessary between the decompression container and the vacuum controller.

2-2 Specification

Product name			Vacuum controller
Model			NVC-3000
Performance	Pressure measurement range		0～1066hPa(mbar)　(0～800mmHg)
	Pressure measurement range	Manual control (fixed-value control)	VAC, 1～1013hPa(mbar)　(VAC, 1～760mmHg)
		Auto control (automatic control)	Automatic control of pressure at a level appropriate for the sample and automatic fixed-pressure control
		Program control (gradient control)	Typical 55 types of solvents are preset 10 solvents available for the user to register
		Step program control	【Fixed-value control】VAC, 1～1013hPa(mbar), Atmo　(VAC, 1～760mmHg, Atmo) 【Gradient contro】1～1013hPa(mbar)　(1～760mmHg)
	Switching pressure units		hPa、kPa、mbar、mmHg、Torr
	Hysteresis setting range *1	Fixed-value control	Automatic (2%) or 1 ～ 20hPa(mbar)　(1 ～ 15mmHg)
		Gradient control	Automatic (2%) or 1 ～ 20%　※2
	Vapor temperature measurement range		0 ～ 150℃(when an optional sensor is connected)
	Time setting range		【Automatic stop time】OFF, 1 ～ 999min 【Gradient control】1 ～ 999min 【Step program control】0 ～ 999min
	Pressure control mode		Four types: fixed-value control, auto control, solvent program control, step program control (20 steps, 2 programs)
Function	Setting		Input on the sheet key, dial system
	Indicated items		Operation mode, measured pressure, pressure setting, vapor temperature (when an optional sensor is connected), elapsed operation time, operation status
	Automatic leak function		Automatic leak at the end of control: ON-OFF selectable
	Cleaning function		Automatic cleaning at the end of operation (Operation time: 1 ～ 10min setting): ON-OFF selectable Manual cleaning：Press the leak key longer (approx.: 3 seconds)
	Hold function		Hold at any vacuum during decompression or gradient control
	Evaporator link function		Available by combining with the models N-1300, N-1210 and N-2110
	Water bath interlocked function		Possible by combining with models SB-1300 or OSB-2200
	Coolant circulation unit interlock function		Possible by combining with models CA-1116A, CA-1330, or CCA-1112A
	NVC mutual communication function		Possible by combining with model NVC-3000
	Diaphragm pump control system		Inverter diaphragm type vacuum pump：PID control Diaphragm type vacuum pump：ON/OFF control
Configuration	Pressure sensor		Diffusional semiconductor pressure transducer , material of the liquid contacting part：SUS316L
	Solenoid valve for leak		Orifice diameter: φ1.6mm
	Material of pipes and couplers		PP, PTFE
Standard	Leak nozzle diameter		φ10mm
	Solenoid valve for control (optional)※3	Model CV-11	Nozzle diameter: φ10mm, orifice diameter: φ1.6　Material of liquid contacting part of solenoid valve：PVDF,FFKM
		Model CV-12	Nozzle diameter: φ13mm,orifice diameter:φ3.2　Material of liquid contacting part of solenoid valve：PPS,PTFE
	Connecting pump (optional)		○Inverter diaphragm type vacuum pump Model NVP-1000V,NVP-2000V,NVP-2100V DTC-30DC ○Diaphragm type vacuum pump Model NVP-1000・2000・2100 Model EVP-1000・1100・1200 Model DTC-22・41, Model DTU-20, Model MD1C, Model N920

Product name	Vacuum controller
Model	NVC-3000
Operating ambient temperature range	5～35℃
Operating ambient humidity range	30～80%RH(no condensation)
External dimensions (W x D x H) mm * External dimensions in parentheses ( ) include protrusions.	138.7(150)×50(114.6)×114.2
Weight: kg	Approx. 670g
Power input, rated power supply	DC24V 375mA

Product name (Sold separately)	Diaphragm pump control box
Type	PBX
Standards	Pump output (outlet) MAX6A
Operating environmental temperature range	5～35℃
Operating environmental humidity range	30～80%RH(no condensation)
External dimensions (W×D×H) mm	63×63×148
Weight kg	Approx. 570g
Power input, rated power supply	100V～240V 1A（NVC-3000 is connected）

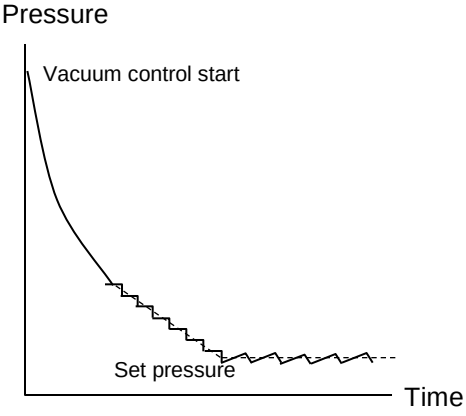
※1 Setting of the hysteresis (ΔP) is unnecessary when you use an inverter pump.

※2 Percentage of a target gradient pressure.

※3 CV-11 (For a condensation unit of 1 ～ 5 liters)
CV-12 （For a condensation unit of 5 ～ 10 liters）

2-3 Vacuum control (differences among pumps)

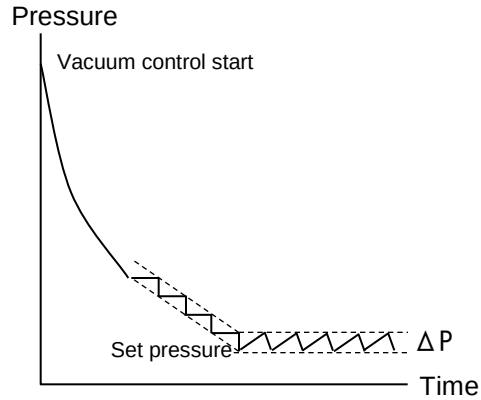
・When you use an inverter diaphragm type vacuum pump, connect it with the model NVC-3000 with a communication cable. Vacuum is controlled by continuously varying the number of rotations of the pump motor by using control signals for the model NVC-3000.
Vacuum level is controlled by increase the number of rotations immediately after starting vacuum control and decreasing the number of rotations at around the set pressure (stops below the lowest number of pump motor rotations).



・When you use a diaphragm type vacuum pump (constant rotation speed), vacuum is controlled by connecting the model NVC-3000, the diaphragm control box PBX, and the NVC control solenoid valves CV-11・12 models.
Model PBX receives control signals from NVC-3000 to control the vacuum level.

- ・Open/close the solenoid valve (vacuum line)
- ・Start/stop the pump motor

※1 You can set a hysteresis ΔP(Pressure control width by opening/closing the solenoid valve).



2-4 Pressure control mode

There are four types of functions below in the control mode.

MANUAL (fixed-value control) mode

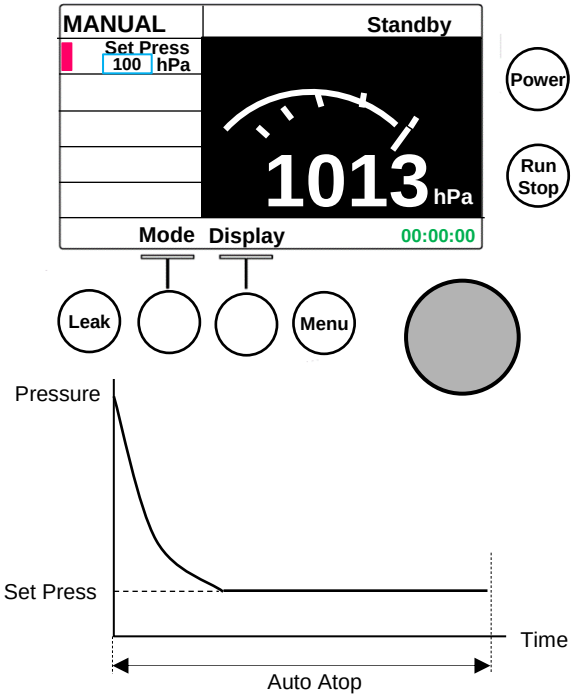
After operation is started, fixed-value control will start at the fixed pressure (Set Press).

The settable range for fixed pressure (Set Press) is between VAC (continuous decompression) and 1013hPa (760mmHg).

You can change the fixed pressure any time irrespective of whether the present mode is standby, decompressing or fixed-value control.

You can stop the unit automatically based on the operation time by setting an operation stop condition (Auto Stop).

You can stop operation of the unit automatically based on the margin of temperature increase (Stop Temp) from the vapor temperature by using a vapor temperature sensor (optional).



AUTO (Automatic Control) mode

There are two modes**:** **AUTO** mode and **AUTO-2** mode.

AUTO mode is an automatic operation mode that automatically controls pressure to prevent sudden boiling and automatically determines a pressure that enables a favorable collection rate and a condensation time at the same time (Mark Press) in order to perform the fixed-value control.

When an inverter pump is used, the Mark Press value will be adjusted automatically as necessary after fixed-value control has started.
You can stop the unit automatically based on the operation time by setting an operation stop condition (Auto Stop).

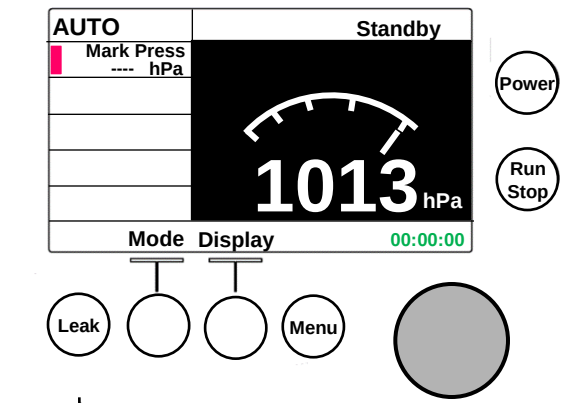
AUTO-2 mode uses a vapor temperature sensor (optional). In addition to the functions of the AUTO mode, the following functions are available:

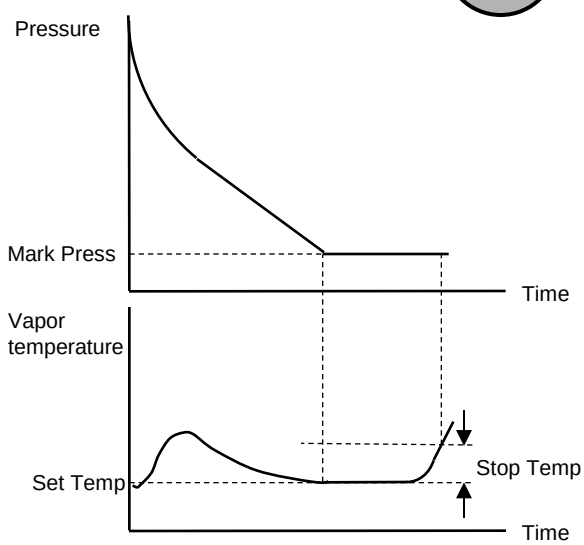
- Fixed-value control at the pressure (Mark Press) determined automatically appropriately to the vapor temperature (Set Temp).
- Automatic stop based on the margin of temperature increase (Stop Temp) from the vapor temperature (Set Temp).
- You can use mixed solvent by using an adjusted temperature (Adjust Temp) and the count of adjustment

※The unit has been set to be an optimal state at the room temperature of 25℃±3℃ and the cooling water temperature of 5 to 10℃ at the conditions below:

Solvent with low boiling point: Bath temperature 40℃
Solvent with high boiling point: Bath temperature 60℃

※Sudden boiling might be suppressed depending on the sample.
In such a case, take following measures in consideration: reducing samples, lowering the number of sample flasks, or lowering the bath temperature.



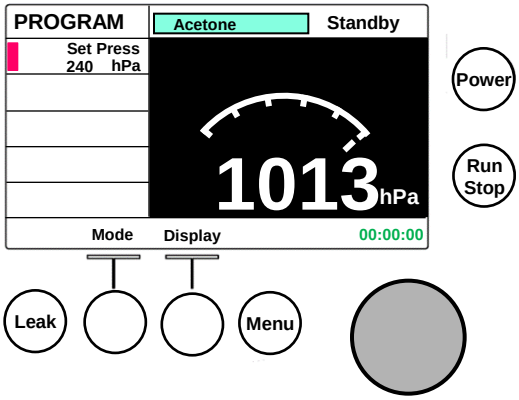


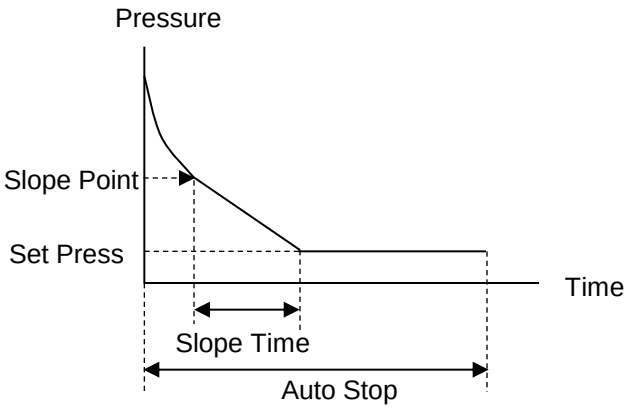
Program (Slope Control) mode

The product has a database of 65 solvents in total including 55 kinds of solvents including pre-registered 10 solvents (pre-registered solvents) and 10 user solvents which the user can freely set which allows the user to control vacuum appropriately according to the solvent used.
The registered solvents at the factory shipping are as follows:

2 : Acetone	(350hPa→240hPa : 3min)
7 : Benzene	(160hPa→ 90hPa : 2min)
13 : Chloroform	(380hPa→200hPa : 3min)
17 : 1,2-Dichloroethane	(180hPa→ 70hPa : 3min)
21 : Dichloromethane	(950hPa→480hPa : 3min)
26 : Diethyl ether	(800hPa→550hPa : 3min)
30 : Ethyl acetate	(266hPa→ 93hPa : 2min)
35 : Hexane	(280hPa→160hPa : 2min)
52 : Toluene	(90hPa→ 20hPa : 4min)
53 : 1,1,1-Trichloroethane	(340hPa→160hPa : 3min)

※ The setting has been selected to realize the optimal condition at the bath temperature of 40℃, the cooling water temperature between 5 and 10℃, and the room temperature of 25±3℃.





The unit controls a slope with a slope time (Slope Time) from the slope start pressure (Slope Point) to the fixed pressure (Set Press) and controls at a fixed value up to the fixed-pressure.

You can stop the unit automatically based on the operation time by setting an operation stop condition (Auto Stop).

You can stop the unit automatically based on the temperature increase margin from the vapor temperature by using a vapor temperature sensor (optional).

You can set a solvent name for user solvents up to 18 characters and symbols. Characters available are alphanumeric characters, space and symbols (,.-+*/()).

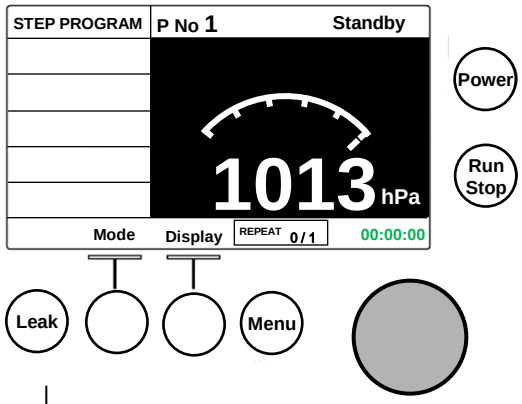
STEP PROGRAM(Step Program) mode

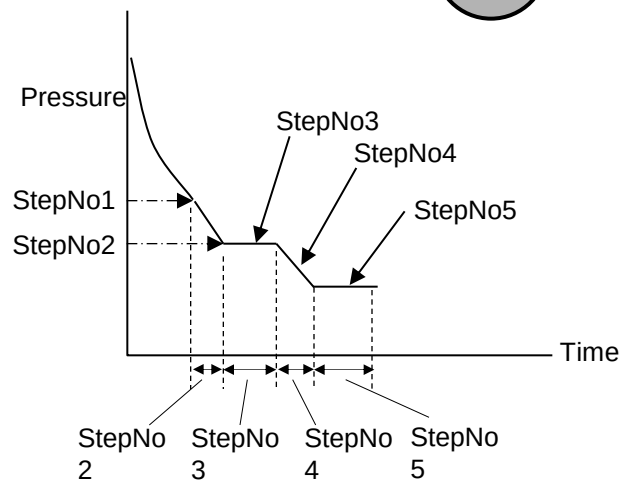
There are 5 programs up to 99 steps each
to be used as a programed vacuum controller which allows programming of fixed-value control, slope control and release to the atmosphere.

Control is made based on the set pressure (Press) and the step operation time (Time).

You can set the next item on the program operation setting screen.

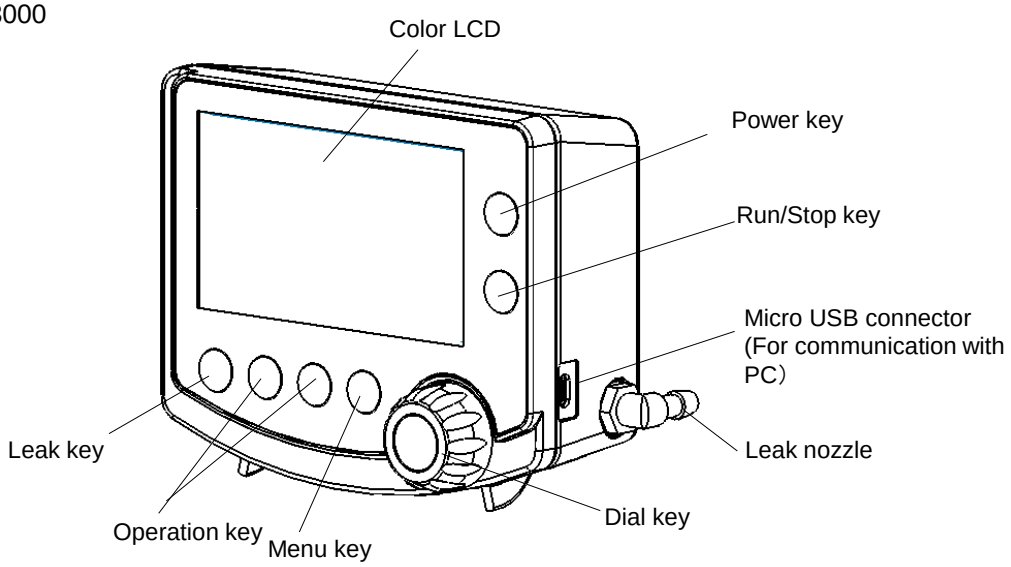
- Starting Step No（Start Step No）
- Finishing Step No（Finish Step No）
- Number of repetitions (Repeat)
- Automatic Leak (Auto Leak)
- Automatic cleaning(Auto Cleaning)
- Recovery from Power Failure (Power Fail)

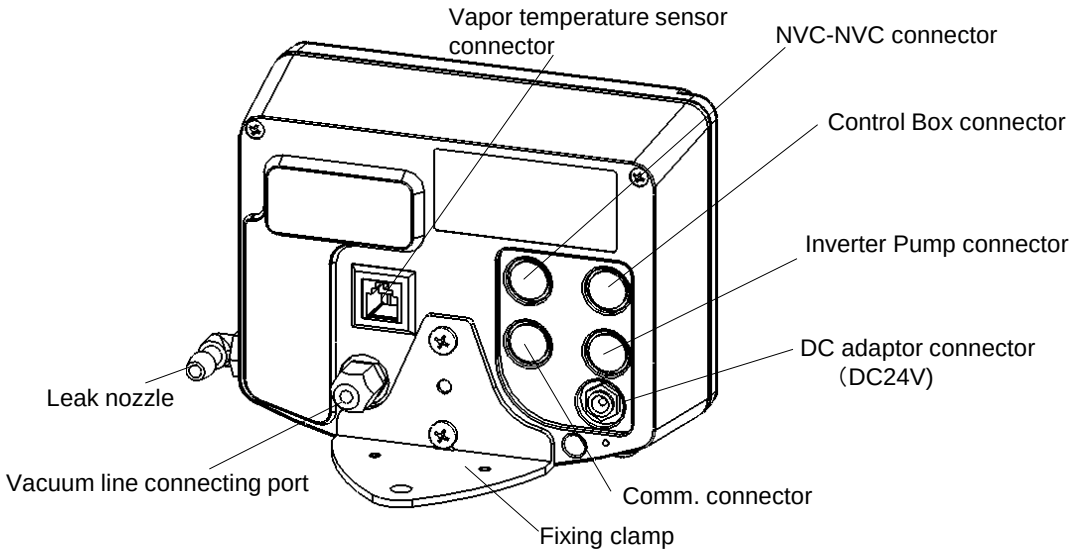




2-5 Names of parts

●Model NVC-3000

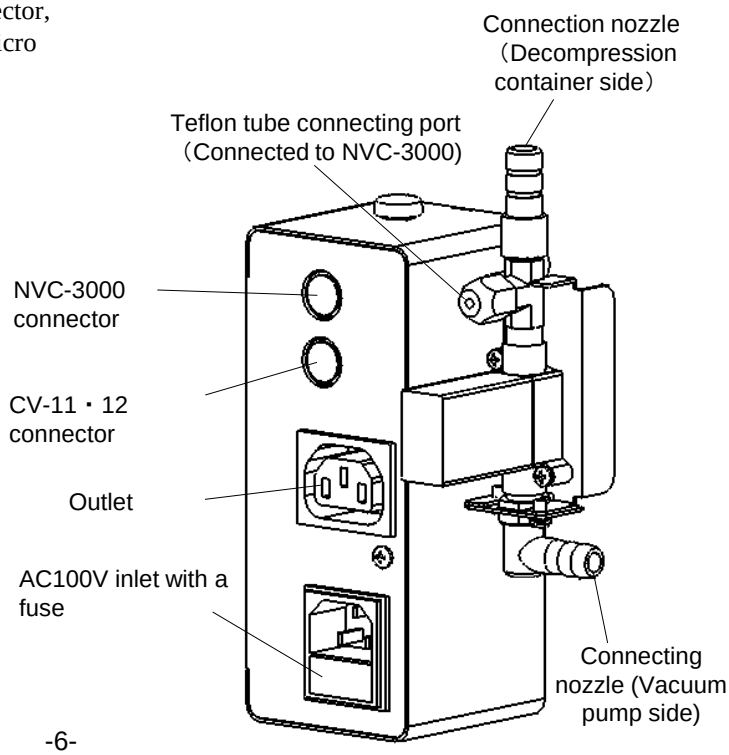




※ Communication connectors, DC adaptor connector, vapor temperature sensor connector and the micro USB connector have a protective cap. Remove the cap before connecting them.

