

	Page
For Safe Operations.....	1
Safety Precautions .....	2

Chapter 1 Before Operation

1-1. Check of the Main Unit and Accessories .....	1-1
1-2. Description and Function of Each Unit .....	1-1
1-2-1. Front Panel (Fig. 1-1(a)). .....	1-2
1-2-2. Rear Panel (Fig. 1-1(c)). .....	1-4
1-2-3. Side Panel (Fig. 1-1(b)). .....	1-4
1-2-4. Safety Door Lock (Option) .....	1-4
1-3. Accessories .....	1-4

Chapter 2 Operation

2-1. Operation Unit .....	2-1
2-1-1. Parameter Setting .....	2-1
2-1-2. Spinning Stand-by and during Spinning .....	2-3
2-1-3. Display in case of Error and Countermeasures .....	2-4
2-2. Procedure for Sample Preparation .....	2-5
2-2-1. Setting of the Equipment .....	2-5
2-2-2. Spinning Procedure .....	2-20
2-3. Cleaning after Sample Preparation .....	2-22
2-4. Procedures for Replacing Filters .....	2-23

Chapter 3 Maintenance

3-1. Cleaning .....	3-1
---------------------	-----

Chapter 4 Troubleshooting

4-1. Troubleshooting method .....	4-1
-----------------------------------	-----

Product Warranty and Service

External Dimensions



## For Safe Operations

---






### (1) Symbols for Safe Operations

In this manual, the following symbols are used to indicate the operation and handling of products that are hazardous in order to prevent harm to customers and other people and damage to property.






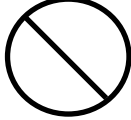
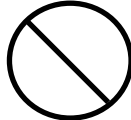
Read text carefully while understanding contents.

 <b>WARNING</b>	<p>If the content is used without observing the information given under this symbol, serious injury or death may result.</p>
 <b>CAUTION</b>	<p>This indication indicates that if the product is handled incorrectly, damage to human beings can be expected and damage to the product can be caused only.</p>


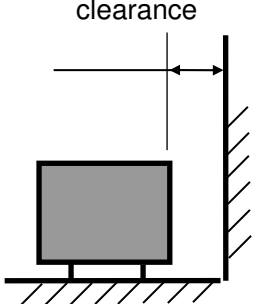
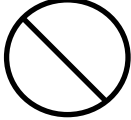
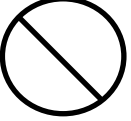
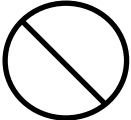



### (2) Explanation of Symbols

	<p>⊘ represents "Prohibition".          This symbol means "Don't disassemble".</p>
	<p>⚠ represents "Caution" (including warning).          Contents to be pay attention to is shown in the triangle.          This symbol means "Be careful of electric shock."</p>
	<p>⚠ represents "Caution" (including warning).          This symbol means "(general) Caution."</p>
	<p>The symbol represents a protective ground terminal.          Be sure to connect it to the ground (earth) before operations.</p>
	<p>Indicates "functional ground terminal".          Don't use as "protective earth terminal".</p>
<p>I</p>	<p>This symbol means "Power On".</p>
<p>○</p>	<p>This symbol means "Power Off".</p>


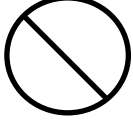
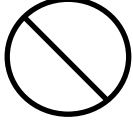
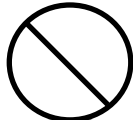





Safety Precaution

 <b>WARNING</b>	
<p>Stop operations if the equipment generates smoke, odd smell or strange noise. It may cause electric shock and/or fire. Shut off the power immediately and disconnect the AC plug. Contact our sales representative shown at the end of this manual. Note: Don't try to disassemble and repair the equipment by yourself. It is very dangerous!</p>	 <b>ELECTRIC SHOCK</b>
<p>Don't touch any terminals while power is on. It may cause electric shock.</p>	 <b>ELECTRIC SHOCK</b>
<p>Don't disassemble the equipment or touch the inside of the equipment while power is on. It may cause electric shock.</p>	 <b>ELECTRIC SHOCK</b>
<p>Don't disassemble or modify the equipment except as mentioned in this manual. It may cause injuries, electric shock and/or fire.</p>	 <b>ELECTRIC SHOCK</b>
<p>Don't use the power source out of the rated range. It may cause electric shock and/or fire. Secure rated voltage inputs in unstable power-supplying environments.</p>	 <b>ELECTRIC SHOCK</b>
<p>This equipment employs a three-prong plug with a ground terminal. Be sure to connect the plug to a receptacle with a protective ground terminal. If a two-prong plug has to be used, be sure to ground the protective ground terminal of the equipment to avoid electric shock and/or fire by leakage.</p>	 <b>ELECTRIC SHOCK</b>