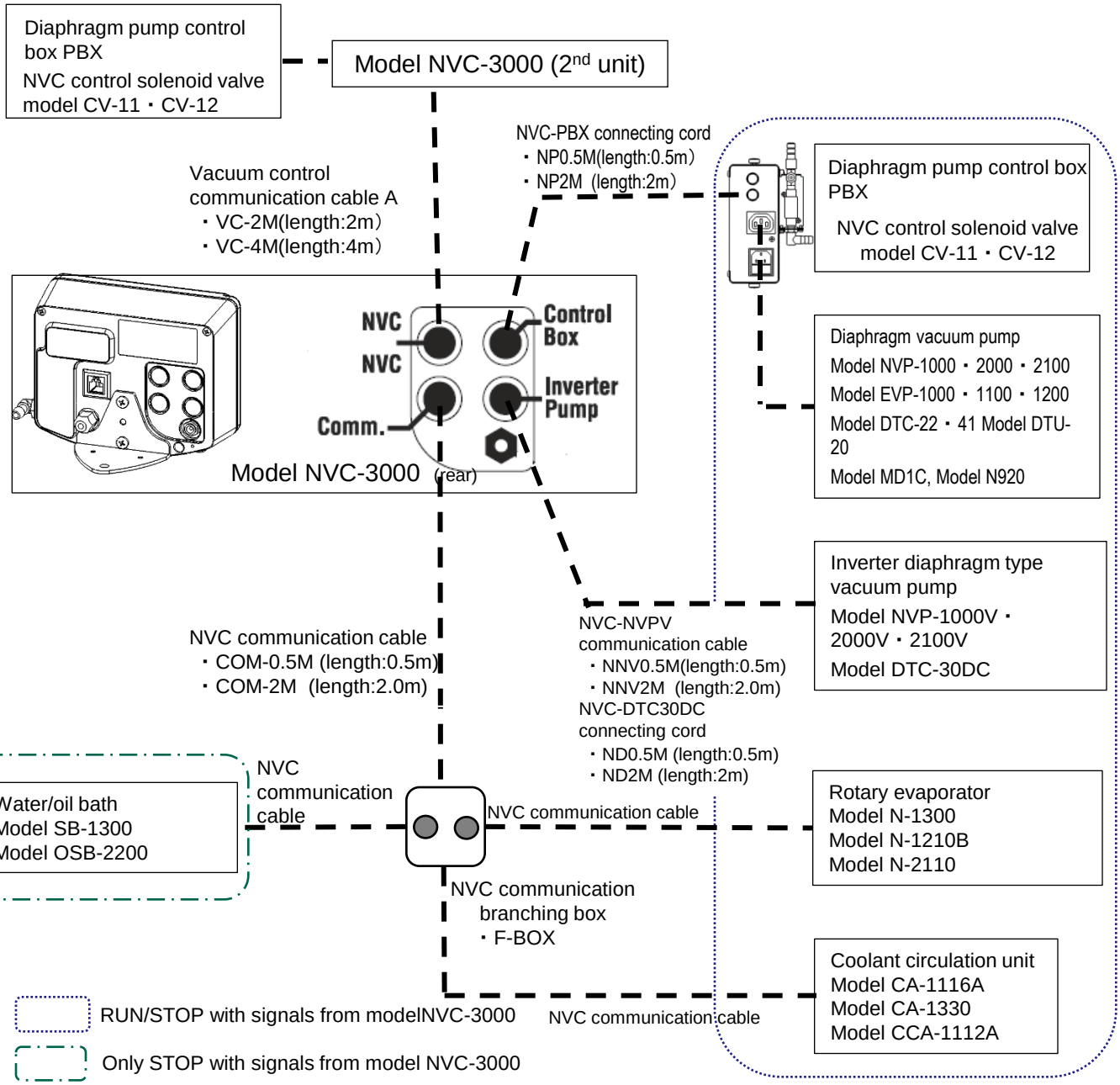
● Diaphragm pump control box
PBX(Optional)

● NVC control solenoid valve model
CV-11・12
(Optional)



2-6 Interlocking with related units

- The model NVC-3000 is interlocked with related units that are combined with communication optional parts for a communication function.
  See P.43～P.44 "Operation of related units connected with NVC communication" for operating procedures.

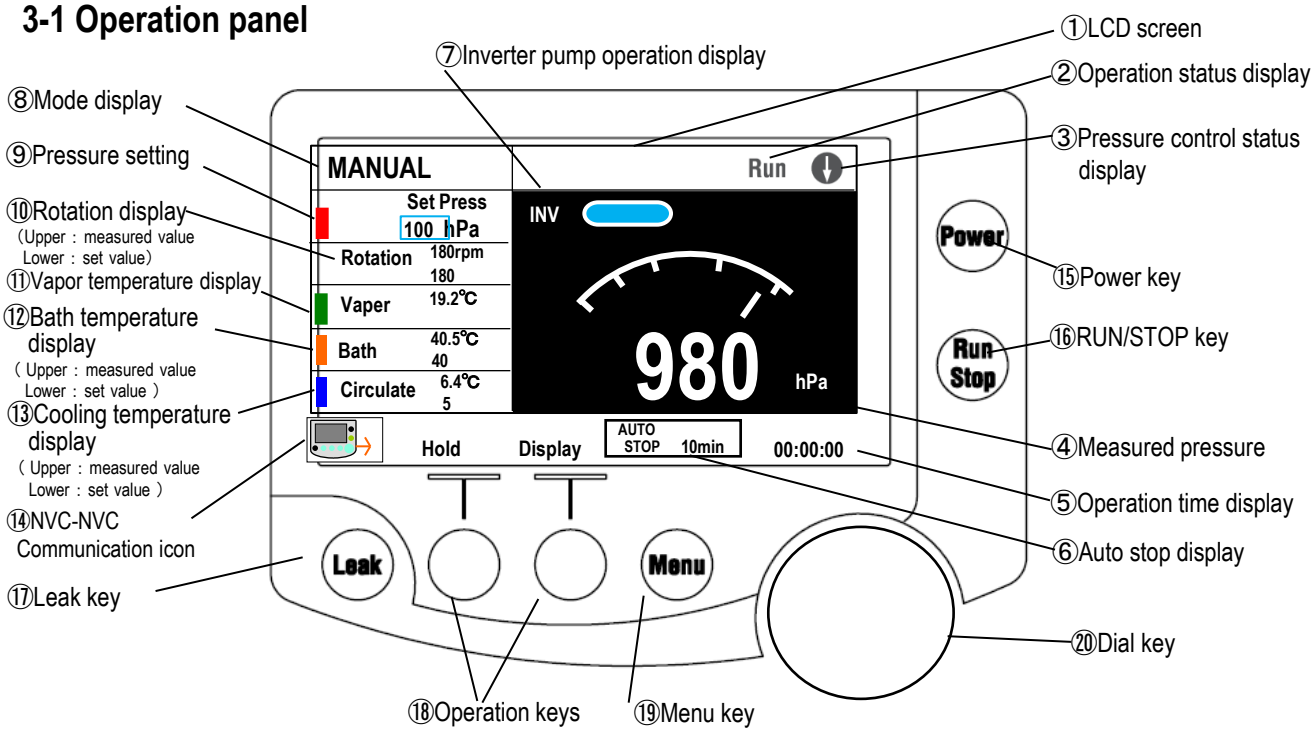


		Related unit				
		Rotary evaporator	Water bath/oil bath	Coolant circulation unit	Decompression unit	
					Inverter diaphragm type vacuum pump	Diaphragm type vacuum pump
Vacuum controller NVC-3000	Indication	Set rotation Measured rotation	Set temperature Measured temperature	Set temperature Measured temperature	Set vacuum level Measured vacuum level	
	Setting changes	○	×	○	○	
	During RUN	Rotation start	※1	Coolant circulation start	Decompression start	
					Motor rotation control	Solenoid valve ON-OFF control
	During STOP	Rotation stop※2	※1	Coolant circulation stop	Decompression stop	

※1 Manually press the RUN/STOP key to start/stop temperature control of the water and oil baths.
※2 The jacks of the models N-1210B and N-2110 automatically rise during STOP.

3 Names and functions of the control assembly

3-1 Operation panel



①	LCD screen	Displays a control mode, settings, measured values and an operating status.
②	Operation status display	Displays operating statuses: Standby, Operation (Run, Leak, Cleaning or Hold)
③	Pressure control status display	Displays a pressure control status during operation (decompression, decompression slope, fixed value, increase or increase slope) with an arrow.
④	Measured pressure	Displays a measured pressure.
⑤	Operation time display	Operation time is displayed in the form of Day:Hour:Minute:Second. Day is not indicated when operation time is less than 24 hours.
⑥	Auto stop display	Displays the set time or the stop temperature when automatic stop based on operation time and temperature has been set. The stop temperature will be displayed when the vapor temperature has stabilized and may be adjusted automatically depending on the operation status.
⑦	Inverter pump operation Indication	Operation status when the inverter pump is connected is displayed as a bar graph. The light blue bar lengthens as the number of rotations increases and the whole bar turns to light blue at MAX. INV
⑧	Mode display	Displays one of the control modes: [MANUAL], [AUTO], [PROGRAM] and [STEP PROGRAM].
⑨	Set pressure	Displays the set pressure.
⑩	Rotation display	Displays the number of the flask when connected to the evaporator with the communication cable.
⑪	Vapor temperature display	Displays the value measured on the vapor temperature sensor when it is connected.
⑫	Bath temperature display	Displays the setting and the sensor measured value when the unit is connected to the bath with a communication cable.
⑬	Cooling temperature display	Displays the setting and the sensor measured value when the unit is connected to the coolant circulation unit with a communication cable.
⑭	NVC-NVC communication icon	Displayed when communication is enabled by connecting two vacuum controllers.
⑮	Power key	Used to start by turning unit power on. *Any operations of the power key are not accepted unless the operating unit is stopped.
⑯	Run/Stop key	Used to start or stop operation (automatic leak and automatic cleaning).
⑰	Leak key	Used to open or close the leak valve. During operation: The leak valve opens while this key is pressed. During stop: The leak valve opens when this key is pressed and it closes when the key is pressed again. During washing: Pressing this key forces washing to finish. If you keep this key pressed for more than three seconds, you can start manual cleaning.
⑱	Operation key	Displays a function according to the control mode, the display screen or operation status, selects a control mode, switches screens or cancels or holds setting changes.
⑲	Menu key	Used to switch to the parameter setting screen.
⑳	Dial key	Used to move the cursors, change or determine settings. Clockwise turn: Increase a value and move the cursor downward Anticlockwise turn: Decrease a value and move the cursor upward Pressed down: Start changing settings or determining changes made

3-2 Safety function

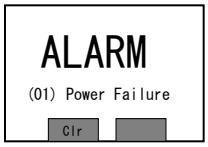
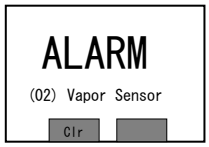
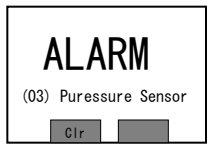
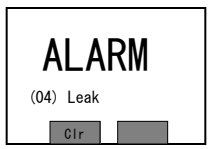
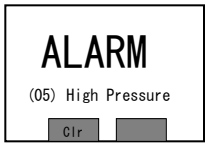
This product has the following safety functions. When an abnormal situation occurs, take appropriate measures referring to the “Causes and countermeasures of troubles” on P.46.

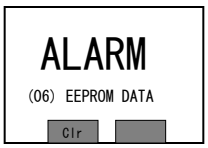
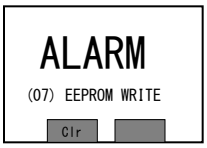
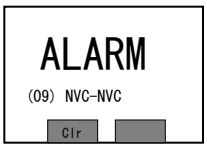
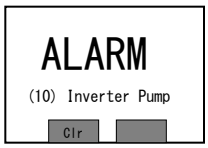
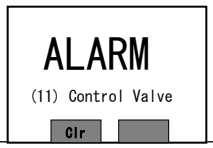
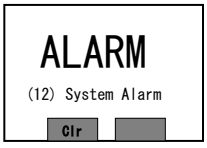
Safety unit	Operations	Causes of activation
Fuse	Fuse will blow to shut off power.	Over current flew to the PBX type pump output outlet (vacuum pump output). ※Dedicated for diaphragm vacuum pump（6A or less）

3-3 Alarm and warning functions

Alarm

When alarm occurs, the buzzer will sound (automatically stops after five seconds) and the display shows the description of the alarm as follows.

No	Indications and names	Contents and status	How to release
01	Power failure alarm Power Failure 	When a power failure occurs during operation, the unit will stop at the operation complete status when power recovers. The Power Failure alarm will not be activated when power is turned off using the power key during operation.	Use the [Clr] key to clear errors. The display will return to the ordinary screen. The buzzer, if it is sounding, will stop.
02	Vapor sensor alarm Vapor Sensor 	When measurement of a vapor temperature becomes no more possible during control that requires the vapor temperature sensor, the unit will stop at the operation end status. The same situation occurs when the vapor sensor connector is removed during operation or operation is started without setting the vapor sensor.	Use the [Clr] key to clear errors. The display will return to the ordinary screen. The buzzer, if it is sounding, will stop.
03	Pressure sensor alarm Pressure Sensor 	When measurement of pressure becomes no more possible during operation, the unit will stop at the operation end status.	Use the [Clr] key to clear errors. The display will return to the ordinary screen. The buzzer, if it is sounding, will stop. If there is a malfunction in the vapor sensor, the same alarm will occur when operation is attempted.
04	Leak alarm Leak 	The leak alarm valve will open when the pressure is below 900hPa measured after cleaning has finished. Control output to the connecting cord (diaphragm vacuum pump output) is stopped and the control solenoid valve is closed.	Use the [Clr] key to clear errors. The display will return to the ordinary screen. The buzzer, if it is sounding, will stop.
05	High pressure alarm High Pressure 	The unit will stop at the operation complete status when a measure pressure exceeds 1100hPa during operation.	Use the [Clr] key to clear errors. The display will return to the ordinary screen. The buzzer, if it is sounding, will stop. (Control solenoid valve and leak valve: close, pump: stop)

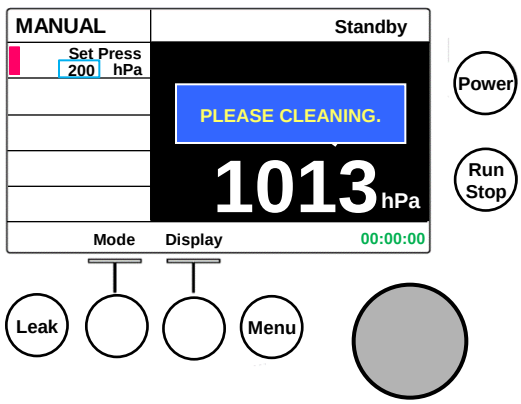
No	Indications and names	Contents and status	How to release
06	Data error EEPROM DATA 	This error occurs when there is an error in the data in the non-volatile memory when power is turned on. The portion with that error will be reset to the factory shipping settings.	Use the [Clr] key to clear errors. The display will return to the ordinary screen. The buzzer, if it is sounding, will stop.
07	Memory write error EEPROM WRITE 	This error is triggered when a write error of the user data region to the non-volatile memory occurs. (Settings including pressure, program and calibration data)	Use the [Clr] key to clear errors. The display will return to the ordinary screen. The buzzer, if it is sounding, will stop.
09	NVC mutual communication error NVC-NVC 	This error is triggered when the mutual communication between vacuum control assemblies is impossible for more than five seconds during operation (Run, Leak, or Cleaning). This error occurs when connection of the inverter pump is detected during mutual connection with NVC. This error occurs when a unit other than the model NVC-3000 (such as the model NVC-2300) is connected. The unit will stop at the operation end status. (Only when the vacuum control assembly mutual communication function is used)	Use the [Clr] key to clear errors. The display will return to the ordinary screen. The buzzer, if it is sounding, will stop.
10	Inverter pump alarm Inverter Pump 	This error is triggered when a error occurs to the inverter pump. The unit will stop at the operation end status. (Only when the inverter pump is used)	Use the [Clr] key to clear errors. The display will return to the ordinary screen. The buzzer, if it is sounding, will stop.
11	Control valve wrong connection alarm Control Valve 	This error occurs when CV-1 or CV-2 is connected to the control valve. This error status stop when operation is finished.	Use the [Clr] key to clear errors. The display will return to the ordinary screen. Only the buzzer if it is sounding will stop.
12	System Alarm System Alarm 	This error occurs when an alarm generated on a related unit connected by communication is received. Operation stops without releasing vacuum. (Only when the related unit is connected by communication.)	Use the [Clr] key to clear errors. The display will return to the ordinary screen. The buzzer, if it is sounding, will stop.

Warning

Warnings will be released automatically when the release conditions are met.
They will also be released automatically when operation has ended.
Operation status displays will switch between "Run" and "Warning" alternately.

No.	Names	Contents and status	How to release
13	Insufficient decompression capacity	Indicated when pressure cannot be reduced by 1hPa or more for one minute during forced decompression during operation of a control mode.	Released automatically when pressure reduced by 1hPa or more for one minute or the setting is attained.
14	Pressure drop	This indication appears when the measured pressure drops below the set pressure by 10hPa or more during fixed-value control.	Released automatically when returned to the set pressure.
15	Pressure increase	This indication appears when the measured pressure exceeds the hysteresis of the set pressure for 10 seconds continuously during fixed-value control. When the inverter pump is used, it appears when the measured pressure exceeds 2% of the set pressure.	Released automatically when returned to the set pressure.
16	Slop pressure drop	This indication appears when the measured pressure exceeds the hysteresis of the set pressure for 10 seconds continuously during fixed-value control.	Released automatically when the pressure returns to the target pressure.
17	Slop pressure increase	This indication appears when the measured pressure exceeds the hysteresis of the target slop pressure for 10 seconds continuously during slope control. When the inverter pump is used, it appears when the measured pressure exceeds 2% of the set pressure.	Released automatically when the pressure returns to the target pressure.
18	Insufficient slope decompression capacity	This indication appears if the fixed-value set pressure is not attained even when 30 seconds have passed since the end of slope control.	Released automatically when returned to the set pressure.

Recommended cleaning display



When the accumulated operation time exceeds 10 hours while the automatic cleaning time is set at “Off”, a ”PLEASE CLEANING” message to prompt cleaning will appear after operation is stopped. Cleaning can be started by keeping the [Leak] key pressed for three seconds or more. The cleaning process makes solvent remaining in the control solenoid valve or pipes evaporate and discharge.
Although you can operate the unit by pressing the Run/Stop key, the same message ”PLEASE CLEANING” will appear again when operation is completed.

*See the conditions below as a rough guide for auto cleaning time:
When a low boiling point solvent is mainly used: 3 min
When a high boiling point solvent is mainly used: 5 min

See P.39 for auto cleaning settings.

*See P.40 for manual cleaning settings.

4 Installation

4-1 Installation environment

Warning

Never install in a dangerous atmosphere

This product is not explosion proof. Operating this unit in a dangerous atmosphere may cause a fire.

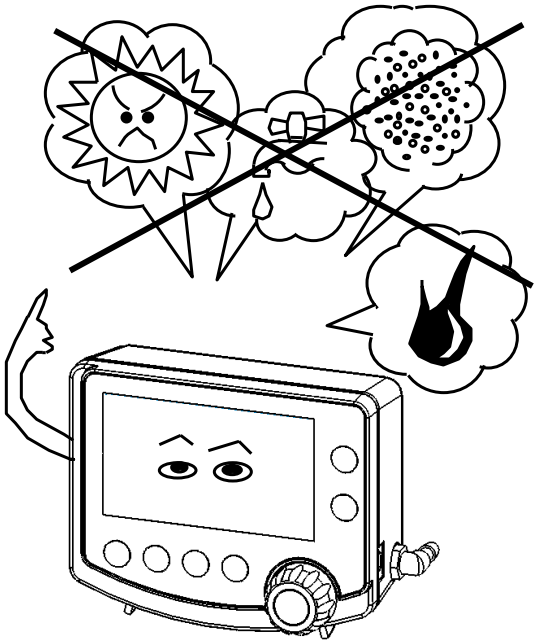
Warning

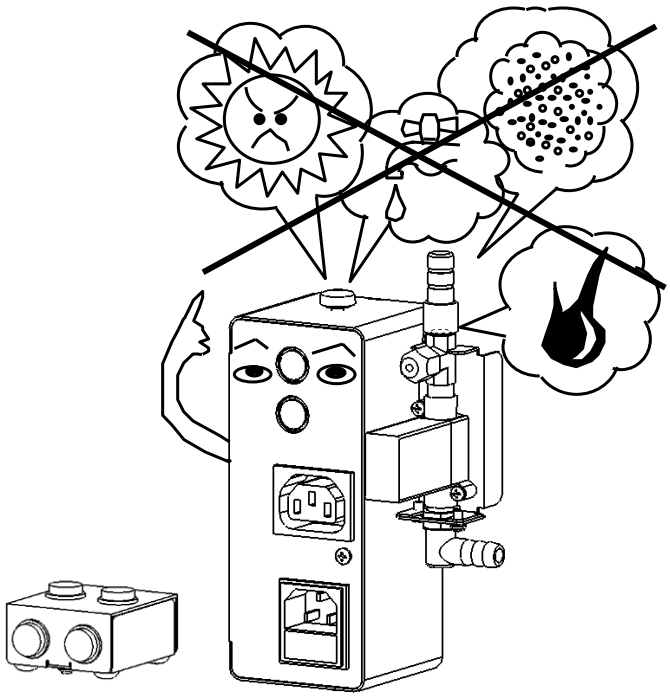
Be sure to handle a deleterious or a toxic solvent in the draft chamber.

Improper handling of a deleterious, a toxic or similar solvent may lead to an unexpected accident.

Select a site that meets the following conditions for installing the product.

- Place free of flammable gas, liquid, or solid materials in the vicinity of the product.
- Place free from direct sunshine
- Place where the ambient temperature can be kept within a range of 5～35℃.
- Place free from condensation
- Place of drafty or well-ventilated.
- Place with less humidity and free from splashing water
- Place with less dust
- Level, stable, and firm place
- Place free of units that will produce excessive electric noises in the surrounding areas.





F-BOX
(Selling separately)

PBX,CV-11
(Selling separately)

4-2 Installation conditions

⚠ Caution

Be sure to install the vacuum controller at a place higher than the decompression container and the vacuum pump.

The product may malfunction if the solvent is liquefied in the pipe.
If you cannot install the unit at a higher position, install a waste liquid trap between the decompression container and the control solenoid valve.

⚠ Caution

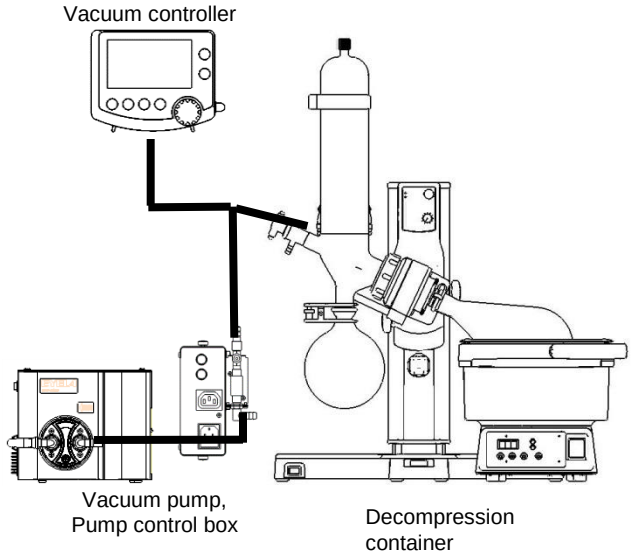
Observe the instructions for Connecting pipes.

Incorrect connection of pipes will prevent the unit from operating correctly as well as may cause a malfunction or an accident.

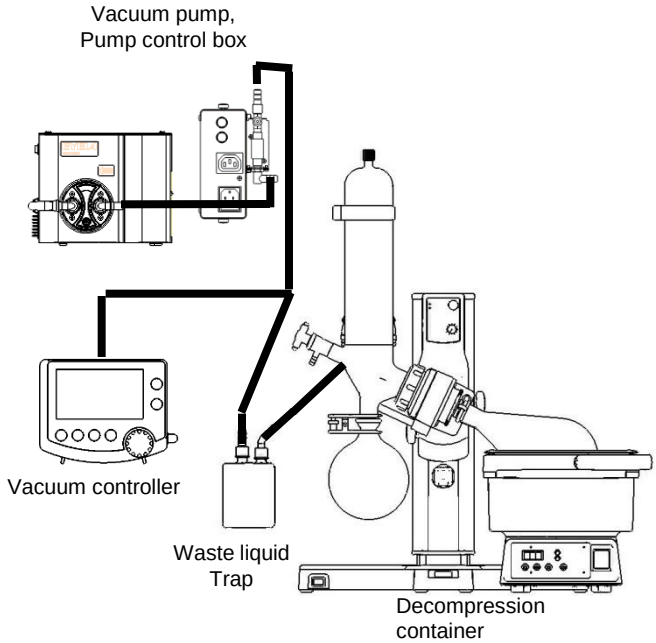
Pay attention to the following when installing the vacuum controller .

- Prepare appropriate hose and couplers.
  Select hoses and couples for connecting to the decompression container and the vacuum pump appropriate for the nozzle diameter of the device and the type of solvent used.
- Install the vacuum controller at a higher position.
  Select a position higher than the decompression container, the vacuum pump, hoses and couplers.
- If you cannot install the unit at a higher position, install a waste liquid trap.
  If you cannot install the vacuum controller at a position higher than the decompression container or the vacuum pump, install an optional waste liquid trap between the decompression container and the control solenoid valve. Install the waste liquid trap at a position to make the pipe for the control solenoid valve minimum.
- Make the piping distance between the unit and the decompression container or the vacuum pump as short as possible.
- Take extreme care not to tightly close the leak nozzle or allow foreign objects from entering.
- When atmospheric air to be suctioned at the release of decompression must be clean, install a filter to the leak nozzle.
- When you do not want to atmospheric air to be suctioned at the release of decompression, purge N2 gas or other inactive gas.

※ Set the purging pressure to 1029hPa or lower.
Applying a pressure higher than this may prevent a correct operation or cause a malfunction.
An alarm is displayed and stops at a pressure of 1030hPa or higher.



When the unit is installed at a position higher than the decompression container or the vacuum pump.



When the unit is installed at a position lower than the decompression container or the vacuum pump.

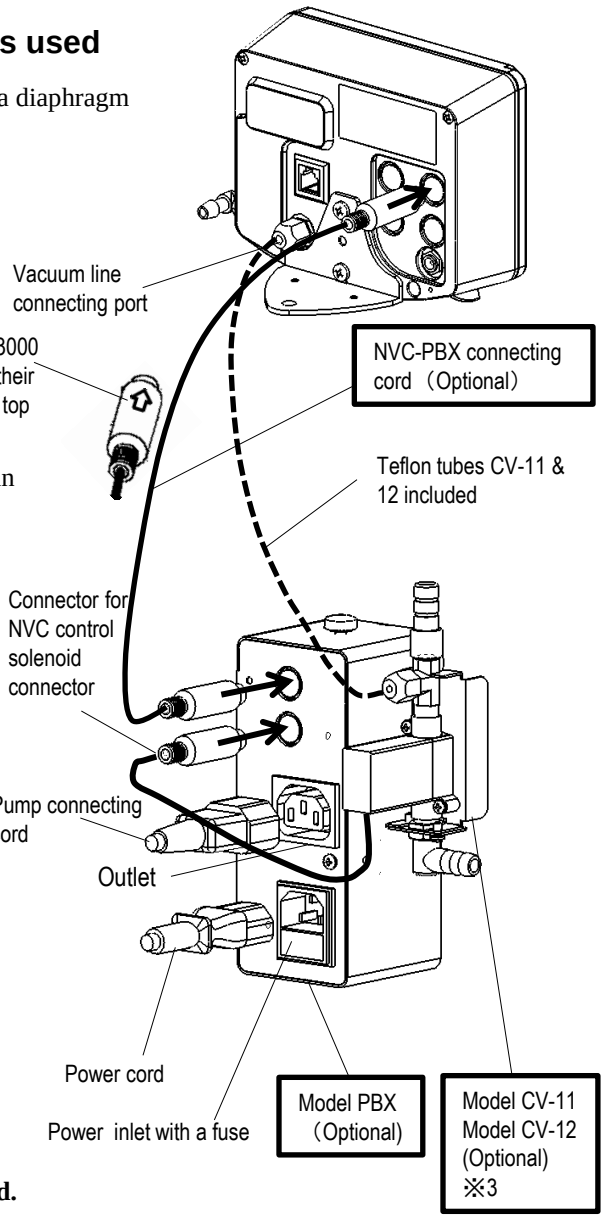
4-3 Installation procedures

Necessary optional devices will differ depending on the vacuum pump to combine with.

4-3-1 When a diaphragm type vacuum pump is used

Use optional items below to combine the model NVC-3000 with a diaphragm type vacuum pump (constant rotation)

- Diaphragm pump control box PBX
- NVC control solenoid valve
  Model CV-11 (For 1 to 5 litter condensation units)
  Model CV-12 (For 5 to 10 litter condensation units)
- NVC-PBX connecting cord
  NP0.5M (length:0.5m)
  NP2M (length:2m)



(1) Connect the model NVC-3000 and the model PBX as shown in the right figure with a connecting cord.

(2) Connect the connector for the CV solenoid valve for NVC control to the model PBX.

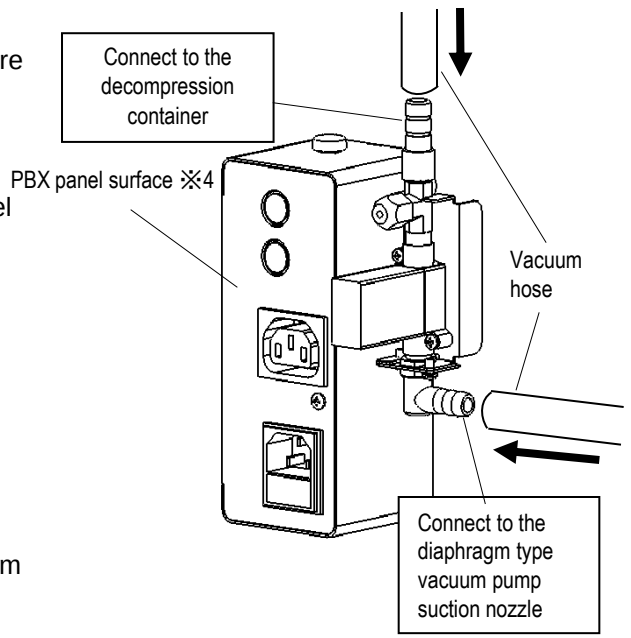
(3) Connect the Teflon tube included with the NVC control solenoid valve to the connecting port of the vacuum line of NVC-3000.
(Refer to the instruction manual of the CV-11 & CV-12)

(4) Insert the connecting cord to the outlet of the model PBX and insert the power plug of the diaphragm type vacuum pump into the opposite socket. ※1

(5) Insert the power cord included with the model PBX into the Power inlet with a fuse of the model PBX.

(6) Insert the vacuum hose into the nozzle of the NVC control solenoid valve to the end.

Carefully check where to connect the vacuum hose beforehand.



※1 Diaphragm type vacuum pumps that can be connected are as follows:
Models NVP-1000・2000・2100
Models EVP-1000・1100・1200
Models DTC-22・41, Model DTU-20, Model MD1C, Model N920
(You cannot use any other vacuum pump types.)

※2 Power for NVC-3000 is supplied from the model PBX.

※3 Never attempt to touch the surface of CV-11 or CV-12 solenoid valve for NVC control since it may be hot during operation.

※4 Do not install the PBX with its panel surface (connector surface) facing above to avoid foreign objects or water from entering.

4-3-2 When an inverter diaphragm type vacuum pump is used

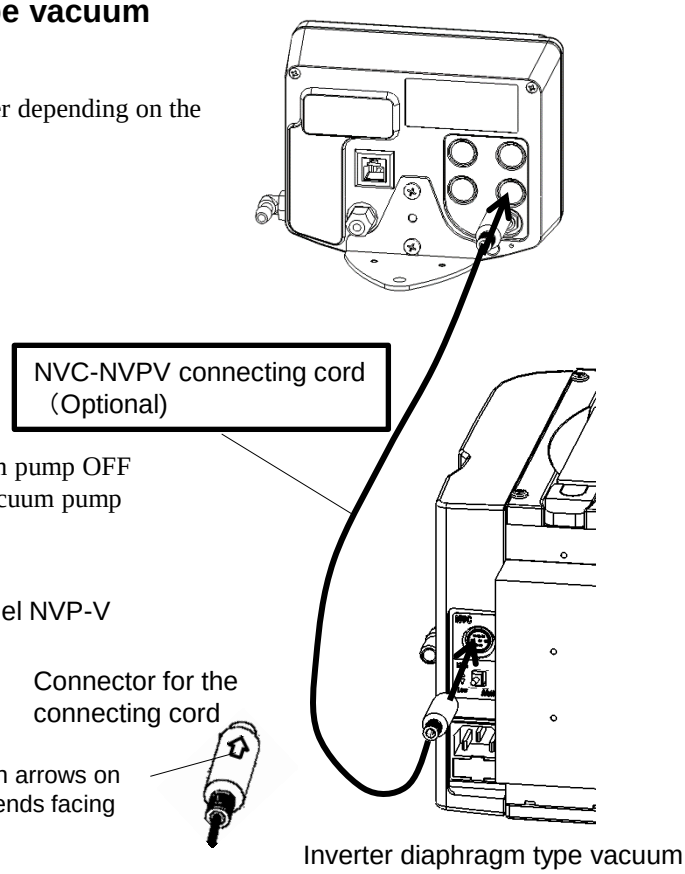
Connecting cords and power adaptors to use will differ depending on the type of the inverter diaphragm pump to connect.

When combining model NVP-1000V, NVP-2000V, or NVP-2100V with the model NVC-3000

・Use NVC-NVPV connecting cord（For NVP-V)
NNV0.5M （length:0.5m)
NNV2M (length:2m)

(1) Turn power of the inverter diaphragm type vacuum pump OFF and then connect the model NVC-3000 and the vacuum pump using the connecting cord.

* Power for NVC-3000 is supplied from the model NVP-V and does not require a DC adaptor.

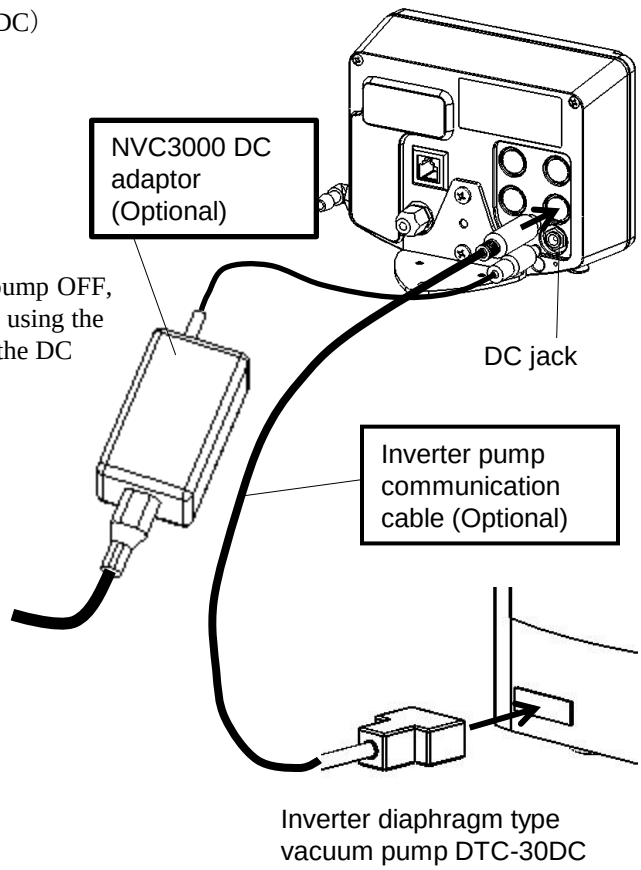


When combining the model DTC-30DC with the model NVC-3000

・NVC3000-DTC30DC connecting cord (For DTC-30DC）
ND0.5M （length:0.5m)
ND2M （length:2m)

・DC adaptor for NVC3000 is used.

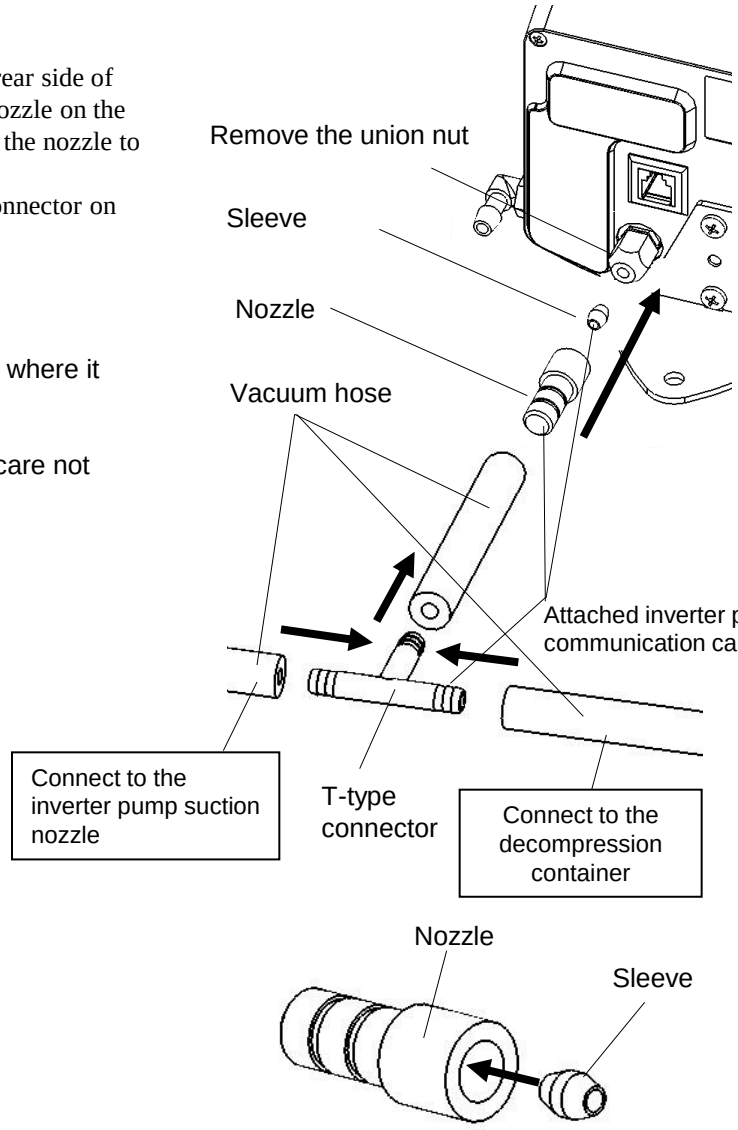
(1) Turn power of the inverter diaphragm type vacuum pump OFF, connect the model NVC-3000 and the vacuum pump using the connecting cord and then insert the DC adaptor into the DC jack of the model NVC-3000.



(2) Remove the union nut and the sleeve from the rear side of the NVC main unit, insert the sleeve into the nozzle on the inverter pump communication cable and install the nozzle to the rear side of the NVC main unit.
Then insert the vacuum hose fully into the T-connector on the inverter pump communication cable.

※ Connect the vacuum hose after checking where it should be connected.

※ The sleeve is a very small part and take care not to lose it during installation.

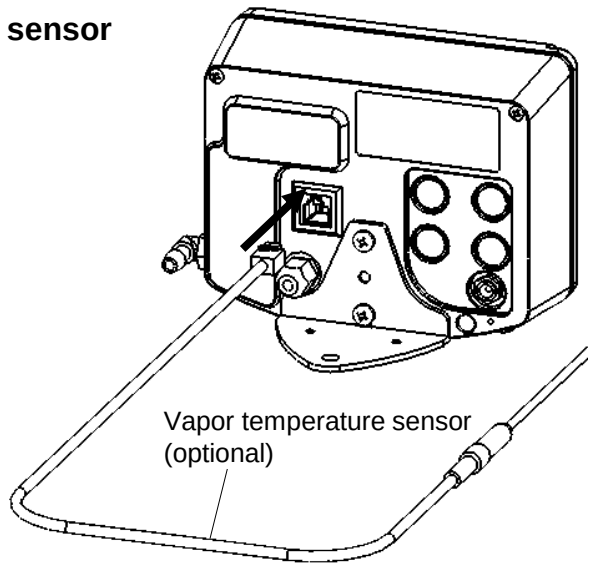


※ Put the sleeve in the nozzle first and then install it to the rear of the NVC main unit.

4-4 Installation of the vapor temperature sensor (optional)

When you use a vapor temperature for vacuum control, connect a vapor temperature sensor (optional) to NVC-3000 as shown in the right figure.

※ Vapor temperatures may be subject to influences in the vicinity of a unit that produces excessive electric noises.



4-5 Connecting the communication cable (optional)

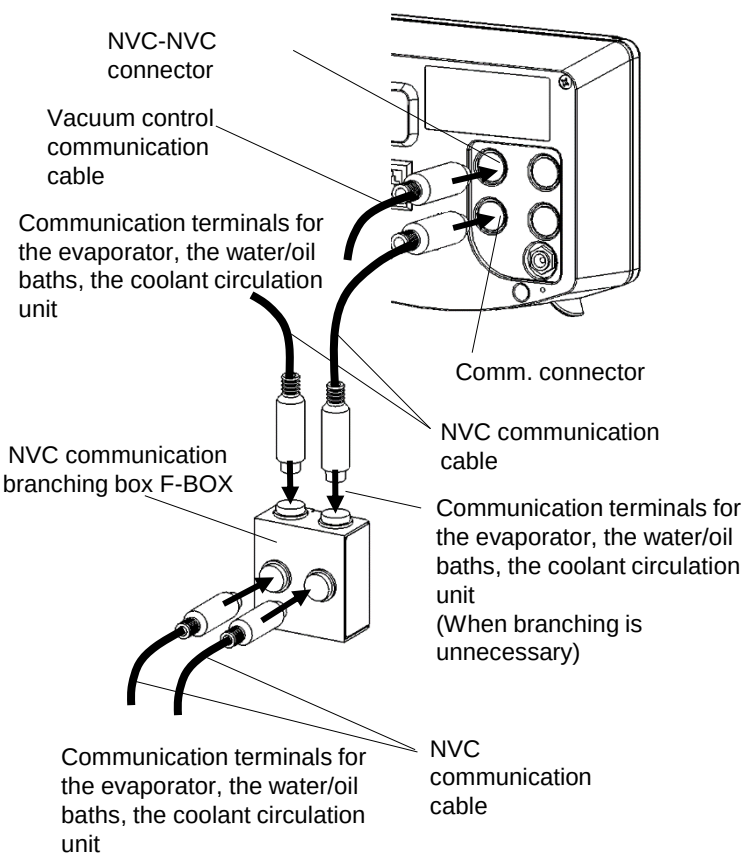
Use a communication cable (optional) and a branching box (optional) to combine the NVC-3000 and a related unit such as an evaporator with a communication terminal.

Product name	Connection	Additional functions
Vacuum control communication cable VC-2M（length:2m） VC-4M（length:4m） ※Note that you cannot use this cable when you use the inverter pump.	Connect the vacuum controller model NVC-3000 and the model NVC-3000 vacuum controller.	When two vacuum controllers are controlled with one diaphragm vacuum pump, you can operate these units by monitoring their operation and by preventing from interfering with operations of each other.
NVC communication cable COM-0.5M（length:0.5m） COM-2M（length:2m）	Connect the model NVC-3000 vacuum controller to a condensation unit-related unit with a communication terminal.	Evaporator：N-1300, N-1210B, N-2110 You can start, stop rotation of, set and display the number of rotations from NVC-3000. Water/oil bath:SB-1200,OSB-2200 You can stop temperature control interlocked with operation and display a temperature from NVC-3000. （Starting and setting of temperature control is possible from the bath only.） Coolant circulation unit：CA-1116A, CA-1330, CCA-1112A You can control the circulation pump interlocked with operation and set and display temperatures from NVC-3000.
Branching box F-BOX for NVC communication	Branches the NVC communication cable	The NVC communication is branching-connected when you connect two or more condensation related units to NVC-3000. The specifications are the same for 4 connectors.

Caution

Do not switch off the inter-connected units with the communication cables

If the inter-connected unit is switched off during the operation ,it may cause the interruption of the communication between the Vacuum Controller and the inter-connected units



4-6 Connecting the utility

Warning

Confirm the voltage, phase, capacity, and the type of receptacle of power supply.

Wrong connection of power supply may cause fire or electric shock

WARNING

Do not use a a branching socket or a power strip.

It may cause burnout of burn out of cables or a fire from overcurrent.

WARNING

Check the plug terminal before connecting to an outlet.

Dusts or dirt on the plug terminal may make it humid, short-circuited and ignition.

WARNING

Be sure to connect the earth wire.

Failure to connect the earth wire may cause an electrical shock.

Warning

Never fail to connect the earth wire correctly.

Never connect the earth wire to a gas or a water pipe in order to avoid an electric shock.

Power supply of NVC-3000 will differ depending on the unit it is combined with.

- When the diaphragm pump control box PBX is combined, the power supply of the NVC-3000 is supplied from the model PBX.

Model	Required power source	
	Voltage	Capacity
NVC-3000 ＋PBX	AC100～ AC230V	15A

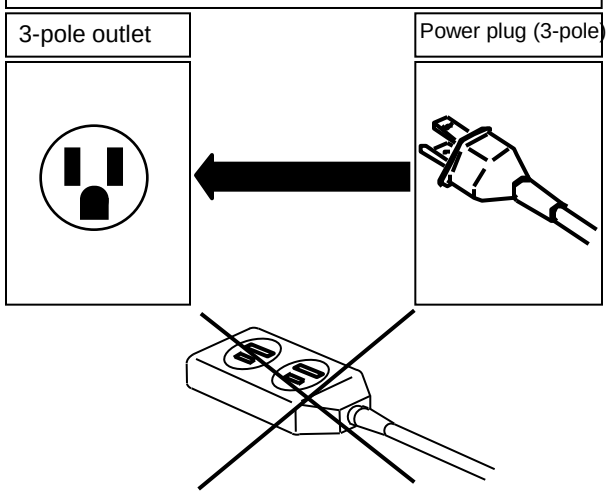
Check the outlet on the planned installation site. (Do not connect the power plug yet.)

A power plug can be used as it is on earthed outlets.

Please consult one of our sales offices if your outlet does not have an earth terminal.

Do not use a branching socket or a power strip for connection to the power supply.

When a power plug with earth is used



- When combined with the inverter diaphragm vacuum pump NVP-V;
  Power for NVC-3000 is supplied from the model NVP-V with the NVC-NVPV connecting cord (See P.15).

- When connected to the power supply by installing the NVC3000 DC adaptor
  Power for NVC-3000 is supplied from the DC adaptor. （See P.15.）

Model	Required power source	
	Voltage	Capacity
DC adaptor for NVC3000	AC100～ AC230V	1A

5 Operation

5-1 Preparing for operation

Warning

Be sure to use the power cord included with the product.

Using any other cord might cause a fire.

Caution

Avoid subjecting the power cord to load.

Using the power cord or the power plug with under load or sharply kinked may cause disconnection and make the unit inoperable.

Warning

Do not connect any device other than the specified vacuum unit.

Operating the product with a device other than the specified vacuum unit may prevent its proper operation as well as lead to a malfunction or an accident.

Caution

Care for burning.

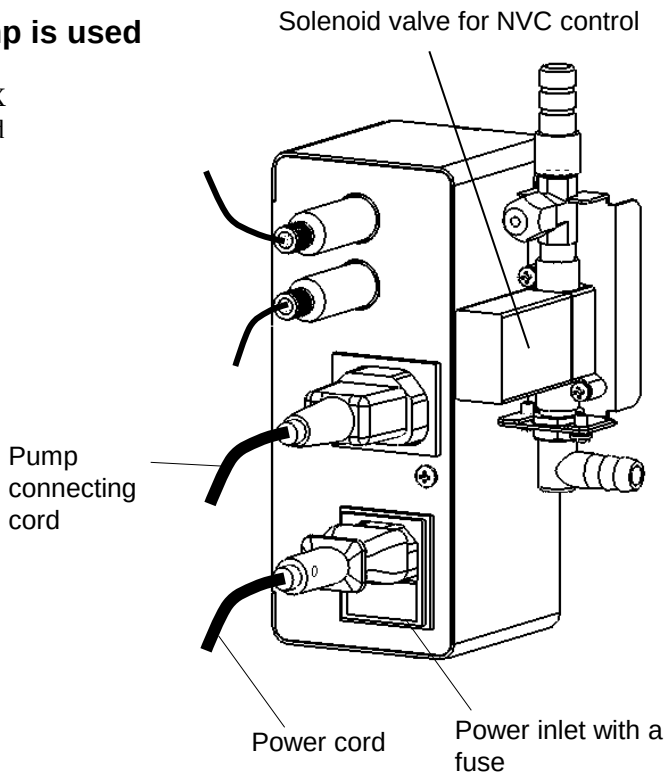
Do not attempt to touch the surface of the solenoid valve for NVC control during operation.

5-1-1 When the diaphragm vacuum pump is used

(1) Connect the power cord included with the model PBX into the Power inlet with a fuse of the model PBX and then insert it into a power outlet.

(2) Turn the power switch of the diaphragm type vacuum pump ON.