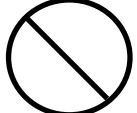





## For Safe Operations

 <b>WARNING</b>	
<p>Don't block the ventilation opening. Bad ventilations may cause overheating and fire.</p> <p>Don't put an article, especially flammable materials such as paper and plastics, close to the ventilation opening.</p> <p>Don't install the equipment in bad ventilations such as in a small room or in a box.</p> <p>Don't install the equipment on the carpet.</p> <p>Don't turn the equipment upside down or over sideways.</p> <p>Have a certain clearance for ventilations when the equipment is installed along the wall.</p>	
<p>Don't insert or drop any metal or flammable articles from an opening on the equipment. It may cause electric shock and/or fire.</p> <p>If any articles enter the equipment, shut off the power immediately and disconnect an AC plug from the receptacle.</p> <p>Then, contact our sales representative shown at the end of this manual.</p>	 <b>ELECTRIC SHOCK</b>
<p>Spilling water or chemical over the equipment may cause electric shock and/or fire.</p> <p>If some liquid is spilled, shut off the power immediately and disconnect an AC plug from the receptacle.</p> <p>Then, contact our sales representative shown at the end of this manual.</p>	 <b>ELECTRIC SHOCK</b>
<p>Don't use a damaged power cord to avoid electric shock and/or fire.</p> <p>Follow the instructions below.</p> <ul style="list-style-type: none"> <li>• Don't modify the power cord.</li> <li>• Don't put heavy objects on the power cord.</li> <li>• Don't strain or bend the cord forcedly.</li> </ul> <p>If the cord is damaged, please contact our sales representative shown at the end of this manual.</p>	 <b>ELECTRIC SHOCK</b>
<p>Don't connect too many power cords to one receptacle.</p> <p>It may cause fire.</p>	 <b>FIRE</b>
<p>Mishandling of an AC plug may cause fire.</p> <ul style="list-style-type: none"> <li>• Don't insert a plug with dust to a receptacle.</li> <li>• Insert a plug to a receptacle until the end securely.</li> </ul>	 <b>FIRE</b>
<p>Don't spin by placing combustibles such as organic solvents on the collector.</p> <p>It may cause fire by discharge.</p> <p>Please note that MECC shall not be liable to repair any damage in this case.</p>	 <b>FIRE</b>

## For Safe Operations

 <b>CAUTION</b>	
<p>Don't install the equipment on the unstable place. It may fall off or down, and cause the injury.</p>	 <b>INJURY</b>
<p>Don't install something heavy on the equipment, and don't ride on the equipment. It may cause the injury.</p>	 <b>INJURY</b>
<p>Don't operate in the place with humid and /or dust. It may cause the electric shock and/or fire.</p>	 <b>INJURY</b>
<p>Be sure to use original cable only. If you use the substitute, it may cause short, discharge, electric shock and/or fire, and malfunction.</p>	 <b>ELECTRIC SHOCK</b>
<p>Each connection cable has a part of high voltage output. Be sure to turn off the power before connecting/disconnecting cables. It may cause electric shock. Be sure to confirm that cables are locked before connecting/disconnecting cables.</p>	 <b>ELECTRIC SHOCK</b>
<p>Don't handle AC plug with wet hand. It may cause electric shock.</p>	 <b>ELECTRIC SHOCK</b>
<p>Don't strain the AC cord forcedly to disconnect. Damage on the cord may cause fire and/or electric shock. You should grab the plug to disconnect the cord.</p>	 <b>ELECTRIC SHOCK</b>
<p>Be sure to Power Off, AC plug out and remove all wiring before move the equipment. It may damage the AC cord and cables and cause the electric shock and/or fire.</p>	 <b>ELECTRIC SHOCK</b>