* The surface of the solenoid valve for NVC control may become hot during operation.



5-1-2 When the inverter pump is used

(1) Turn the power switch of the inverter diaphragm type vacuum pump ON.

5-1-3 When connected to a condensation related unit with a communication cable

(1) Turn power of the condensation related unit ON.

5-2 Operating procedures

Caution

Stop operation immediately if you notice an abnormal condition.

When an abnormality occurs, immediately turn the power switches of the related units off and take appropriate measures referring to the section of “Causes and solutions of troubles” on P-41.

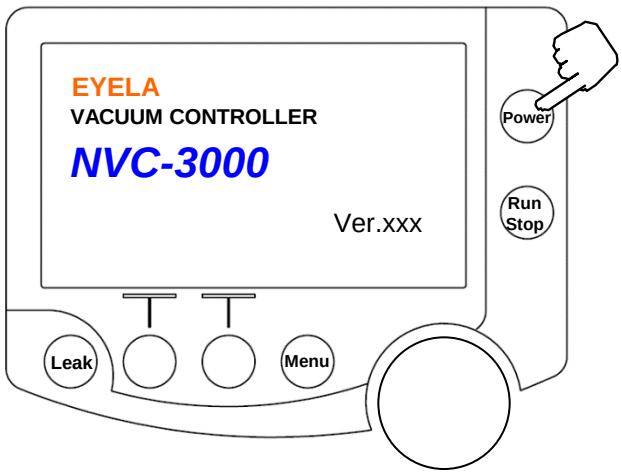
Warning

Take extreme care for use of a flammable or combustible solution.

Flammable or combustible solution will vaporize and ignite when left at a temperature of room temperature or higher (or lower depending on some solutions). Be sure to assure proper ventilation of the room and take extreme care when using such a solution.

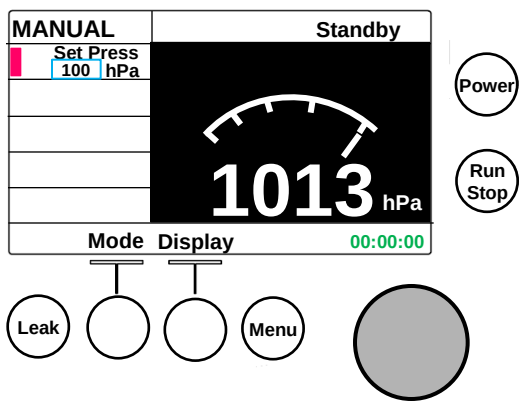
(1) Turn the power switch ON.
The buzzer sounds and the initial screen will appear. Then the screen will automatically switches to the control mode selection screen.
The MANUAL (set temperature control) mode screen appears at the first time after purchase.
Once the product has been used, the control mode used in the last session will appear.

■ Initial screen



Automatically switches to the control mode select screen in three seconds.

■Control mode select screen

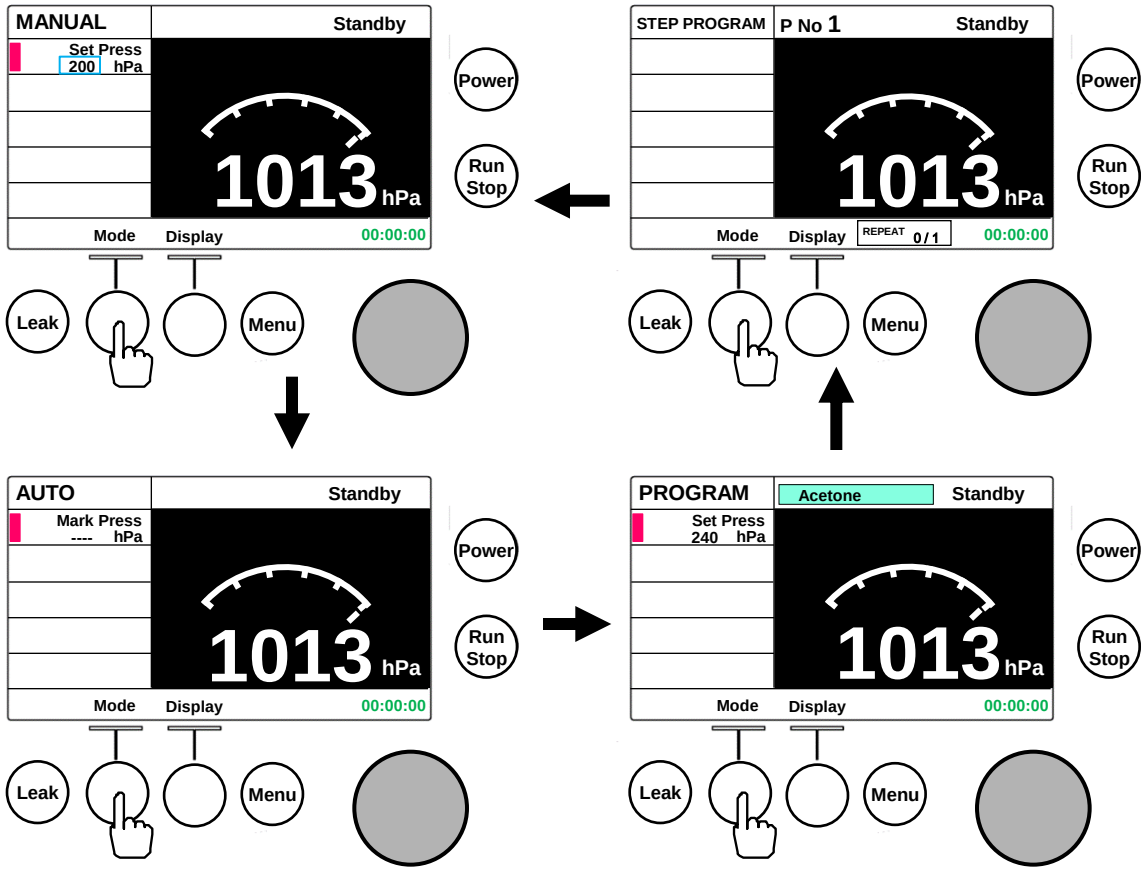


(2) Select a control mode.

Four control modes below will change each time you press the [Mode] key in the order below:

MANUAL → AUTO → PROGRAM → STEP PROGRAM

■Control mode select screen



(3) Pressing the [Display] key displays the graph screen and pressing it again displays the setting screen.

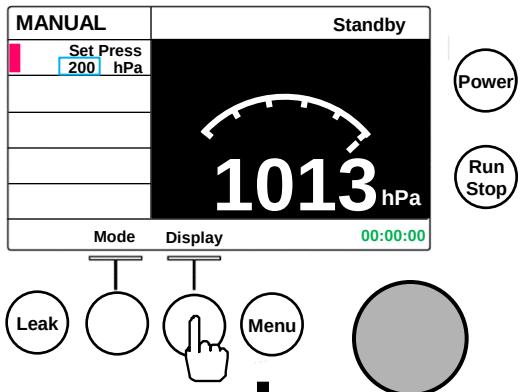
* See the following pages for how to operation each control mode.

* You can return to the control mode select screen by pressing the [End] key on the setting screen.

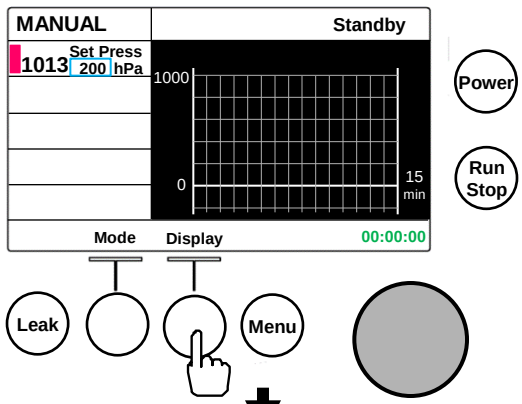
(4) Items that you can change are shown in light blue in each screen.
Once you start adjusting an item by pressing the dial, the item will change to yellow.
The item will return to light blue when it is determined by pressing the dial.

(5) After having set operating conditions such as pressure, temperature or time for the control mode you want to use, use the Run/Stop key to start operation.

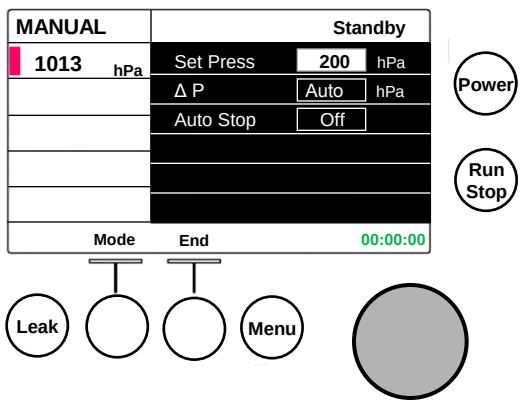
■Control mode select screen



■Graph screen



■Setting screen

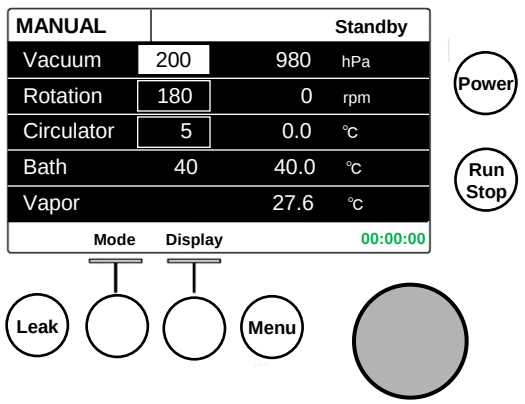


(6) Communication system control screen
Changing the setting in the MAIN/SUB Screen of the system parameter 2 screen (See P.41) will change the screen from the control mode select screen to the communication system control screen. Setting to MAIN+SUB will display both the control mode select screen and the communication system control screen.

Settings and measured values are also displayed for the related units that are connected and communicated with the NVC communication cable.

You can change the set vacuum level, the set rotation of the evaporator and the set temperature of the coolant circulation unit in this screen.

■Communication system control screen



* Settings changed from NVC will remain valid as long as communication with the NVC continues.
The settings will return to those before change in about 1 minute after communication is shut off.

Functions common to the all modes.

(1) "Hold" function

If you press the [Hold] key during decompression or slope control during operation, the pressure at the time you pressed the key will be maintained.

* This function is useful to avoid bubbling or sudden boiling, pause condensation or change the set pressure.
Press the [Hold] key again to release this function.

(2) Manual "Cleaning" function

If you keep the leak key pressed for more than three seconds during standby, the unit enters the manual cleaning mode and purges solvent remaining in the vacuum pump, the control solenoid valve or pipes to outside the unit.

* The manual cleaning will finish automatically in about three minutes (initial setting) and you must not forcibly end in the middle of it.

* For set time of manual cleaning, see "Parameter setting" on P. 36.

【Caution】

You cannot perform manual cleaning while two vacuum control assemblies are in the mutual communication control and one of them is in operation.

(3) Graph display function

You can use the [Display] key on the control mode select screen to display a graph during operation. You can check pressure trend on a graph including decompression status (slope and a fixed-value), status using the hold function by setting the operation start as 0 minute. The time scale will change depending on the operation time as follows:

15min→30min→60min→90min.

* When the operation time has exceeded 90 minutes, only the graph will be scroll-displayed. (You can check on the graph pressure changes up to 90 minutes before.)

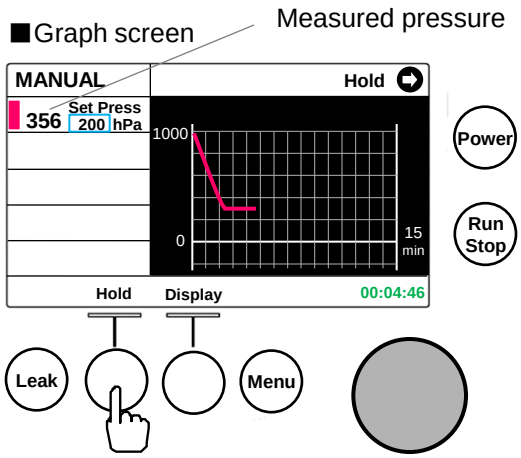
(4) Vapor temperature display function

You can measure vapor temperature during condensation by connecting a vapor temperature sensor (optional).
Vapor temperatures will be displayed on the control mode setting screen, the setting screen, and the graph screen.

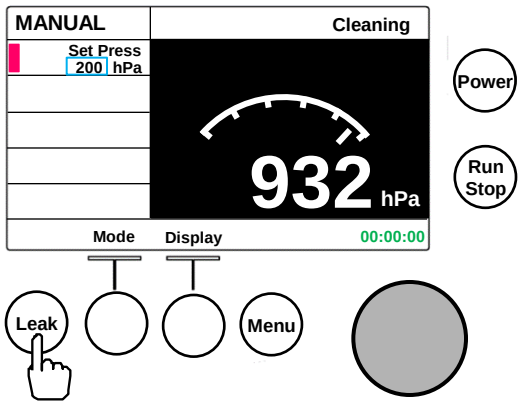
(5) Canceling operation being set [Esc] function

You can press the [Esc] key during setting to cancel the setting operation and return to the original setting.

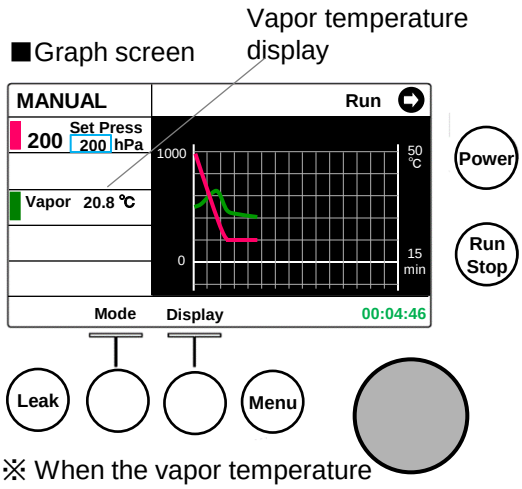
■Graph screen



■Control mode select screen

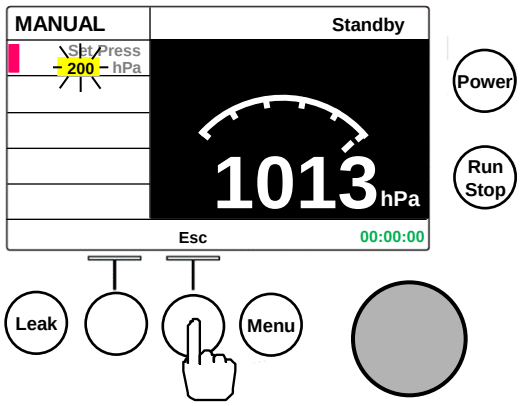


■Graph screen



※ When the vapor temperature sensor is connected

■Control mode select screen

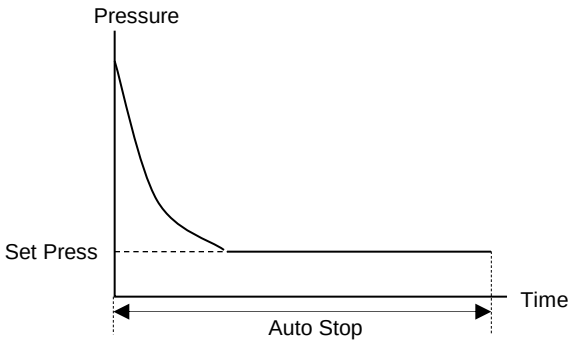


5-3 Operation in the MANUAL (fixed-value control) mode

After operation is started, fixed-value control will start at the fixed pressure (Set Press).

You can stop operation of the unit automatically according to the operation time by setting an operation stop condition (Auto Stop).

You can stop the unit automatically based on the temperature increase margin from the vapor temperature by using a vapor temperature sensor (optional).



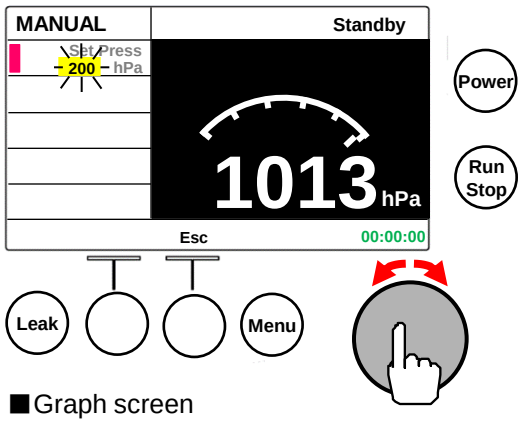
(1) Fixed pressure (Set Press) setting

Setting range：VAC、1 ～ 1013hPa(unit:1)
Initial value ：200 hPa

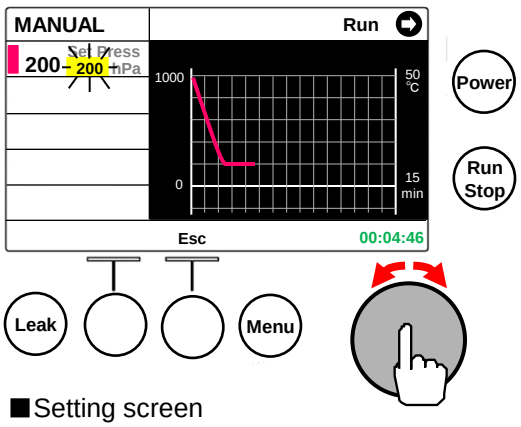
VAC will be controlled but continuously decreased.

you can change settings in any mode of standby, decompression, or fixed-value control and in any of [Control mode select screen], [Graph screen], or [Setting screen].

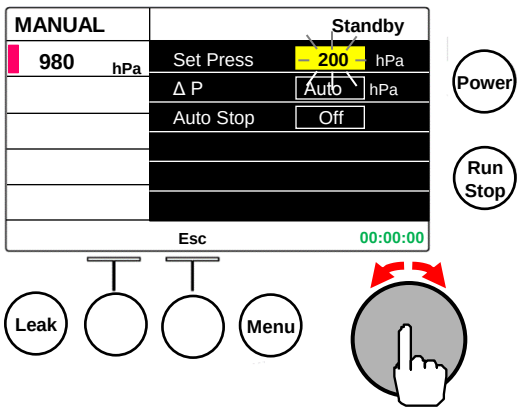
■Control mode select screen



■Graph screen



■Setting screen



● In the Control mode select screen or the Graph screen
Turn the dial key to start setting.
This [Set Press] color will change from light blue to yellow and you can change the value using the dial.
Turn the dial key to change the value to the pressure you want and then press the key to select it as the fixed-pressure.
(Once a value is determined, its color will return from yellow to light blue.)

* When five seconds have passed without determining a value, it will return to the one before change.

● In the Setting screen
Press the [Display] key on the Control mode select screen to change to the Setting screen.
Turn the dial key to move the cursor to [Set Press] and press it to start setting.
(The indication color will change from light blue to yellow.)
Turn the dial key to change the value to the pressure you want and then press the key to select it as the fixed-pressure.
(Once a value is determined, its color will return from yellow to light blue.)

* You can quickly change the values by turning the dial key faster.

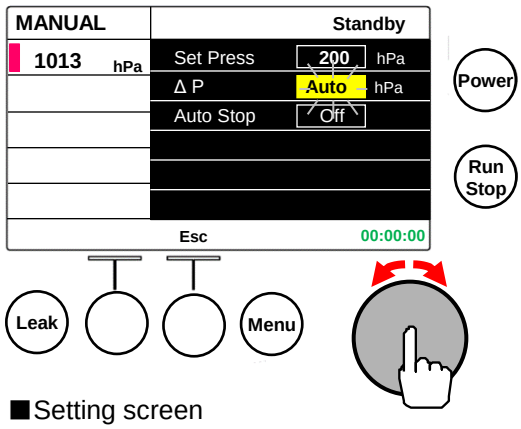
(2) Setting of hysteresis (control width) (ΔP)
Setting range : Auto, 1 ～ 20hPa(unit:1)
Initial value : Auto

In the Auto mode, pressure is automatically controlled with the 2% of the fixed-pressure (Set Press) set as ΔP.

Setting of ΔP is made on the Setting screen.
Turn the dial key to move the cursor to ΔP and press it to start setting.
(The indication color will change from light blue to yellow.)
Turn the dial key to change the value to the pressure you want and press it to determine.
(Once a value is determined, its color will return from yellow to light blue.)

* No setting is necessary for the inverter pump.

■Setting screen



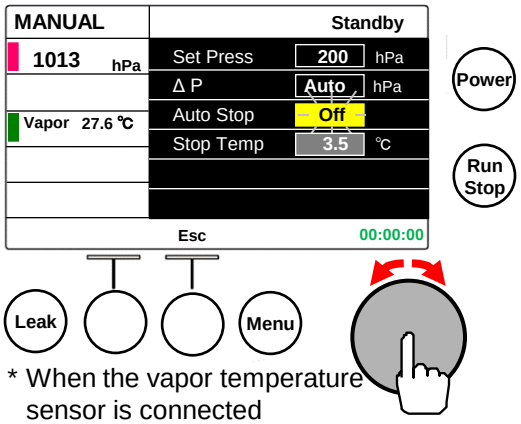
(3) Setting of operation stop conditions (Auto Stop)
Setting range : Off, 1 ～ 999min(unit:1)
Temp (When the vapor temperature sensor is connected)
Initial value : Off

The unit will stop automatically when the set time has elapsed since the start of operation.
When Off is selected, operation will continue until it is stopped with the Run/Stop key.
At the Temp setting, the unit will stop automatically according to the increase in the vapor temperature.
See the description on the stop temperature (Stop Temp).

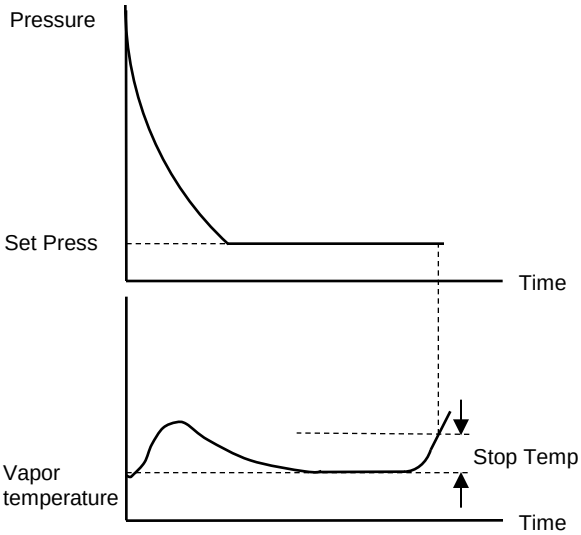
Setting of Auto Stop is made on the Setting screen.
Turn the dial key to move the cursor to [Auto Stop] and press it to start setting.
(The indication color will change from light blue to yellow.)
Turn the dial key to change the value to the time you want to set and press it to determine.
(Once a value is determined, its color will return from yellow to light blue.)

* You can set Temp only when the Vapor temperature sensor (optional) is used.
* When you have set Temp, the mark  for controlling with the vapor temperature sensor will be displayed.
* You can quickly change the values by turning the dial key faster.
(Except for during operation)

■Setting screen



* When the vapor temperature sensor is connected

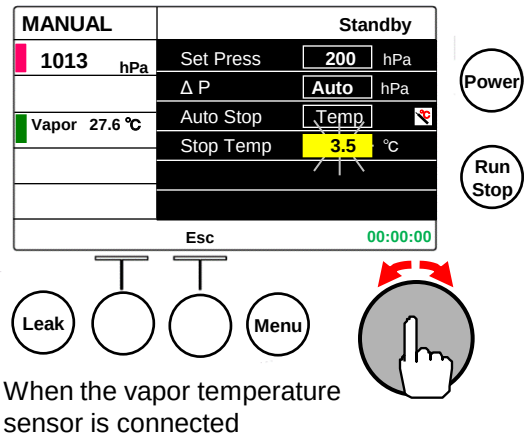


(4) Setting of a Stop Temperature (Stop Temp)
This setting will be valid when you have set the operation stop condition (Auto Stop) to
Temp.
Setting range : 0.1 ～ 15.0℃(unit:0.1)
Initial value : 3.5℃

You can stop operation of the unit automatically based on the margin of temperature increase (Stop Temp) from the vapor temperature if you use a vapor temperature sensor (optional).
When a temperature measured on the vapor temperature sensor reaches the sum of the vapor temperature and the stop temperature (Stop Temp) operation will stop.

* Make this setting larger if operation stops too early and make it smaller if operation stops too late.

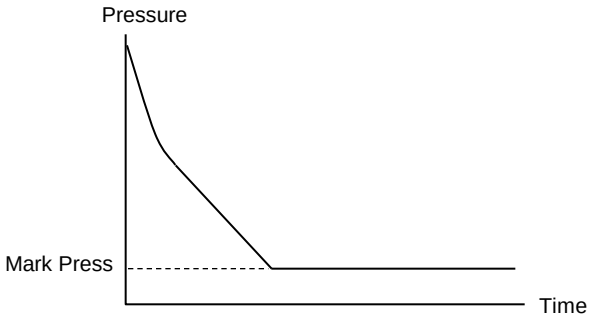
■Setting screen



* When the vapor temperature sensor is connected

5-4 Operation of the AUTO (Automatic Control) mode

The AUTO (Automatic Control) mode automatically controls pressure to prevent sudden boiling, automatically determines a pressure that enable an optimal collection rate and a condensation time at the same time (Mark Press) for the fixed-value operation.
There are two modes: AUTO mode that detects pressure changes and controls the pressure and AUTO-2 mode that uses a vapor temperature sensor (optional) in addition to pressure changes.



* The unit has been set to be an optimal state at the cooling water temperature between 5 and 10℃ and the room temperature of 25℃±10℃ at the conditions below:
  Solvent with low boiling point: Bath temperature 40℃
  Solvent with high boiling point: Bath temperature 60℃

* Sudden boiling might not be suppressed depending on the sample.
  In such a case, take following measures in consideration: reducing samples, lowering the number of sample flasks, or lowering the bath temperature.

* For the inverter pump, Mark Press will be adjusted automatically once the fixed-value control has started. (If you set the number of adjustment (Mark Count) to 2 or larger in the AUTO-2 mode, the second session and the sessions that follow do not perform automatic adjustment of Mark Press.)

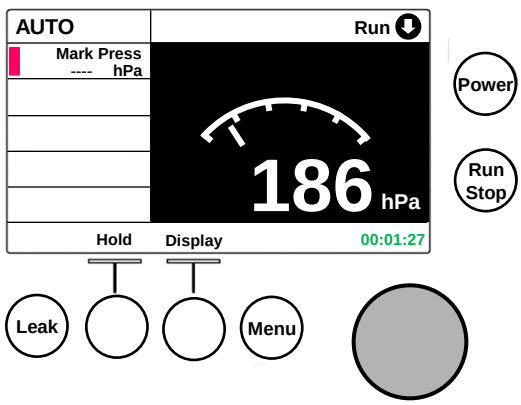
5-4-1 AUTO mode

In the AUTO mode, pressure is controlled automatically by detecting pressure changes.

You can stop the unit automatically based on the operation time by setting an operation stop condition (Auto Stop).

While the AUTO mode does not need any changes of settings in principle, if you definitely need to change the control status, the following functions and settings may be changed.

■Control mode select screen

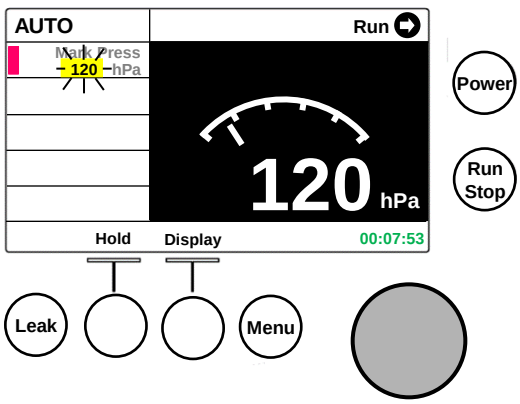


(1) [Hold] function
  You can stop decompression to avoid bubbling or sudden boiling.
  If you press the [Hold] key during decompression or slope control, the pressure at the time you pressed the key will be maintained.
  Press the [Hold] key again to release.

(2) Adjusting of the automatically determined pressure (Mark Press)
  You can adjust the automatically determined pressure (Mark Press).
  Press the dial key to start adjusting after a pressure has been determined automatically, then turn the dial key to change the value to the pressure you want and press to determine.

  * For the inverter pump, Mark Press will be adjusted automatically as needed, note that automatic adjustment will not be performed once you have adjusted the setting using the dial key.

■Control mode select screen



(3) Setting of hysteresis (control width) (ΔP)

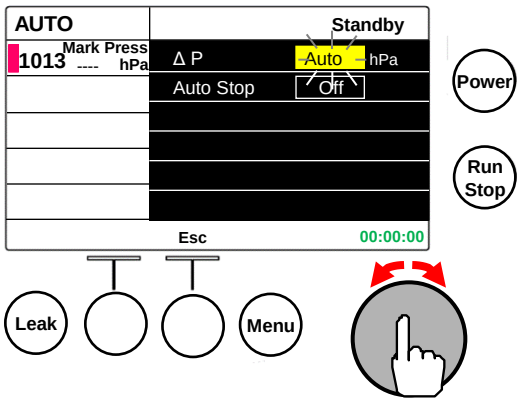
Setting range : Auto, 1 ～ 20hPa(unit:1)
Initial value : Auto

In the Auto setting, automatic control is performed with 2% of the target pressure set as ΔP.

Changing of ΔP is made on the Setting screen.
Turn the dial key to move the cursor to ΔP and press and turn the dial key to select a value you want and then press it to determine.

* No setting is necessary for the inverter pump.

■Setting screen



(4) Setting of operation stop conditions (Auto Stop)

Setting range : Off, 1 ～ 999min(unit:1)
Initial value : Off

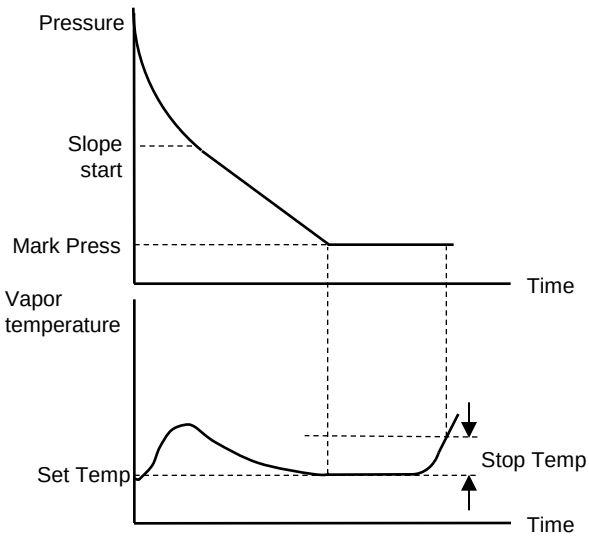
The unit will stop automatically when the set time has elapsed since the start of operation.
When Off is selected, operation will continue until it is stopped with the Run/Stop key.

* You can quickly change the values by turning the dial key faster.

5-4-2 AUTO-2 mode

You can switch to the AUTO-2 mode by using a vapor temperature sensor (optional).
In addition to the functions of the AUTO mode, the following functions are available:

- Fixed-value control at the pressure (Mark Press) determined automatically appropriately to the vapor temperature (Set Temp).
- Automatic stop based on the margin of temperature increase (Stop Temp) from the vapor temperature (Set Temp).
- You can use mixed solvent by using an adjusted temperature (Adjust Temp) and the count of adjustment (Mark Count).



(1) [Hold] function

This is the same as for the AUTO mode.

(2) Adjusting of the automatically determined pressure (Mark Press)

This is the same as for the AUTO mode.

(3) Setting of hysteresis (control width) (ΔP)

This is the same as for the AUTO mode.

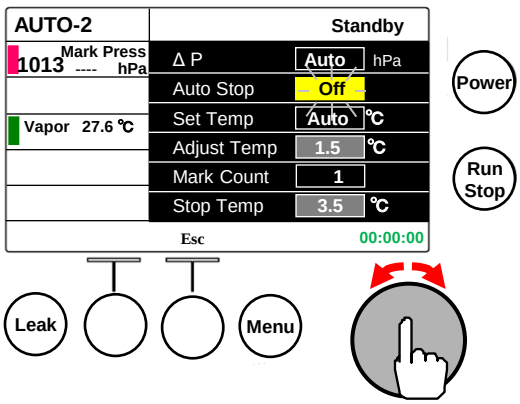
(4) Setting of operation stop conditions (Auto Stop)

Setting range : Temp, Off. 1 ～ 999min (unit:1)
Initial value : Off

Set conditions for automatic stop.
At the Temp setting, the unit will stop automatically according to the increase in the vapor temperature.
See the description on the stop temperature (Stop Temp).
When Off is selected, operation will continue until it is stopped with the Run/Stop key.

* You can quickly change the values by turning the dial key faster.

■Setting screen



(5) Setting a vapor temperature (Set Temp)

Setting range : Auto, 0 ～ 150.0℃(unit:0.1)

Initial value : Auto

Pressure will be determined automatically according to the set vapor temperature (Mark Press) and fixed-value operation will be carried out.
In the Auto setting, pressure (Mark Press) will be determined automatically as in the case of the AUTO mode.

* You cannot modify settings once slope operation has started.
* When you have set a temperature, the mark for controlling with the vapor temperature sensor will be displayed.
* You can quickly change the values by turning the dial key faster.

(6) Setting of a Stop Temperature (Stop Temp)

This setting will be valid when you have set the operation stop condition (Auto Stop) to Temp.

Setting range : (Adjust Temp+0.1) ～ 15.0℃(unit:0.1)

Initial value : 3.5 ℃

When a temperature measured on the vapor temperature sensor reaches the sum of the vapor temperature (Set Temp) and the stop temperature (Stop Temp) operation will stop.

* Make this setting larger if operation stops too early and make it smaller if operation stops too late.

(7) Setting of a adjusting temperature (Adjust Temp)

Setting range : 0.1 ～ (Stop Temp-0.1)℃ (unit:0.1)

Initial value : 1.5 ℃

When one of mixed solvents has been used up, you can resume decompression automatically and determine a pressure for the next solvent automatically.
When a measured vapor temperature reaches the sum of the vapor temperature （Set Temp) and the adjustment temperature (Adjust Temp) decompression resumes.

(8) Setting a count of adjustment (Mark Count)

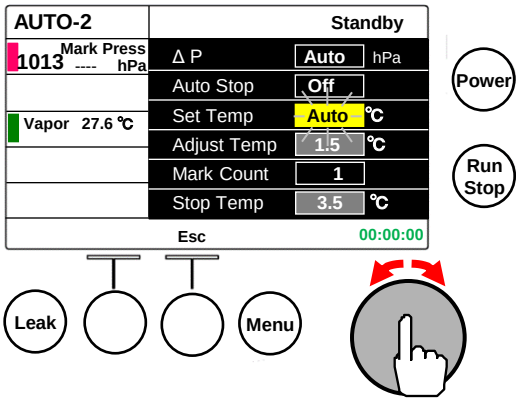
Setting range: 1 ～ 10, Unlimited

Initial value : 1

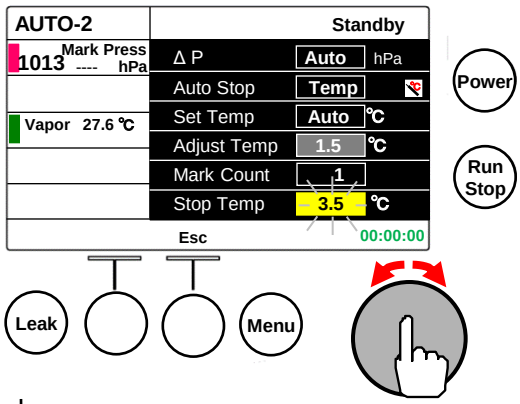
You can set a count of adjustment for mixed solvents.
Initial determination after slope control shall be the first count for automatic determination of a pressure/.
At Unlimited, pressure will be adjusted based on the adjustment temperature for an unlimited number of times.

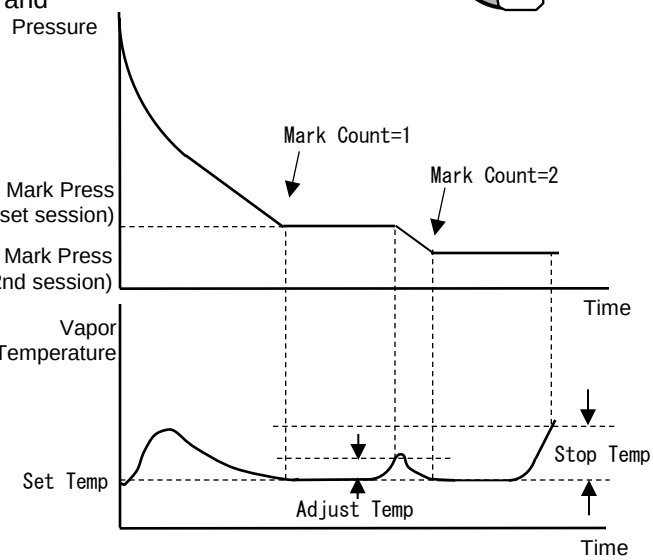
* When pressure will not be adjusted for example, for a single solvent, set this item to 1.
* When conditions for automatic stop are met before the set count of adjustment is reached, operation will be automatically stopped.
* When 2 or larger count is set for the count of adjustment, the mark will appear indicating that control is being made with a sensor.

■Setting screen

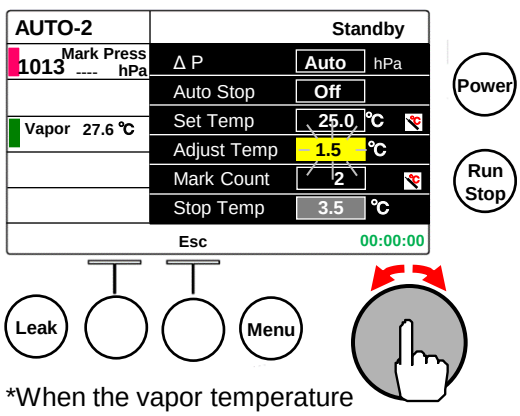


■Setting screen





■Setting screen



*When the vapor temperature sensor is connected

5-5 Operations in the PROGRAM (Slope Control) mode

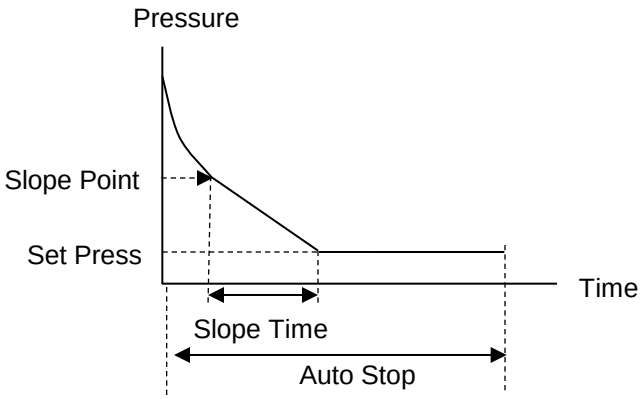
The product has a database of 65 solvents in total including 55 kinds of solvents including pre-registered 10 solvents (pre-registered solvents) and 10 user solvents which the user can freely set.
You can freely change registered solvents with those in the database.

After operation has started, slope control shall be carried out between the slop start pressure (Slope Point) and the fixed-pressure (Set Press) for the slope time (Slope Time) and fixed-control will be performed at the fixed-pressure.

You can stop the unit automatically based on the operation time by setting an operation stop condition (Auto Stop).

You can stop the unit automatically based on the temperature increase margin from the vapor temperature by using a vapor temperature sensor (optional).

* The setting of the programs for 55 solvents has been selected to realize the optimal condition at the bath temperature of 40℃, the cooling water temperature between 5 and 10℃, and the room temperature of 25±3℃.



User solvents are allocated to No.56～65 in the database and you can change their settings as well as set a solvent name up to 18 characters. Characters available are alphanumeric characters, space and symbols (,.-+*/()).

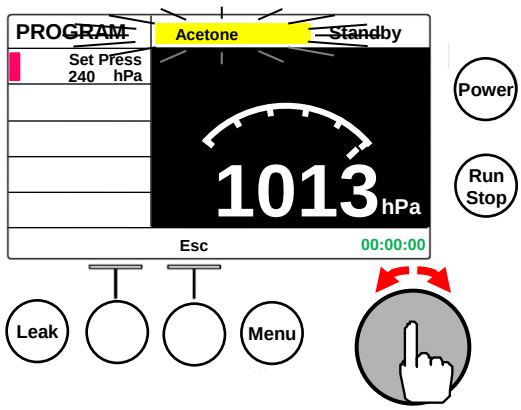
(1) Solvent select (Program Select)
Initial value: [Acetone]

You can select a solvent on the control mode select screen. When you press the dial key, the cursor at the solvent name will change to yellow. Turn the dial key to display the solvent name you want and press it to determine.

The registered solvents at the factory shipping are as follows:

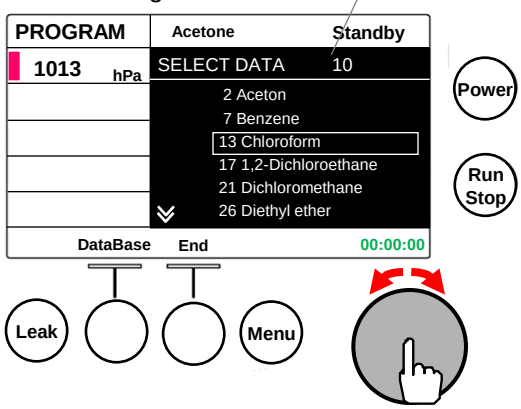
No : Solvent name	(Slope Point→Set Press	: Slope Time)
2 : Acetone	(350hPa→240hPa	: 3min)
7 : Benzene	(160hPa→ 90hPa	: 2min)
13 : Chloroform	(380hPa→200hPa	: 3min)
17 : 1,2-Dichloroethane	(180hPa→ 70hPa	: 3min)
21 : Dichloromethane	(950hPa→480hPa	: 3min)
26 : Diethyl ether	(800hPa→550hPa	: 3min)
30 : Ethyl acetate	(266hPa→ 93hPa	: 2min)
35 : Hexane	(280hPa→160hPa	: 2min)
52 : Toluene	(90hPa→ 20hPa	: 4min)
53 : 1,1,1-Trichloroethane	(340hPa→160hPa	: 3min)

■Control mode select screen



No. of registered solvents

■Solvent registration screen



You can select a solvent from the solvent registration screen as well.
The selected solvent is indicated with a light blue cursor and others are indicated with a black frame cursor.
Turn the dial key to move the cursor to the solvent you want and then press it to determine.

* You can change each of the settings according to the operating conditions.
See P.30 for how to change settings.

* See P.31 for how to change the registered solvents.

(2) Changing settings

You can change each of settings for each solvent separately according to the use conditions.
Changing of settings is made on the Setting screen.
You can move to the Setting screen by first selecting a solvent of which you want to change the setting on the solvent registration screen, and then pressing the dial key.
The items you can change settings are as follows:

- Fixed pressure (Set Press)
  Setting range : VAC、1 ～ 1013hPa(unit:1)
- Slope start pressure (Slope Point)
  Setting range : 1 ～ 1013hPa(unit:1)
- Slope time (Slope Time)
  Setting range : 1 ～ 999min(unit:1)
- Hysteresis (control width) (ΔP)
  Setting range : Auto, 1 ～ 20hPa(unit:1)
  Initial value : Auto

  This shown a percentage (%) to the target slope value during slope control and the control width during fixed-value control.
  In the Auto setting, automatic control is performed with 2% of the target pressure set as ΔP.

  * No setting is necessary for the inverter pump.

- Operation stop conditions (Auto Stop)
  Setting range : Off, 1 ～ 999min(unit:1), Temp
  (When the vapor temperature sensor is connected)
  Initial value : Off

  The unit will stop automatically when the set time has elapsed since the start of operation.
  When Off is selected, operation will continue until it is stopped with the Run/Stop key.
  When Temp is selected, operation will stop based on the margin of temperature increase (Stop Temp) from the vapor temperature.

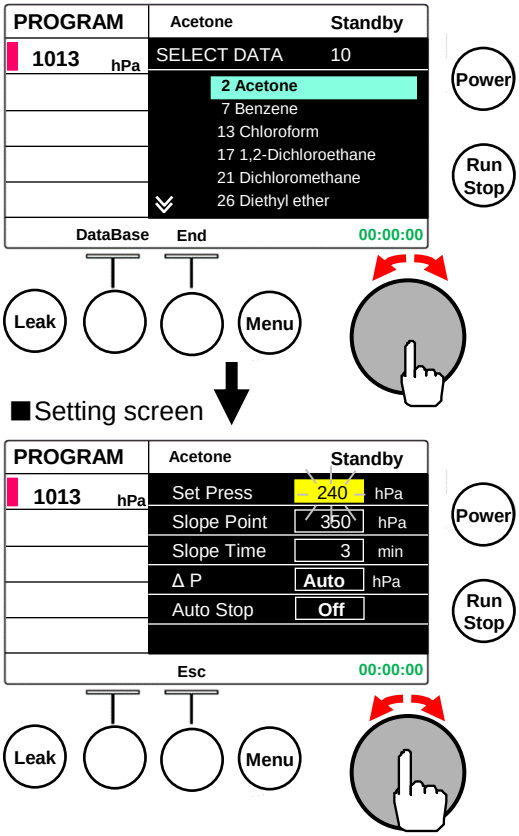
- Stop temperature (Stop Temp)
  This setting will be valid when you have set the operation stop condition (Auto Stop) to Temp.
  Setting range : 0.1 ～ 15.0℃(unit:0.1)
  Initial value : 3.5℃

  When a temperature measured on the vapor temperature sensor reaches the sum of the vapor temperature and the stop temperature (Stop Temp) operation will stop.

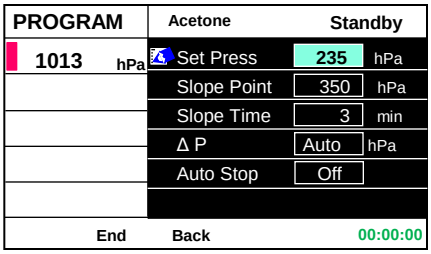
  * Make this setting larger if operation stops too early and make it smaller if operation stops too late.

* The mark  will appear on items or solvents for which settings have been changed. (Excluding ΔP, Auto Stop, and Stop Temp)

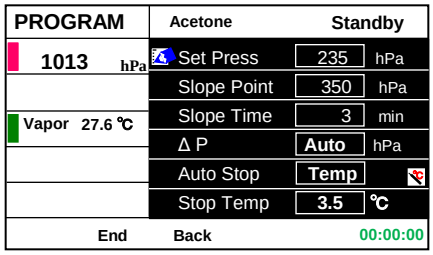
■Solvent registration screen



■Setting screen

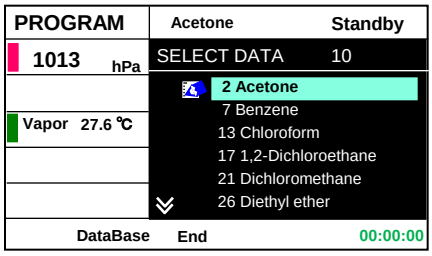


■Setting screen



※ When the vapor temperature sensor is connected

■Solvent registration screen



※ When the vapor temperature sensor is connected

(3) Changing registered solvents

When the solvent you are going to use is not in the registered solvent list, you can add/replace it from the database.
Change of registered solvents is made on the Database screen.
To switch to the Database screen, press the [DataBase] key on the solvent registration screen.

* There is no restrictions on the number of solvents to register.

* The numbers on the right of SELECT DATA on the Solvent registration screen indicate the total number of solvents registered.

Change of registered solvents is made following the steps below:

Select a solvent to add or delete.
Press the [DataBase] key on the Solvent registration screen to display the Database screen.
To add a solvent, turn the dial key to move the cursor on the name of the solvent to add and then press the dial key to put a check mark on it. To delete a solvent, turn the dial key to move the cursor on the name of the solvent to delete and press the dial key to delete the check mark of it.