## For Safe Operations

 <b>CAUTION</b>	
<p>You should install the equipment on the floor with no vibration, such as a place where vibration from another machine is transmitted. It may cause injury.</p>	 <b>INJURY</b>
<p>This product is heavy and should not be carried by one person when unpacking or moving it. Failure to do so may cause the product to fall and result in injury.</p>	 <b>INJURY</b>
<p>When using the rotary collector, do not touch anything to avoid being caught in the collector. Otherwise, it may cause damage to surrounding parts or injury.</p>	 <b>INJURY</b>
<p>Don't open the spinning chamber door during spinning. There is a risk of leaking gas in the chamber into the laboratory. Before opening the doors, you should have been well ventilated in the chamber.</p>	 <b>INJURY</b>
<p>To prevent fire, you should attach the AC plug to an outlet near the equipment. In addition, a flammable/combustible material should not be placed around the inlet of the upside.</p>	 <b>FIRE</b>
<p>When integrating optional components, don't mistake directions and/or front/back. Incorrect integration may cause malfunctions. Make operations correctly according to instructions in this manual</p>	 <b>ELECTRIC SHOCK</b>

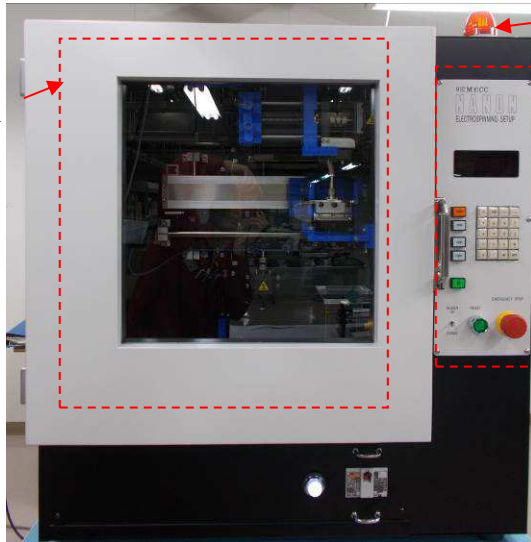
Chapter 1 Before operation

1-1. Check of the Main Unit and Accessories

Check the main unit visually for no damage on the surface and no missing accessories referring to the accessory list.

1-2. Description and Function of Each Part

B.  
SPINNING  
CHAMBER



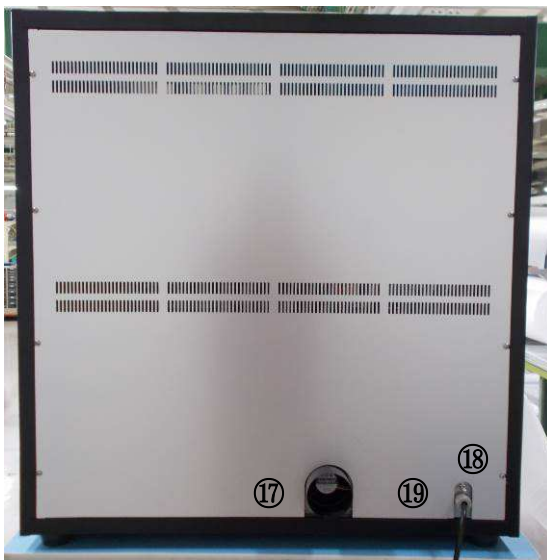
(a)

C.  
ALARM  
LAMP

A.  
OPERATION  
UNIT



(b)



(c)



(d)

Figure 1-1. Appearance of NANON Appearance

(a)Front view (b) Left-side view (c) Rear view (d) Right-side view

## 1-2-1. Front Panel (Fig. 1-1(a)).

**A. OPERATION UNIT**

To program parameter values related to spinning and operation of the equipment.

① **Parameter display** (VFD fluorescent display)

A display to show values of parameters and the operational status.