Repeat these steps to change more solvents.

Press the [End] key to return to the Solvent registration screen.

* Registered solvents are checked with ☑ on the Data base screen.

• The mark  will appear on solvents for which settings have been modified.

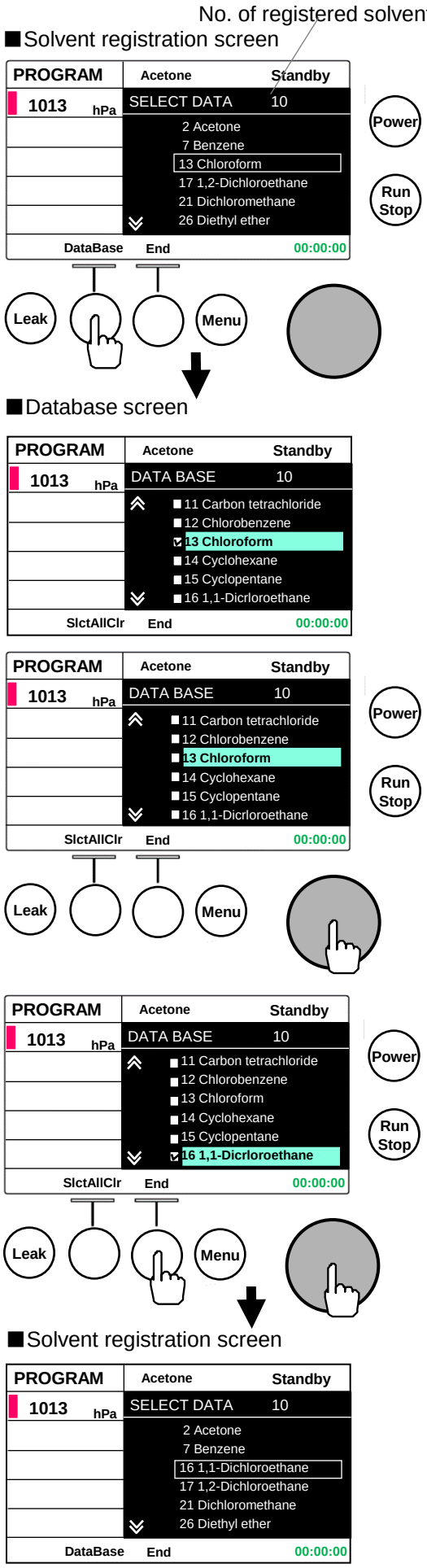
* If you have deleted a solvent that as been selected, the next solvent in the registered solvent list will be selected.

* If you delete all solvents in the registered solvent list, the solvent name column on the Control mode select screen will show "NO SELECT DATA" and you cannot operate the unit in the Program mode.

* Press the [SlctAllClr] key to delete all of the registered solvents.

* The solvent you add will be added to the position next to the cursor on the Solvent registration screen.

* The changed settings will remain even if solvents are deleted from the registered solvent list.



(4) User solvents

You can set solvent names and settings as user solvents in No.56～65 of the database according to your objectives.

The initial settings are as follows.
Change them to your specific objectives.

Fixed pressure (Set Press) : 200 [hPa]
Slope starting pressure (Slope Point): 400 [hPa]
Slope time (Slope Time) : 5 [min]
Hysteresis (Δ P) : Auto
Operation stop condition (Auto Stop) : Off
Stop temperature (Stop Temp) : 3.5 [℃]
Solvent name (Name) : User-01 ～ User-10

Settings and solvent names can be changed in the setting screen.
Follow the procedures below to display the setting screen.
Select a user solvent to change in the database screen.
("User-01" in the upper right example)
Press the [End] key to change to the solvent register screen.
Move the cursor to the solvent to change, press the dial key to change to "SELECT DATA" for solvents.
Then press the dial key again to change to change to the setting screen.

Items whose settings can be changes are as follows.

- Fixed value pressure (Set Press)
  Setting range : VAC , 1 ～ 1013 hPa (Scale:1)

- Slope start pressure (Slope Point)
  Setting range : 1 ～ 1013 hPa (Scale:1)

- Slope time (Slope Time)
  Setting range : 1 ～ 999 min (Scale:1)

- Hysteresis (ΔP)
  Setting range : Auto , 1 ～ 20 hPa (Scale:1)

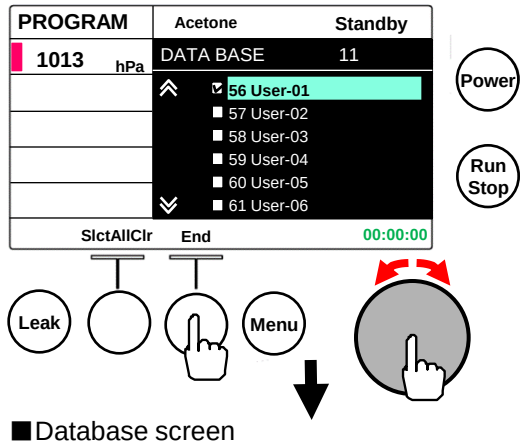
  *No settings are necessary for the inverter pump.

- Operation stopping condition (Auto Stop)
  Setting range: Off , 1 ～ 999 min (Scale:1)
  Temp (When a vapor temperature sensor is connected)

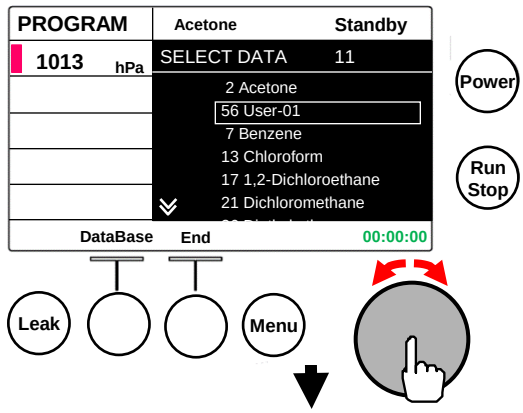
- Stop temperature (Stop Temp)
  It is valid when the operation stopping condition (Auto Stop) is set to Temp.
  Setting range : 0.1 ～ 15.0 ℃ (Scale:0.1)

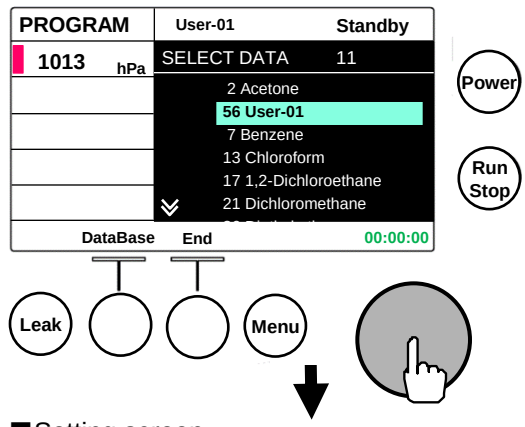
- Solvent name (Name)
  You can set a solvent name up to 18 alphanumeric characters, space and symbols (,.-+*/()).
  See P.33 for setting procedures.

■Solvent registration screen

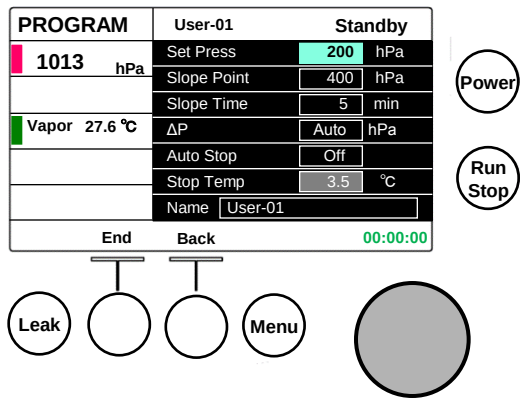


■Database screen





■Setting screen



* When a vapor temperature sensor is connected

(5) Setting a name of a user solvent

In the setting scree, turn the dial key to move the cursor to the solvent name and press the dial key to start setting. Characters will change to yellow one by one from the left most character and turn the dial key to select the character. When you have selected the first character, press the [➡] key to move the yellow highlight to the next character and turn the dial key to select the character.

Solvent names shall be up to 18 characters. Available characters are: alphanumeric characters, space and eight symbols:

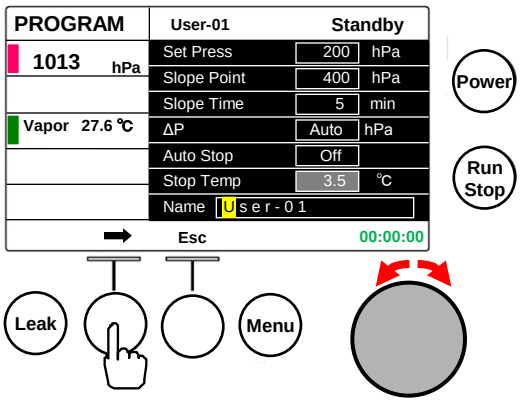
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789,.-+*/()

*Operations to delete or insert a character are not available.

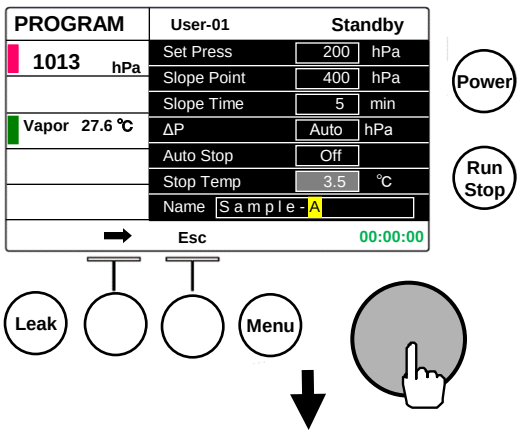
When you have entered to the last character, press the dial key to determine the solvent name.

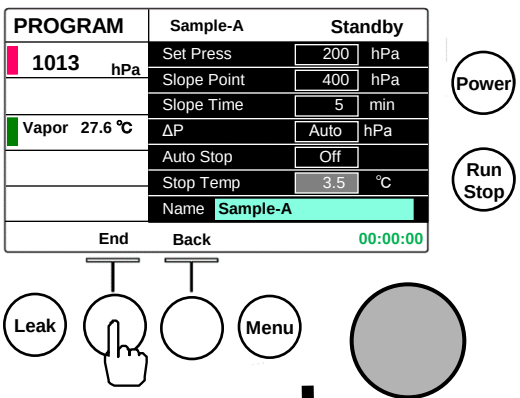
Press the [End] key to switch to the solvent register screen.

■Setting screen

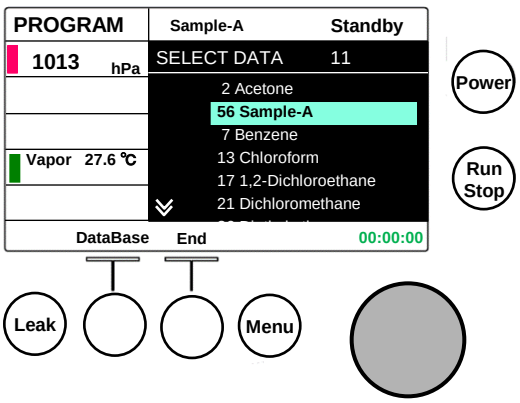


* When a vapor temperature sensor is connected





■Solvent registration screen

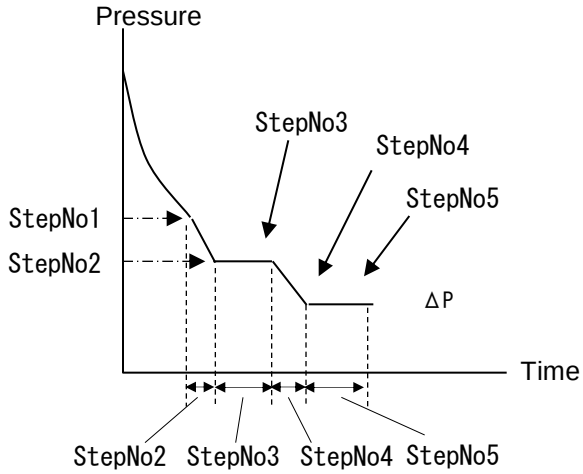


5-6 STEP PROGRAM(Step Program) Mode operations

There are five programs up to 99 steps each to be used as a programed vacuum controller which allows programming of fixed-value control, slope control and release to the atmosphere.

Fixed-value control will be made for the set time .

In slope control, decompression will be made at the set time from the slope start pressure （set pressure of the previous step） to the set pressure.



You can set a step program on the Program setting screen. The items and the initial values of the steps are as follows:

Set pressure	(Press)	: VAC [hPa]
Step operation time	(Time)	: 0 [min]
Hysteresis	(ΔP)	: Auto
Control condition select	(Condition)	: Step
Selecting a priority condition	(Priority)	: Press

* Setting the control condition select (Condition) to Step starts the fixed value control and setting it Slope start slope control.

* Setting priority condition select (Priority) to Press continues the present step until the set pressure is attained after the set time has elapsed.
  When it is set to Time, the process will move to the next step when the step operation time has elapsed.

* For the inverter pump, you do not need to set a hysteresis (ΔP).

You can set program operations on the Program setting screen. The items and the initial values are as follows:

Starting Step No.	(Start Step No)	: 1
Finishing Step No.	(Finish Step No)	: 5
Number of repetitions	(Repeat)	: 1
Auto Leak	(Leak)	: ON
Auto Cleaning	(Auto Cleaning)	: 3 [min]
Recovery from Power Failure	(Power Fail)	: Cont

You can set a program on the Program setting screen.

Turn the dial key to move the cursor to the item you are going to make setting for.

* Turning the dial key clockwise will move the cursor in the following order:
StepNo → Press → Time → ΔP → Condition → Priority → next step・・・

Press the dial key to start setting.
(The indication color will change from light blue to yellow.)
Turn the dial key to change the value to the value you want and press to determine.

(1) Set pressure (Press)

Setting range：VAC, 1 ～ 1013hPa(unit:1), Atmo
Initial value :VAC

VAC Decompression is made continuously.
Atmo The leak valve is opened and decompression is released.

* You can quickly change the values by turning the dial key faster.

(2) Set time (Time)

Setting range：0 ～ 999min(unit:1)
Initial value ：0

* You can quickly change the values by turning the dial key faster.

* If you set Time to [0] for slope control, pressure will change to the set pressure at the highest rate.

(3) Hysteresis (control width) (ΔP)

Setting range：Auto, 1 ～ 20hPa(unit:1)
Initial value ：Auto

In the Auto setting, automatic control is performed with 2% of the set pressure set as ΔP.

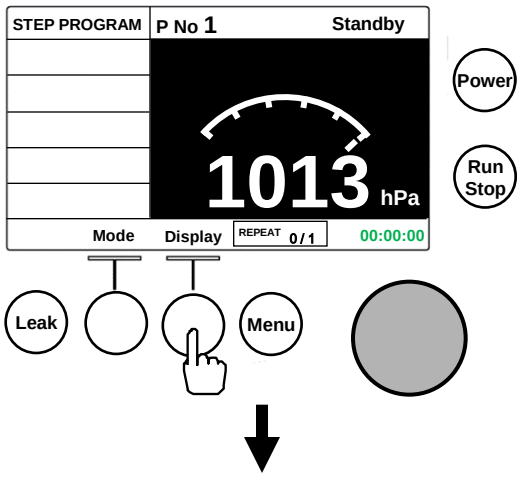
* No setting is necessary for the inverter pump.

(4) Control condition select (Condition)

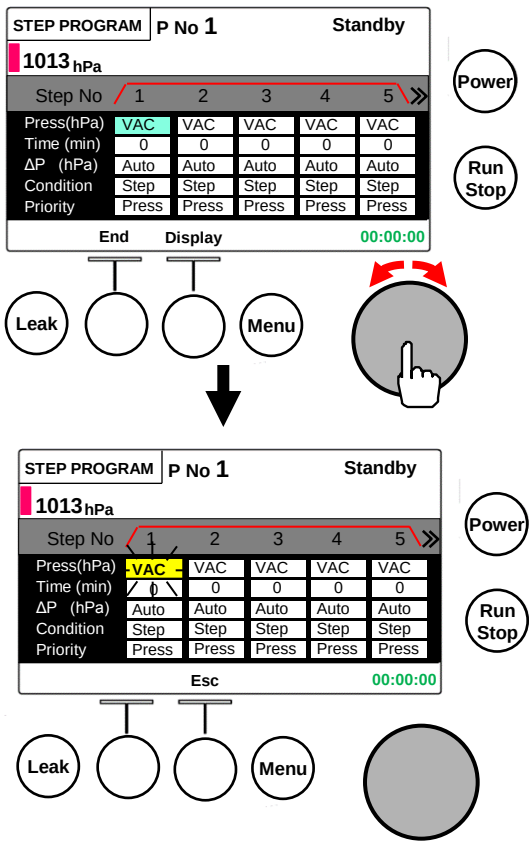
Setting conditions：Step, Slope
Initial value：Step

Step Performs fixed value control at the set pressure for the set duration.
Slope Controls the slope so that it follows the line that connects the slope start pressure (set press of the previous step) and the set pressure based on the set time. When Slope is set for the first step after operation has started, the pressure measured at that time will be set as the slope start pressure.

■Control mode select screen



■Program setting screen



(5) Selecting a priority condition (Priority)

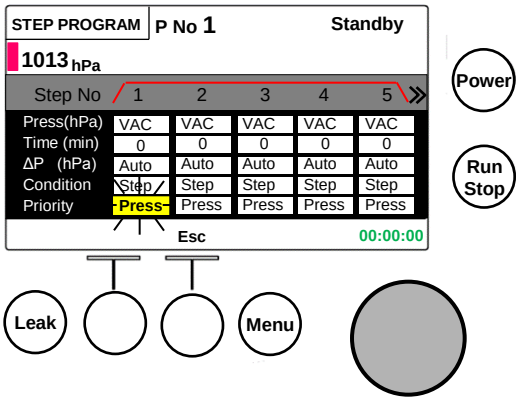
Setting conditions : Press, Time

Initial value : Press

Press The present step will continue until the set pressure is attained after the set time has elapsed by putting priority on the pressure.

Time The step will move to the next step after the set time has elapsed with the time prioritized.

■Program setting screen



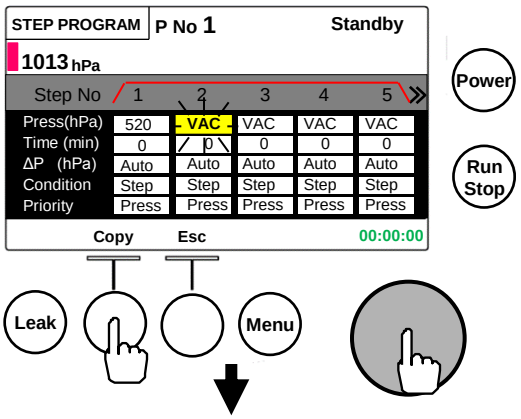
(6) Copy [Copy]

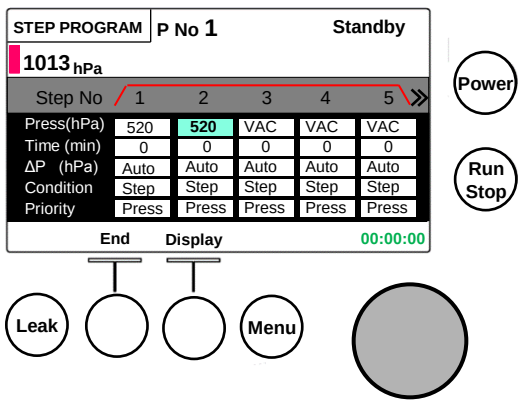
You can copy the settings for the previous step when make settings for the Step No.2 and following steps.

Pressing the [Copy] key after staring setting, the settings for the previous step will be copied for the item.

* At this stage, the settings are only copied and not determined.

Press the dial key to determine.





(7) Insert [Ins], deletion [Del] and movement of display of a step

You can insert or delete steps.

Turn the dial key to move the cursor to a step No.

Pressing the dial key changes the color of the step No. and its settings to yellow.

Pressing the [Ins] key inserts a new step before the current step.

(Initial value: VAC, 0, Auto, Step, Press)

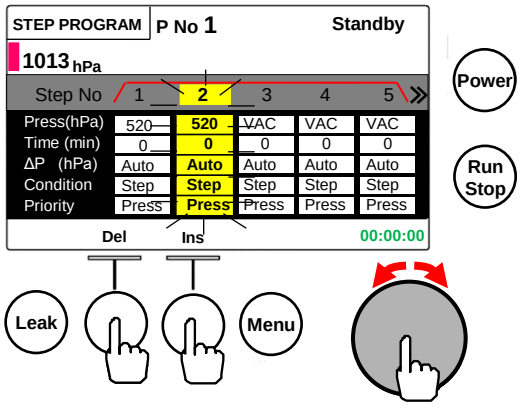
【Caution】

You cannot insert a step when a setting is already entered in Step No.99.

Pressing the [Del] key deletes the current step.

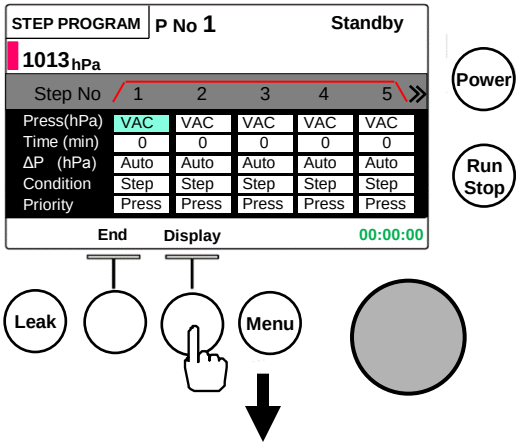
Turning the dial key moves the step at the cursor position.

Pressing the dial key returns to the original indication.



After having completed setting of each step, make settings for operation on the Program operation setting screen.
You can display the Program operation setting screen by pressing the [Display] key on the Program setting screen.
You can make setting for the five Step programs. separately.

■Program setting screen



(8) Starting Step No（Start Step No）

Setting range：1 ～ (Setting for the finishing step)
Initial value　：1

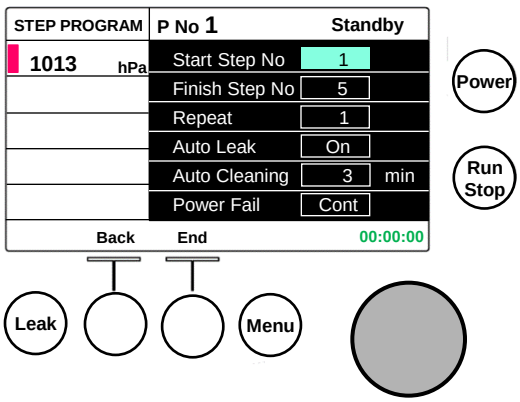
You set the start step No. for a program.
The range to execute is indicated with a red line （ ）.

(9) Finishing Step No（Finish Step No）

Setting range：(Setting for the start step) ～ 99
Initial value　：5

You can set the start step No. for a program
The range to execute is indicated with a red line （ ）.

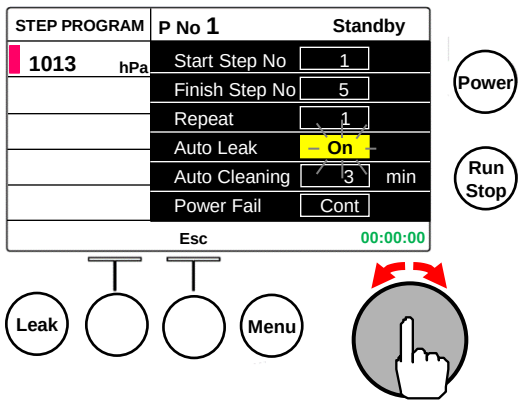
■Program operation setting screen



(10)　　Number of repetitions (Repeat)

Setting range：∞ , 1 ～ 999
Initial value　：1
You can set a number of repetitions for a step program.
Your program will be repeated for the number of times you have set.
When ∞ is set, the program will be repeated for the unlimited times.

■Program operation setting screen



(11) Auto Leak (Auto Leak) setting
Setting range:On, Off
Initial value　：On

You can set On or Off for the release of decompression at the end of operation.

When it is set to On, a series of operation "Pump output Off→Auto leak" will be carried out automatically when operation has completed.

【Caution】
Note that auto cleaning will not operate while Auto Leak is set at Off.
In principle, set Auto Leak to On.

(12) Auto Cleaning (Auto Cleaning）setting
Setting range：Off, 1 ～ 10min(unit:1)
Initial value　：3 min
You can set an Auto cleaning time for the pump and the control solenoid valve after Auto Leak.

【Caution】
In principle, do not set Auto cleaning Off because it purges liquefied steam from the control solenoid valve or diaphragm vacuum pump. (Set a time.)

(13) Setting for recovery from power failure (Power Fail)

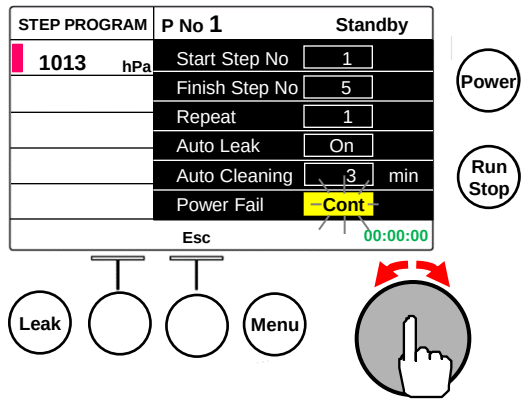
Setting range: Cont, Stop

Initial value: Cont

You can set an operation mode after recovery from a power failure which may have occurred during step program operation.

When Cont (Continue) is selected, the operation of the step that had been operated before the power failure will resume.
When Stop (Stop) is selected, operation will stop.

■Program operation setting screen

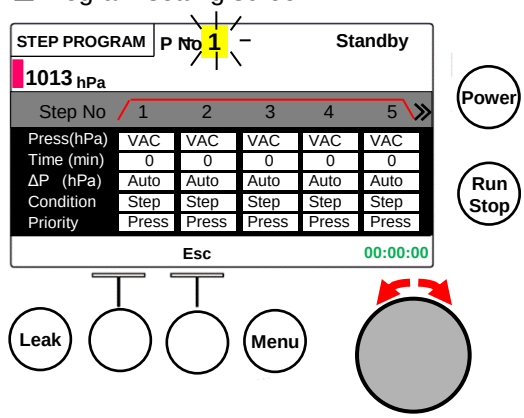


(14) Setting a program No.

You can save up to 5 step programs.

Turn the dial key anticlockwise to move the cursor to the program number to the right of "P No." and press the dial key to start setting.
Turning the dial key clockwise changes the No. as 1→2→3→4→5 and turning it anticlockwise changes the No. as 5→4→3→2→1.
Press the dial key to determine the Program No. you have selected.

■Program setting screen

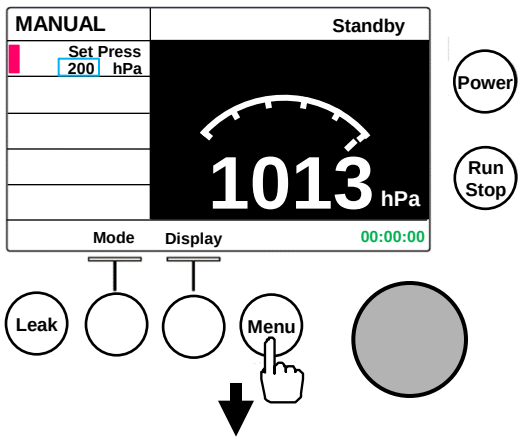


5-7 Setting parameters

You can make settings of various operations or reset data you have changed on the system parameter setting screen.
You can move to the system parameter setting screen by pressing [Menu] key.
There are three types of the system parameter setting screens. Switch the indication with the [Menu] key and press the [End] key to return to the Control mode select screen.

* The System parameter 3 setting screen will not appear during operation.

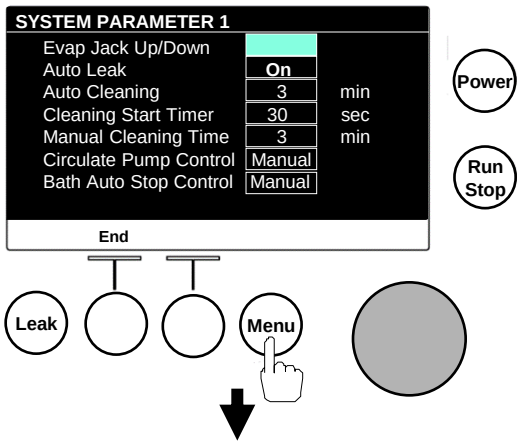
■Control mode select screen



System Parameter 1 Setting screen [SYSTEM PARAMETER 1]

(1) Operation of the evaporator jack (Evap Jack Up/Down)
This screen is displayed while N-1210B or N-2110 is connected.
Press the dial key to highlight this item in yellow, and click the key once to perform jack up or jack down for a short time.
Turn the key clockwise to jack up and anticlockwise to jack down.
To finish, press the dial key to return the color to light blue.

■System Parameter 1 Setting screen

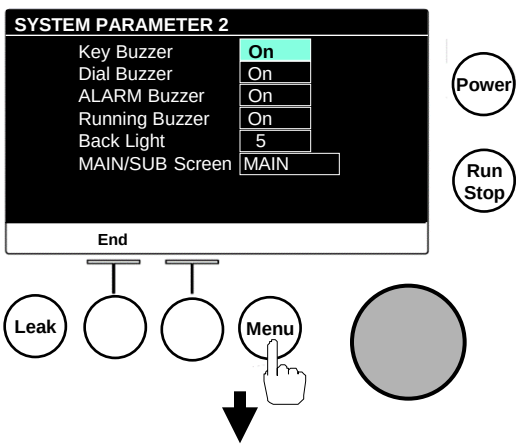


(2) Automatic Leak (Auto Leak)
Setting range: On, Off
Initial value : On
You can set the release of decompression at the end of operation.
When you select On, Auto Leak will be carried out at the end of operation.
When you select Off, Auto Leak and Auto Cleaning will not be carried out at the end of operation.

* Step program operation is controlled according to the setting on the Program operation setting screen.

【Caution】
Note that auto cleaning will not operate while Auto Leak is set at Off.
In principle, set Auto Leak to On.

■System Parameter 2 Setting screen

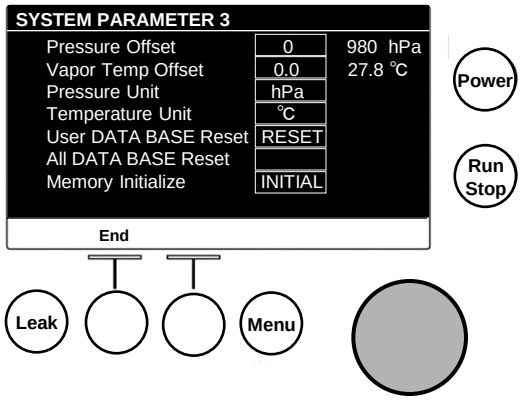


(3) Auto Cleaning (Auto Cleaning)
Setting range : Off, 1 ～ 10min(unit:1)
Initial value : 3 min
You can set an Auto cleaning time after Auto Leak has completed.
When Off is selected, Auto cleaning will not be carried out after Auto Leak.

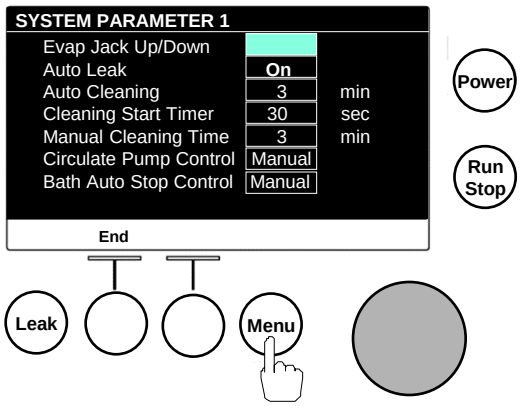
* Step program operation is controlled according to the setting on the Program operation setting screen.

【Caution】
In principle, do not set Auto cleaning Off because it purges liquefied steam from the control solenoid valve or the diaphragm vacuum pump.
(Set a time.)

■System Parameter 3 Setting screen



■System Parameter 1 Setting screen



(4) Setting of a Cleaning Start Time （Cleaning Start Timer）
Setting range：0 ～ 60sec (unit:1)
Initial value ：30 sec
You can set a wait time from completion of auto leak after operation before auto cleaning starts.

(5) Manual Cleaning Time （Manual Cleaning Time）
Setting range：1 ～ 10min(unit:1)
Initial value ：3 min
You can set a manual cleaning time.

(6) Control of the coolant circulation pump （Circulate Pump Control）
Setting range：Manual, Auto
Initial setting：Manual
Control for the circulation pump of the coolant circulation unit when it is connected with the NVC communication cable.
Manual setting: Does not control the circulation pump.
Auto setting: Circulation pump is turned ON at the start of operation and the pump is turned OFF when operation is stopped.
See P.43 “Controlling related units connected via NVC communication” for details.

(7) Auto stop control of the bath temperature control(Bath Auto Stop Control）

Setting range：Manual, Auto
Initial setting：Manual

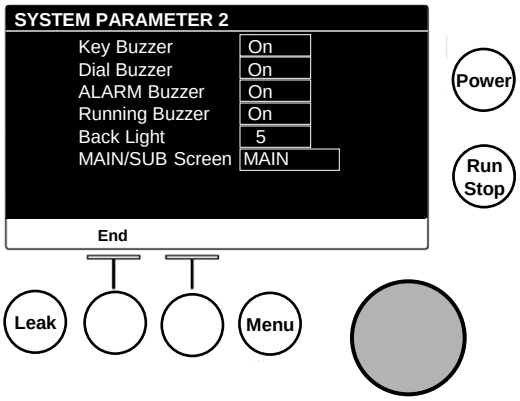
You can set auto stop of temperature control for the bath interlocked with NVC or the evaporator when the water bath or the oil bath is connected with the NVC communication cable.

Manual setting: Does not perform auto stop of temperature control. Temperature control is stopped when “(12) System Alarm” occurred.

Auto setting: Stops temperature control of the bath interlocked with the operation stop of NVC. When the evaporator is connected with the NVC communication cable, bath temperature control is stopped about 2 seconds after turning the evaporator power OFF.

* Bath temperature control can be started from the bath only.

■System Parameter 2 Setting screen



(8) Key Buzzer (Key Buzzer)
Setting range: On, Off
Initial value : On

You can set a beep sound (On/Off) when you operate the Run/Stop key, the Operation key, or the Leak key.

(9) Dial buzzer (Dial Buzzer)
Setting range: On, Off
Initial value : On

You can set a beep sound (On/Off) when you turn or press the dial key.

(10)Alarm Buzzer (ALARM Buzzer)
Setting range: On, Off
Initial value : On

You can set the alarm sound (On/Off) when an alarm is triggered.

(11)Running Buzzer (Running Buzzer)
Setting range: On, Off
Initial value : On
You can set a buzzer sound (On/Off) to notify that an operating phase is switched during operation.

* The running buzzer will sound when:
- When the screen switches from the initial screen after power is turned on
- When proceeding to the next step during Step program operation
- At the end of operation
- At the start and the end of Evaporator link operation

(12) LCD back light (Back Light)
Setting range : 1～9 (Scale:1)
Initial setting : 5
You can set the brightness of the LCD back light.

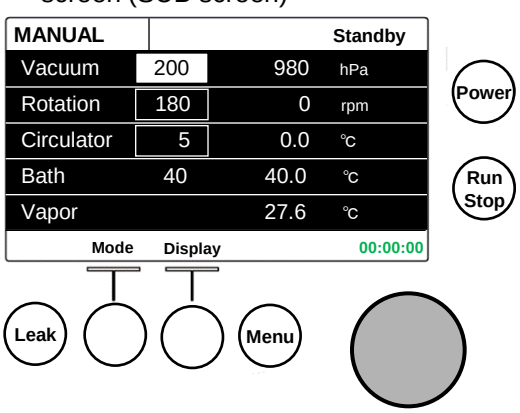
(13) Selection of a display screen (MAIN/SUB Screen)
Setting range: MAIN, SUB, MAIN+SUB
Initial setting : MAIN

You can set a screen to be displayed when the [Display] key is pressed.

MAIN setting: Control mode setting screen (MAIN screen) is displayed.
SUB setting: Communication system control screen (SUB screen) is displayed.
MAIN+SUB setting: Both the control mode setting screen and the communication system control screen are displayed.

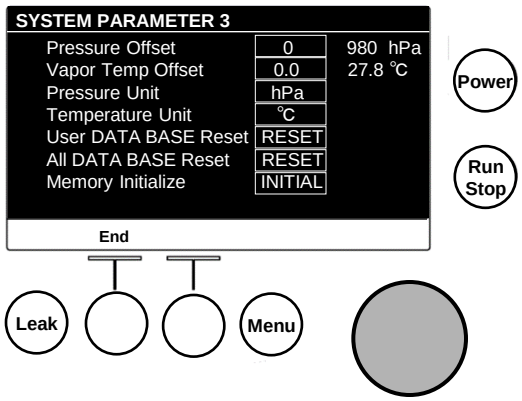
*See P.22 for the communication system control screen.

■ Communication system control screen (SUB screen)



System Parameter 3 Setting screen [SYSTEM PARAMETER 3]

■ System Parameter 3 Setting screen



* The System parameter 3 setting screen will not appear during operation.

(14) Pressure Offset (Pressure Offset)
Setting range：-30 ～ 30(unit:1)
Initial value ：0 hPa
You can set display offset for a measured pressure.

(15) Vapor temperature offset (Vapor Temp Offset)
Setting range：-3.0 ～ 3.0℃(unit:0.1)
Initial value ：0 ℃
You can set display offset for a measured vapor temperature.

(16) Changing the pressure unit (Pressure Unit)
Selectable unit：hPa, kPa, mbar, mmHg,Torr
Initial setting：hPa
You can set a pressure display unit.

(17) Changing the temperature unit (Temperature Unit)
Selectable unit: ℃, K
Initial setting: ℃
You can set a temperature display unit.

(18) Reset of the user solvent database (User DATA BASE Reset)
Resets the user solvent settings of the PROGRAM mode to the initial settings.

Move the cursor to User DATA BASE Reset and press the dial key to display the [YES] and the [NO] keys.
Press the [YES] key to reset.
Press the [YES] key to reset.

(19) Database reset （All DATA BASE Reset）
This function resets the PROGRAM mode settings to the initial settings.

* Resetting the database also resets all settings changed in the program mode including the user solvents to the initial settings. Be sure to note any necessary parameter settings before reset.

Move the cursor to All DATA BASE Reset and press the dial key to display the [YES] and the [NO] keys.
Press the [YES] key to reset.
Press the [YES] key to reset.

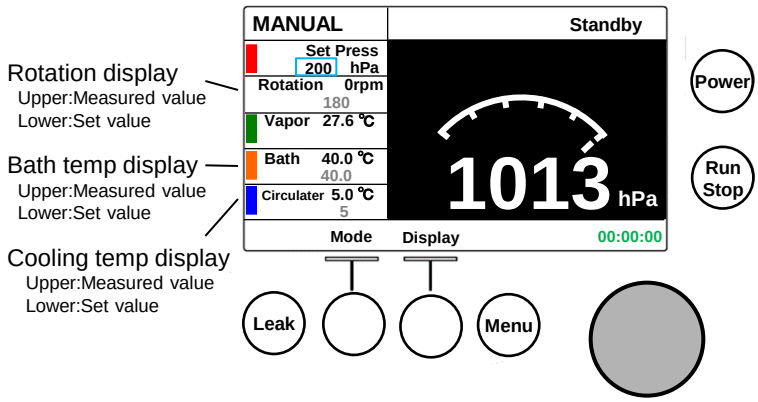
(20) Initialize (Memory Initialize)
This function resets all settings to the initial settings.
The user solvent database and the database will also be reset.

* Note any important parameter settings before initializing which returns any values changed after purchase to the initial settings.

Move the cursor to Memory Initialize and press the dial key to display the [YES] and [NO] keys.
Press the [YES] key to initialize.
Press the [NO] key to cancel.

5-8 Operations of related units connected via NVC communication

When you connect a related units with an NVC communication cable and turn its power ON, communication will start.
LCD display shows measured values and set values.
（Control mode select screen, setting screen, graph screen, solvent registration screen, database screen)

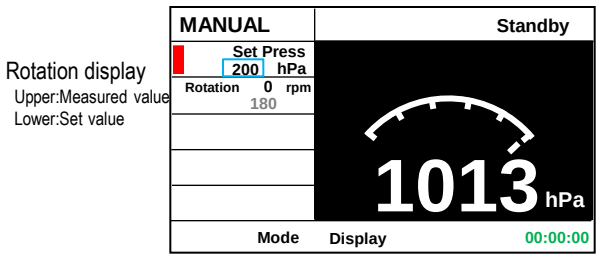


5-8-1. Evaporator

(1) Model N-1300 evaporator
Measured rotations and settings are displayed.

When operation of NVC is started, N-1300 starts rotation and when operation of NVC is stopped, rotation of N-1300 stops.
When rotation of N-1300 is started, operation of NVC starts and when operation of N-1300 is stopped, operation of NVC stops when rotation of the flask is stopped.

When an alarm occurs in any of other units connected with the NVC communication cable, “(12)System Alarm” is triggered and rotation of N-1300 is stopped.

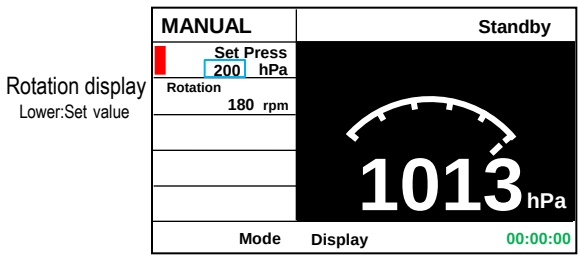


Display example when model N-1300 is connected

(2) Model N-1210B evaporator
Set number of rotations is displayed.

When operation of NVC is started, rotation of N-1210B starts and when operation of NVC is stopped, N-1210B will be jacked up automatically after its rotation has stopped.
When rotation of N-1210B is started, operation of NVC starts and when operation of N-1210B is stopped, operation of NVC is stopped and jacked up automatically after rotation of the flask has stopped.

When an alarm occurs in any of other units connected with the NVC communication cable, “(12)System Alarm” is triggered and N-1210B will be jacked up automatically after its rotation has stopped.

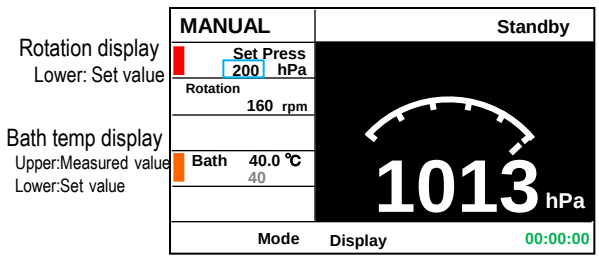


Display example when model N-1210B is connected

(3) Model N-2110 evaporator
Set number of rotations, measured value of the bath and the set value are displayed.

When operation of NVC is started, rotation of N-2110 starts and when operation of NVC is stopped, N-2110 will be jacked up automatically after its rotation has stopped.
When rotation of N-2110 is started, operation of NVC starts and when rotation of N-2110 is stopped, operation of NVC is stopped and will be jacked up after rotation of the flask has stopped.

When an alarm occurs in any of other units connected with the NVC communication cable, “(12)System Alarm” is triggered and temperature control of N-2110 bath is stopped and will be jacked up automatically after its rotation has stopped.



Display example when model N-2110 is connected

5-8-2. Bath

Measured values and set values are displayed.

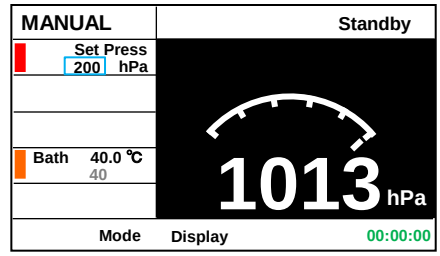
Setting Bath Auto Stop Control in the system parameter 1 setting screen to Auto activates the following interlocked operations.

Temperature control of the bath is stopped interlocked with the operation stop of NVC. When the evaporator is also connected, temperature control of the bath will be stopped in about 2 seconds after the evaporator is turned OFF.

Interlocked operations above are not made when Bath Auto Stop Control is set to Manual.

When an alarm occurs in any of other units connected with the NVC communication cable, "(12)System Alarm" is triggered and temperature control of the bath is stopped.

Bath temp display
Upper:Measured value
Lower:Set value



Display example when model SB-1300, OSB-2200 is connected

5-8-3. Coolant circulation unit

Measured values and set values are displayed.

Setting Circulate Pump Control in the system parameter 1 setting screen to Auto activates the following interlocked operations.

When operation of NVC is started, the circulation pump is turned ON to start circulation of coolant. (Temperature control, if it is stopped, is started.)
When operation of NVC is stopped, the circulation pump is turned OFF and circulation of coolant is stopped. Stopping circulation of coolant minimizes condensation and operation time of the freezer.
While circulation is stopped, the coolant temperature setting is changed to the temperature below and intermittent operation that repeatedly turns the circulation pump ON for one minute in about every 30 minutes to prepare for the next operation of the evaporator.
The setting of temperature is returned to the original setting when operation of NVC is started.

CA-1116A : Set temperature during stop = Original set temperature - 5℃
CA-1330 : Set temperature during stop = Original set temperature - 5℃
CCA-1112A: Set temperature during stop = Original set temperature - 10℃

* Changed within the set temperature range of each unit.

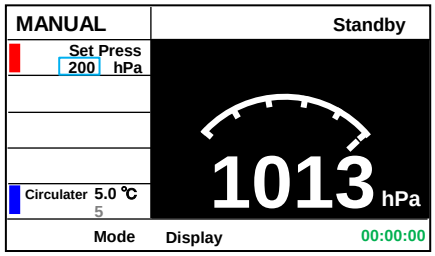
* When the set temperature is 4～9℃(model CA-1116A, CA-1330) or 4～14℃(model CCA-1112A), set the temperature during stop to 4℃ to prevent freezing.

When the evaporator is also connected, the circulation pump is turned OFF in about 2 seconds after the evaporator power is turned OFF to stop temperature control.

Interlocked operations above are not made when Circulate Pump Control is set to Manual and manual operation of the coolant circulation unit only will be made.

When an alarm occurs in any of other units connected with the NVC communication cable, "(12)System Alarm" is triggered and temperature control of the coolant circulation unit is stopped and the circulation pump is turned OFF.

Cooling temp display
Upper:Measured value
Lower : Set value



Display example when model CA-1116A,CA-1330, or CCA-1112A is connected

5-9 Treatment after operation

5-9-1. When you are going to continue operation

(1) Prepare the decompression container (concentrating unit), the cooling circulator, the vacuum pump and the solvent control unit for continued operation.

※When a waste trap is used, check the amount of waste in it. Remove the waste before its amount exceeds 2/3 of the trap container capacity.
The waste trap may not be functional if the waste amount exceeds the 2/3 of the container capacity.

※When the receiving flask contains considerable amount of collected liquid, remove it and process.

(2) Repeat operations as specified in the manual.

5-9-2. When finishing use of the unit

(1) Release compression of the decompression container (concentration unit) or in the connection pipes.

Pressing the [Leak] key opens the leak valve to draw in atmospheric air.

Pressing the key again closes the leak valve.

(2) Make the decompression container (concentrating unit) open to the atmosphere to avoid decompression even if it is operated.

(3) Clean the inside of the diaphragm vacuum pump and the connecting pipes.

Keep the [Leak] key for 30 seconds or more while “Standby” is displayed starts cleaning which will ends automatically.

※ If any liquid is trapped in the waste trap, remove it to empty the trap.

※When the receiving flask contains considerable amount of collected liquid, remove it and process.

※If cleaning is not carried out before completion of use, deterioration of the sensor, the solenoid valve and the diaphragm vacuum pump will accelerate.

(4) Stop the decompression container (concentration unit) and the cooling circulator.