② **Operation keys**• **CL**

A key to move the slider arm to the position to mount/remove a spinneret before starting the NANON. It is also used to clean the tip of the nozzle when spinning stand-by

• **STORE**

A key to store spinning conditions.

• **Left/Right Cursors**

Keys to move the push plate of the syringe pump to left or right during spinning stand-by (when the "START" button blinks).

Also, when the traverse distance of the spinneret is zero, the spinneret can be moved to left or right with the cursors.

• **Numeric keys**

Keys mainly to enter parameter values.

• **Up/Down Cursors**

Keys to select programmed parameters.

• **BS**

A back-space key.

• **ESC**

An escape key to cancel entered values.

• **ENTER**

A key to determine entered values.

• **START**

Press the key once to set spinning stand-by (The START button blinks.) and the syringe pump will start.

Pressing the CL key in this mode enables cleaning of the tip of the nozzle.

Press the START key once again to start spinning and the START key will illuminate while spinning.

• **STOP**

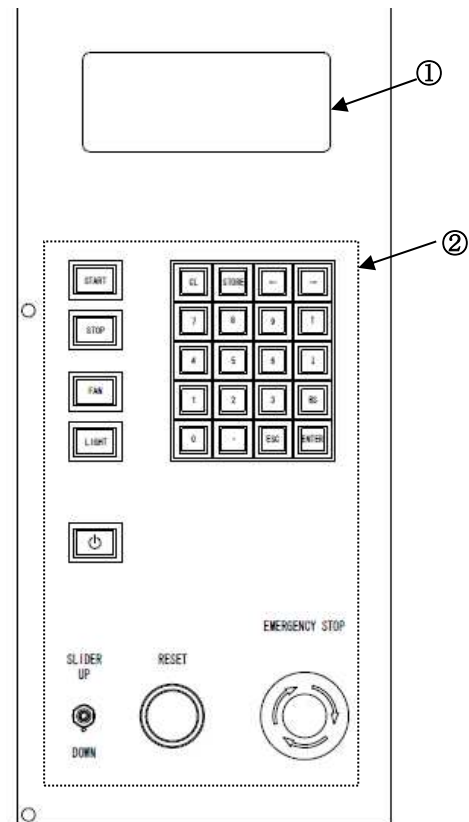
Press the key to stop spinning. Press the key when spinning stops will return the push plate of the syringe pump to the home position.

• **FAN** :

Press the key when the power is off (when POWER lamp is not illuminated) to start a fan and to illuminate the FAN key.

• **LIGHT**

Press the key to light up the tip of the nozzle and to illuminate the LIGHT key.



**Figure 1-2.OPERATION UNIT**



- **⏻ POWER**

Press the switch to energize the equipment and to illuminate the POWER switch.

- **RESET**

Press the switch to reset the equipment to turn on the POWER after turning on the breaker or after pressing the emergency stop switch.

- **EMERGENCY STOP**

Press the switch to stop the entire equipment.

- **SLIDER UP/DOWN**

Turn this switch while the door is closed to move the slider up/down.