Properly handle each device referring to its instruction manual.

(5) Turn the power switches of the main unit and the diaphragm vacuum pump OFF.

※ Remove the power plug off the outlet if you are not going to use the unit for an extended period of time.

6 Causes and countermeasures of troubles

Symptom	Causes	Countermeasures
Power will not be turned on. The LCD does not come on.	The power cable is not connected. (Any of Diaphragm pump control box PBX, inverter diaphragm vacuum pump NVP-V, or DC adaptor)	Connect the cable.
	Power of the NVC-3000 is turned OFF.	Press the power key to turn power ON.
	Power is not supplied.	Turn the breaker on the distribution board ON.
	The fuse for PBX has blown.	Replace the fuse. If the fuse is blown again soon after replacement, stop operation immediately and contact your dealer or our service center.
	A malfunction occurred to the control substrate.	Stop operation immediately and contact your dealer or our service center.
	A malfunction occurred to the LCD indicator.	
The vacuum pump will not operate.	Power for PBX is not supplied.	Turn the breaker on the distribution board ON. Turn power for the vacuum unit ON.
	The power of the vacuum pump is OFF.	Turn the power switch of vacuum pump ON.
	The power plug of the vacuum pump has come off of the power socket of the pump.	Turn the power switch OFF and insert the power plug securely into the power socket of the pump.
	During leak and the control starting pressure is not attained yet.	Continue operating as it is.
	The connection cord is not inserted into the outlet for PBX.	First turn power OFF and insert the connection cord securely into the outlet.
	A malfunction occurred to the diaphragm vacuum pump.	Stop operation immediately and contact your dealer or our service center.
	There is no output at the outlet.	
The inverter pump will not operate.	Connection is not made properly with the connection cord.	Connect the cable by referring to P.15 “When using the inverter diaphragm type vacuum pump”.
	Power of the inverter pump is turned OFF.	Turn power of the inverter pump ON.
Any key operations are not accepted. Any dial operations are not accepted.	A malfunction occurred to the control substrate.	Stop operation immediately and contact your dealer or our service center.

Symptom	Causes	Countermeasures
Decompression does not occur even if operation has started.	Wrong settings have been input.	Check the input settings.
	The power of the vacuum pump is turned OFF.	Turn the power of the vacuum pump ON.
	The pipes have come off or are leaking.	Check for a leak at the connected pipes by checking along them.
	The inverter pump communication cable is not connected.	Connect the cable by referring to "Connecting the communication cable (Optional)" on P.15.
	The control solenoid valve is not connected to the control solenoid valve connector.	Connect the control solenoid valve to the diaphragm pump control box PBX by referring to P.14 “When the diaphragm type vacuum pump is used”.
	There is an abnormality in the decompression container or the vacuum pump.	Check the connected device referring to its instruction manual.
	A malfunction occurred to the vacuum pump.	Stop operation immediately and contact your dealer or our service center.
	There is an error in the solenoid valve or in the pressure sensor. ※1.	Stop operation immediately and contact your dealer or our service center.
Vacuum control is unfeasible.	The control solenoid valve is clogged.	Check for foreign objects that may have entered the nozzles of the control solenoid valves CV-11 and CV-12.
The discharge side vacuum hose of the vacuum pump soon comes off.	The discharge side vacuum hose is kinked.	Rerun the vacuum hose so that it will not be kinked.
	Solvent has frozen in the condenser and clogged the route.	Raise the set temperature for the cooling circulator.
	Water content is being suctioned.	Supply dry air using silica gel through the leak nozzle.
		Connect a as-liquid separator (Woulfe's bottle) between the diaphragm vacuum pump and the vacuum unit.

※1. The unit may not support some types of solvents.
The solenoid valve and the pressure sensor will deteriorate and may disable the control function depending on solvents.
Solenoid valves and pressure sensors are consumable devices. Replacement of the pressure sensor requires adjustment and your dealer or the nearest service center for repair.

Symptom	Causes	Countermeasures
Power failure alarm is triggered. 『(01) Power Failure』	Power outage occurred during operation.	Press the [Clr] key to return to the ordinary screen and then resume operation.
Vapor sensor alarm has been triggered. [(02) Vapor Sensor]	When control with the Vapor temperature sensor was enabled, operation was started without connecting it.	Connect the Vapor temperature sensor. Or change the setting to disable the Vapor temperature sensor.
	When operation with control with the Vapor temperature sensor was enabled, the sensor was removed.	Connect the Vapor temperature sensor.
	When control with the Vapor temperature sensor was enabled, a malfunction occurred to the Vapor temperature sensor during operation.	Replace the Vapor temperature sensor.
Pressure sensor alarm occurred. [(03)Pressure Sensor]	A pressure outside the measurement range was measured during any of the operation modes and operation was stopped. Similar alarm might occur if operation is started with wrong piping connection to the diaphragm vacuum pump or the decompression container.	Remove the vacuum hose from the evaporator and inspect the whole connection path along the vacuum hose. Press the [Clr] key to release the alarm. *If the pressure sensor alarm recurs soon even if the alarm has been released, contact your dealer or nearest service center.
The leak alarm occurred. [(04) Leak]	The Leak nozzle is clogged.	Check for foreign objects in the leak nozzle.
High pressure alarm occurred. [(05) High Pressure]	The suction and the discharge pipes to the vacuum pump are switched.	Remove the pipes to the vacuum pump and the decompression container, check the suction/discharge and the reconnect the pipes.
Data error occurred. [(06) EEPROM DATA]	A data error occurred in the non-volatile memory on power on.	Turn power OFF once, wait for several seconds and then turn it ON again. If the data error recurs, initialize the non-volatile memory. *See P.38 for initialization.
The memory write error occurred. [(07) EEPROM WRITE]	An error occurred during write to the data in the non-volatile memory.	Contact your dealer or nearest service center.

Symptom	Causes	Countermeasures
NVC mutual communication error occurred. [(09) NVC-NVC]	Power of the other vacuum control unit is turned OFF.	Turn power of the vacuum control unit ON.
	The vacuum control communication cable has come off.	Reconnect the cable.
	A unit (model NVC-2200 or NVC-2300) other than the model NVC-3000 was connected to the other vacuum control unit.	Connect the model NVC-3000.
	The inverter diaphragm type vacuum pump is connected. NVC mutual connection is not possible when the inverter diaphragm type vacuum pump is connected.	Use a diaphragm type vacuum pump.
The inverter pump error occurred. [(10) Inverter Pump]	The suction and the discharge pipes to the vacuum pump are switched.	Remove the pipes to the vacuum pump and the decompression container, check the suction/discharge and reconnect the pipes.
Control wrong connection alarm was triggered. “(11)Control Valve”	Model CV-1 or CV-2 was connected as the control valve. (Models CV-1 and CV-2 : Control valve for NVC-2300 or older models.)	Use the model CV-11 or CV-12.
System alarm was triggered. “(12)System Alarm”	An alarm occurred to a related unit (evaporator, bath, coolant circulation unit, etc.) connected with the NVC communication cable.	Check the related units connected and take countermeasures by referring to the instruction manual of each of the units.
An indication that is not described in the instruction manual appears.	Influences of excessive noises.	Make sure that there is no device that generates excessive noise in the vicinity of the unit and then turn power ON again. If the symptom occurs again, contact your dealer or the nearest service center.

7 Maintenance and check up

7-1 Cleaning and care of the product

Warning

Never attempt to disassembly the product.

The unit contains parts with high voltage applied or may become hot, and disassembly may cause an electrical shock or an injury.

(1) Turn the power switch OFF and remove the power plug off the AC outlet before maintenance work.

(2) Use a moistened and well wriggled soft cloth for cleaning. Use milt detergent for stubborn dirt and completely wipe remaining detergent after cleaning.

Caution

Use a correct method and items for cleaning or caring the product.

When cleaning or maintaining the product, never splash water to the exterior or the inside directly, do not put any foreign materials and never use the cleanser, thinner, oil, kerosene, acid, and equivalent. Otherwise, the user may suffer electric shock or damage to the product.

7-2 Replacement of the fuse

（Diaphragm control box PBX）

Caution

Use the specified fuse only.

Fuses not specified may not blow even when overcurrent should flow and may cause a fire or other accidents.

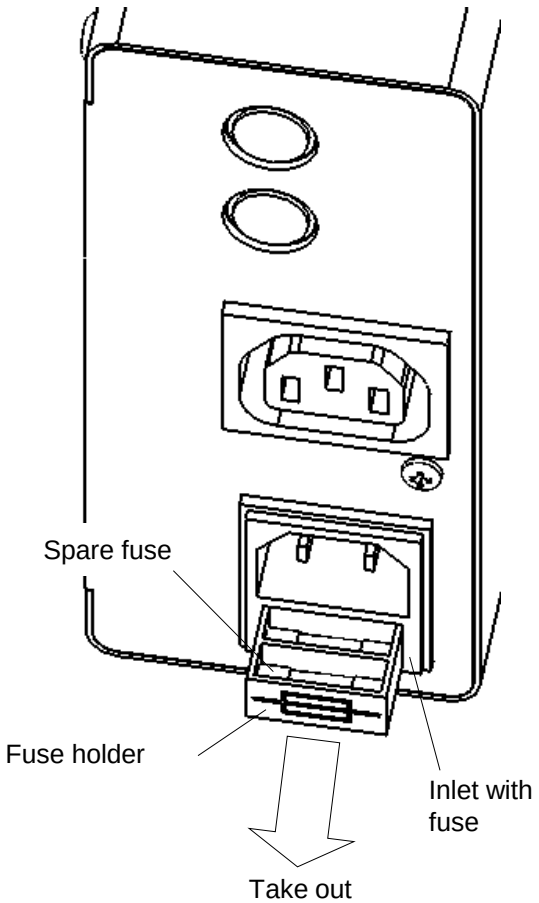
(1) Stop the NVC-3000 and remove the power cord from the fused inlet.

(2) Hold the fuse holder and pull it out.
The fuse set in the back is currently used while the one close to the front is the spare.

(3) Remove the spare fuse in the front and replace it with the one in the back.

※ Use the specified fuse only.
Fuses not specified may not blow even when overcurrent should low and may cause a fire or other accidents.

※ If the replaced fuse blows soon, immediately stop using the unit and contact your dealer or the nearest service center.



Code No.	Names	Qty	Remarks
241040	Fuse for SB-1100CE	2	6.3A time lag fuse

8 Disposal of Products

Disposal of product or part must be done according to the specified disposal method.

Principal components parts and disposal method

Components	Model	Weight kg	External dimensions (W×D×H) mm	How to discard
Vacuum control unit	NVC-3000	Approx. 0.7	138.7×50×114.2	Request the disposal operator for disposal.
Diaphragm pump control box	PBX	Approx. 0.6	63×63×148	Request the disposal operator for disposal.

Completed unit	Major components	Major materials
Vacuum control unit	Housing (metal plate)	Stainless steel
	Housing (resin)	PET (glass fiber contained)
	Substrate, electric components	Epoxy glass, lead-free solder, cupper
	Wire, connector, cable	Copper, PVC, nylon
	Liquid crystal display	Glass, stainless steel, PET
	Solenoid valve	Copper, Viton
	Pressure sensor	Stainless steel, ceramic
	Piping components	PVC, PTFE
	Screw	Stainless steel
Diaphragm pump control box *1	Casing	Iron
	Substrate, electric components	Epoxy glass, lead-free solder, copper
	Wire, connector, cable	Copper, PVC, nylon
	Screw	Stainless steel

* Please separate components of the product before disposing of it according to the materials referring to the table above.

*1 Optional.

9 After-sales Services

1. In case the product does not function satisfactorily, check first by referring to the page on troubleshooting to see if this is actually a trouble.
2. If the product remains unsatisfactory even after checking, contact the dealer from which you have purchased the product or the service center described in the manual and request repair.
3. Repair during the guarantee period will be made according to the guarantee stipulations.
4. After expiration of the guarantee period, the charged repair will be made at the customer's request.

Warranty Provisions

1 The warranty period of your product is 12 months from the date of purchase.

2 We will repair or replace your product free of charge for troubles occurred in your product during proper usage in the warranty period.

3 This warranty is limited to the product itself and shall not be construed to cover all and any consequential losses (operating losses, various expenses, etc.) from malfunctions or troubles of the product.

4 The provisions of this warranty are valid only in Japan.

When you are going to indirectly export the product you purchased to a foreign country, the provisions shall be exempted from application provided that a certification be issued that the product is not subject to the export control regulations and, in such case, all liabilities in relation to the product shall be borne by the exporting party .

5 Repair shall be paid by the user even during the warranty period for the following cases.

a) The user did not return the customer card or made user registration at our HP within one month from the date of purchase.

b) This warranty card was not presented or user registration could not be confirmed at the time of request for repair.

c) When the dealer name is not sealed on the warranty card or the date of the purchase is not indicated on it.

d) Malfunctions or damages caused by handling that is against cautions in the manual or labels on the product, or transportation from the installation site after purchase, dropping during use, or shocks.

e) Malfunctions or damages caused by mishandling, unauthorized modification or repair by the user.

f) Malfunctions or damages caused by a fire, an earthquake, wind and flood, salt damage, lightening, or other Acts of God or external factor including the power supply.

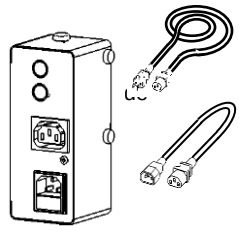
g) Degrading of performance or malfunctions resulted from consumption of consumable parts or replacement of consumable parts.

6 Ask your dealer or the nearest sales office for repair for malfunctions after the warranty period.
(In principle, the retention period of repair parts is five years after the end of production.)

7 Product warranty for products sold overseas by our overseas sales department shall be separately specified.

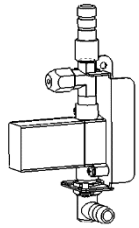
10 Consumable and replacement parts/list of optional items

① Pump control box PBX



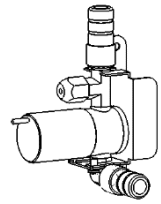
No.	Std	Qty	Code No	Price
1		1	269380	

② Control solenoid valve CV-11



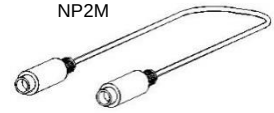
No.	Std	Qty	Code No	Price
2		1	269430	

③ Control solenoid valve CV-12



No.	Std	Qty	Code No	Price
3		1	269440	

④ NVP-PBX connecting cord
(Pump control box connecting cord)
NP0.5M
NP2M

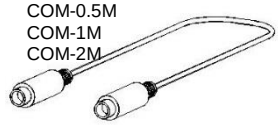


No.	Std	Qty	Code No	Price
4	0.5m	1	269390	
4	2m	1	269400	

⑤ NVC-NVPV connecting cord
(Inverter pump connecting cord)
NNV0.5M
NNV2M

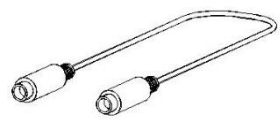
No.	Std	Qty	Code No	Price
5	0.5m	1	269410	
5	2m	1	269420	

⑥ NVC connecting cable
(Condensation related unit connecting cord)
COM-0.5M
COM-1M
COM-2M



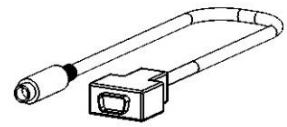
No.	Std	Qty	Code No	Price
6	0.5m	1	269450	
6	1m	1	269460	
6	2m	1	269470	

⑦ Vacuum control communication cable A
(NVC-NVC connecting cord)



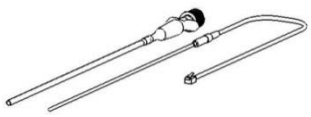
No.	Std	Qty	Code No	Price
7	2m	1	245100	
7	4m	1	246690	

⑧ NVC3000-DTC30DC connecting cord
ND0.5M



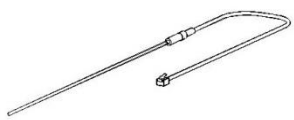
No.	Std	Qty	Code No	Price
8	0.5m	1	271500	
8	2m	1	271510	

⑨ Vapor temperature sensor set



No.	Std	Qty	Code No	Price
9	S type	1	211770	
9	V,T t type	1	211780	

⑩ Vapor temperature sensor

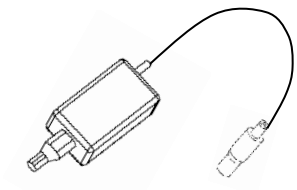


No.	Std	Qty	Code No	Price
10	S type	1	185170	
10	V,T t type	1	185180	

⑪ Capillary for the vapor temperature sensor: For models S. V. and T

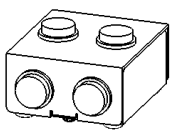
No.	Std	Qty	Code No	Price
11		1	187830	

⑫ DC adaptor for NVC3000



No.	Std	Qty	Code No	Price
12		1	269540	

⑬ Branching box for NVC communication F-BOX



No.	Std	Qty	Code No	Price
13		1	269620	

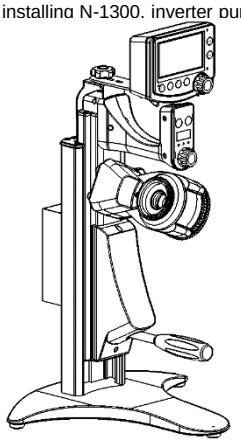
⑭ Fuse
(Replace parts for PBX)

No.	Std	Qty	Code No	Price
14	6.3A	2	241040	

No.	Std	Qty	Code No	Price

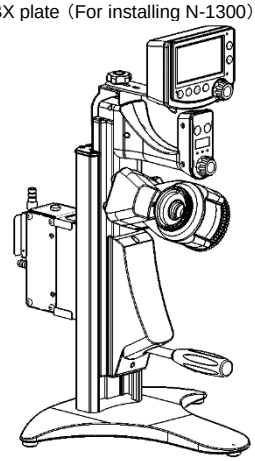
No.	Std	Qty	Code No	Price

⑮ Installation plate NVC3000-N1300 Without PBX plate (For installing N-1300, inverter pump)



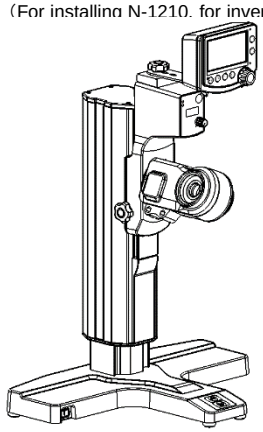
No.	Std	Qty	Code No.
15		1	269480

⑯ Installation plate NVC3000-N1300 With PBX plate (For installing N-1300)



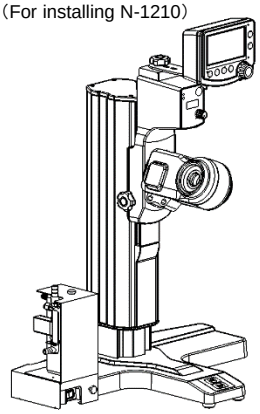
No.	Std	Qty	Code No.
16		1	269490

⑰ Installation plate NVC3000-N1210 Without PBX plate (For installing N-1210, for inverter



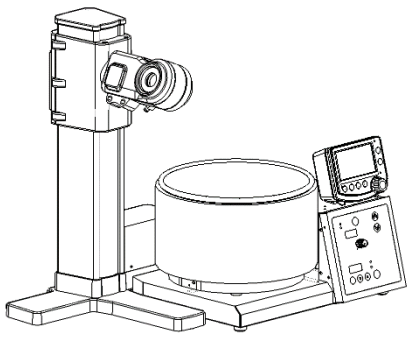
No.	Std	Qty	Code No.
17		1	269500

⑱ Installation plate NVC3000-N1210 With PBX plate (For installing N-1210)



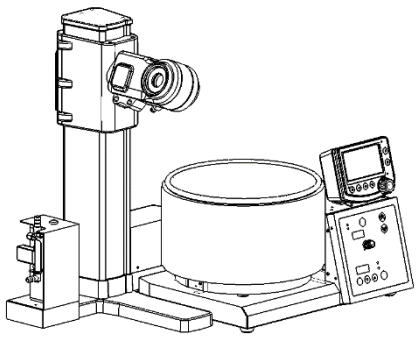
No.	Std	Qty	Code No.
18		1	269510

⑲ Installation plate NVC3000-N2110 Without PBX plate (For installing N-2110, for inverter pump)



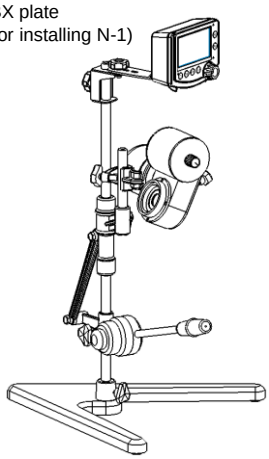
No.	Std	Qty	Code No.
19		1	269520

⑳ Installation plate NVC3000-N2110 With PBX plate (For installing N-2110)



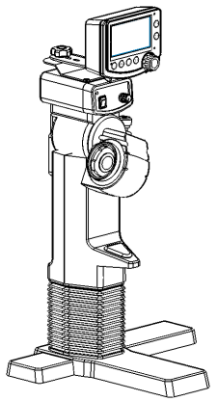
No.	Std	Qty	Code No.
20		1	269530

㉑ Installation plate NVC3000-N1 Without PBX plate (For installing N-1)



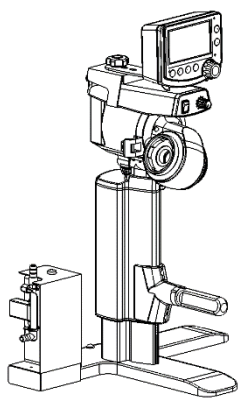
No.	Std	Qty	Code No.
21		1	269590

㉒ Installation plate NVC3000-NN Without PBX plate (For installing N-N)



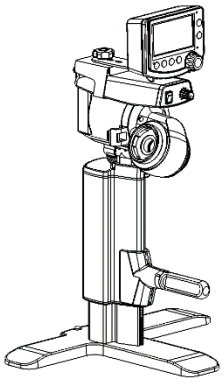
No.	Std	Qty	Code No.
22		1	269600

㉓ Installation plate NVC3000-N1000 With PBX plate (For installing N-1000)



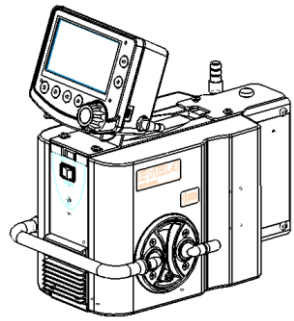
No.	Std	Qty	Code No.
23		1	269610

(24) Installation plate NVC3000-N1000 Without PBX plate
（For installing N-1000）



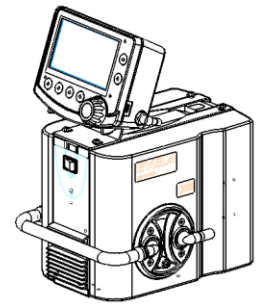
No.	Std	Qty	Code No.
24		1	270080

(25) Installation plate NVC3000-NVP With PBX plate
（For installing NVP）



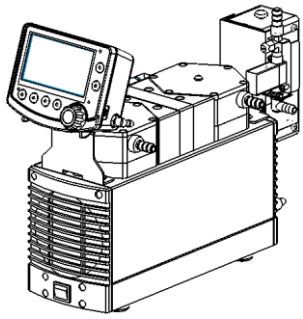
No.	Std	Qty	Code No.
25		1	270090

(26) Installation plate NVC3000-NVP Without PBX plate
（For installing inverter NVP）



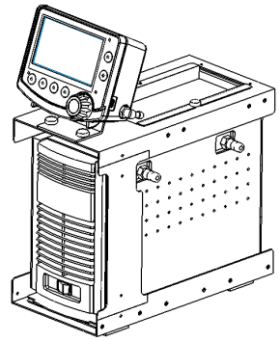
No.	Std	Qty	Code No.
26		1	270100

(27) Installation plate NVC3000-EVP With PBX plate
（For installing EVP)



No.	Std	Qty	Code No.
27		1	270110

(28) Installation plate NVC3000-DTC30DC
（For installing DTC-30DC）



No.	Std	Qty	Code No.
28		1	270120

No.	Std	Qty	Code No.