## B. SPINNING CHAMBER

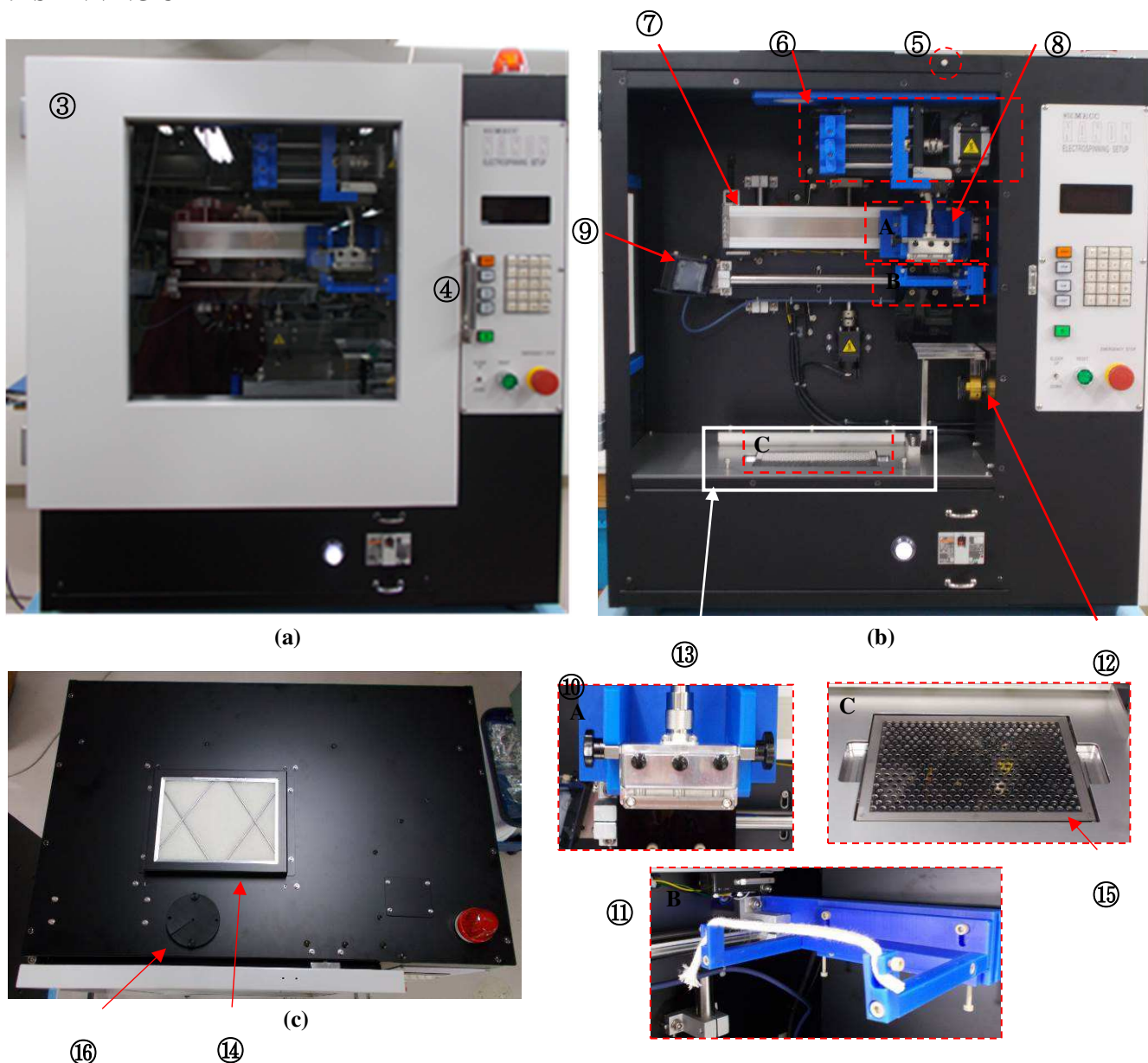


Figure 1-3. SPINNING CHAMBER  
 (a) Appearance (b) Inside of the chamber (c) Top view

- ③ **Door:** Door of the spinning chamber. A reinforced glass is on the center of the door to observe inside.
- ④ **Handle:** A handle of the door.
- ⑤ **Safety lock:** A device to detect open/close of the door. The NANON will not start when the doors is open.
- ⑥ **Syringe pump:** A pump quantitatively to supply solutions from the syringe (injector) to the tip of the nozzle.
- ⑦ **Slider:** A device to slide (traverse) the spinneret arm to the left and the right (on the X axis).
- ⑧ **Slider arm:** A device to mount the spinneret on.
- ⑨ **Light to check jet injection:** A light to check injection of jets.
- ⑩ **Spinneret:** A nozzle to inject nanofiber jet. A tube and a needle is connected to the device and high voltage is applied to it.
- ⑪ **Cleaning jig:** A jig to clean the tip of the nozzle with a rope or a tube.
- ⑫ **Motor shaft:** A rotary shaft to rotate the collector.

- ⑬ **Collector base:** A base to mount the nanofibret collectors.
- ⑭ **Inhale opening:** An opening to inhale external air to the spinning chamber.
- ⑮ **Exhaust opening:** An opening to exhaust gas inside the chamber to outside. Purifying filter and the cover can be installed on it.
- ⑯ **Tubing outlet:** An opening for tubes from an external syringe pump.

### C. Alarm lamp

Illumination: when high voltage is on.

Blinking: when some error generates.

#### 1-2-2. Rear Panel (Fig. 1-1(c)).

- ⑰ **Exhaust duct pipe:** A pipe to join an exhaust hose.
- ⑱ **AC INPUT:** AC power cord.
- ⑲ **GND:** A ground terminal. Be sure to connect it to the ground to avoid electric shock.

#### 1-2-3. Side Panel (Fig. 1-1 (b))

- ⑳ **Side Window:** A window to observe the spinning chamber from the side.
- ㉑ **Wiring opening:** An opening for external cables to go to the spinning chamber.

#### 1-2-4. Safety Door Lock (option)

Lock: The door is locked when the START button is ON or the breaker is turned off.

Unlock: The door is unlocked when spinning completes and the drum collector is stopped.

\*Release key

The key is for the use in case of power failure or emergency.

The door can be opened by setting the key from LOCK to UNLOCK position.

- Caution:
- Be sure to return it to the UNLOCK position after the use.
  - Do not use this key for ordinary operation.
  - This key is to be used only by an authorized person.
  - Do not apply too much power more than  $0.5\text{N} \cdot \text{m}$  on the screw part, or the key may be broken.

#### 1-3. Accessories

Refer to the Table 1 Accessories list.

## Chapter 2 Operation

## 2-1. Operation Unit










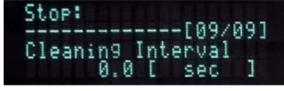

## 2-1-1. Parameter Setting

Display on the screen

The screen consists of four lines as shown in Figure 2-1, and each item can be displayed in order by the up and down key. Display range, resolution, and default values for each parameter are shown in Table 1.

The number at the upper right of the screen ("Displayed parameter number/total number of parameters") can be used to check the number of parameters displayed.

**Figure 2-1. Screen Configuration**

	: Recall the saved data. When the No. blinks, select the destination number (0 to 9) and press the "ENTER" to recall the data. The parameters shown in Fig. 2-3 are displayed.
	: Set the value of the voltage applied to the spinneret.
	: Set the amount of solution to be spun. When the spinning of the set volume is completed, spinning is automatically completed, and HVPS, syringe pump, slider, and collector motor are turned off.
	: Set the amount of solution per unit time to be extruded from the nozzle tip during spinning.
	: Set the internal diameter of the syringe to be used.
	: Set the rotation speed of the collector.
	: Set the amplitude width of the spinneret during spinning.
	: Set the speed of movement/amplitude of the spinneret.
	: Set the period to clean the nozzle tips ((e.g.) 10:00 → 10 min 00 sec). Set to 0 if cleaning is not performed for each cycle.
	: After cleaning, the spinneret can be kept in the vicinity of the cleaning string for a certain period of time before returning to the collector.
	: Shows the cumulative spinning time (Total) and filter replacement time (Filter). When the filter expires and START is pressed, before syringe-pump moves, the message shown in Fig. 2-2 is displayed immediately.

After a total of 100 hours' spinning the message on the right will be shown when power on. Replace the filter as soon as possible. Turn on the power while pressing ESC and CL keys to reset the filter counter.

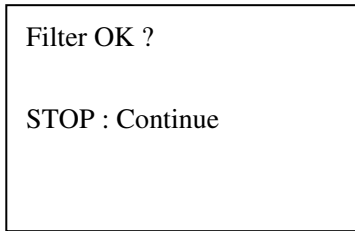


Figure 2-2. Filter message

Saving program data

Press STORE to save programmed data.

Select a preset numbers from 0 to 9 and press ENTER to save the data on the selected number.

Table 1. Indication range, resolution and initial value of each parameter

Display Parameters	Unit	Set value		Resolution	Recommended value	Initial value (Factory setting)
		Minimum value	Maximum value			
HVPS Voltage	kV	0.5	30.0	0.5	-	1.0
Solution Volume	MI	0.1	10.0	0.1	-	1.0
Feed Rate	MI/hr	0.1	100.0	0.1	-	1.0
Syringe Diameter	Mm	5.0	30.0	0.1	-	10.0
Rotation Speed						
Drum collector when in use	Rpm	0	3000	50	100	1000
Disc collector when in use	Rpm	0	3000	50	1000	1000
Spinneret Width	Mm	0	200	1	-	0
Spinneret Speed	Mm/s	0	300	1	50~80	100
Cleaning Frequency	m:s	5s *	59m59s	1s	-	10min
Cleaning interval	S	0.0	9.9	0.1	-	0

\*0 (zero) can be programmed. The setting is the one that does not carry out cleaning per cycle. (p.2-1)

Accuracy of traversing of the slider may generate an error of about 5mm compared to the programmed value.



Recall Preset No.		
HVPS Voltage	Syringe Diameter	Spinneret Speed
Solution Volume	Rotation Speed	Cleaning Frequency
Feed Rate	Spinneret Width	Cleaning Interval

Figure 2-3. List of displayed items for Recall Preset

## 2-1-2. Spinning Stand-by and Spinning

Press the "START" button once to enter the spinning stand-by mode.

Press the "START" button again to switch to the display of spinning.

Note: In the event the feed rate is changed with a 10-key during spinning, the spinning duration is displayed as 'Unlimited' and spinning will NOT complete automatically.

Display on the screen

The screen consists of four lines as shown in Figure 2-4.

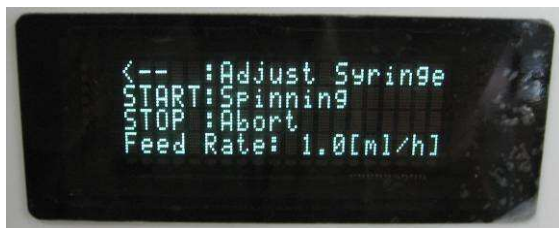
The voltage can be changed with 9 (up) and 7 (down) keys and the feed rate with 3 (up) and 1 (down) during spinning.

The screen can be switched by the up/down keys, and voltages and currents applied during spinning can be monitored.

**Figure 2-4. Contents displayed on VFD**

(a) Spinning stand-by (b) During spinning

(a)



(b)



When using the rotor collector, the acceleration status of the rotor collector is displayed at the same time as the start of spinning.

When the rotation speed reaches the set value, the screen shown on the left appears.

During spinning, you can switch to the screen shown on the left to check the monitored values of applied voltage and current by pressing the down key.

## 2-1-3. Display in case of error and countermeasures

Displays on the screen and countermeasures for errors caused by misoperations are described below.

Table 2. Displays and countermeasures when errors generate

Misoperation or errors	Displays on the screen	
	When error is detected	Countermeasures
Opening of the chamber door during spinning	Emergency Stop Door is opened.	Press STOP Button.
Error related to drum rotation	Emergency Stop Error is Detected. Drum Error	Turn POWER off.
Slider Operation Error	Emergency Stop Error is Detected. Slider Error	Turn POWER off.
Errors related to fan operation	Emergency Stop Error is Detected. Fan Error	Turn POWER off.
Over-current Detection	Emergency Stop Error is Detected. Over Current	Turn POWER off.
Over-current Detection	Emergency Stop Error is Detected. HVPS: Over Current	Turn POWER off.
Opening the Door at Startup	Emergency Stop Error is Detected. Initial: Door Open	Turn POWER off.
Syringe pump Home position detection error	Emergency Stop Error is Detected. Pump: Home Pos Err.	Turn POWER off.
Slider Home position detection error	Emergency Stop Error is Detected. Slider:Home Pos Err.	Turn POWER off.

**CAUTION**

If an error occurs and the message "Turn Power Off" is displayed and you are performing recovery,

**CAUTION**

In case the safety door lock (option) is equipped, unlock the door lock using the release key. Refer to p. 1-4 as for operations.  
After recovery, be sure to return to the original mode with the release key.



2-2. Procedure for sample preparation

2-2-1. Setting of the equipment



Do NOT make spinning by placing combustibles such as organic solvents on the collector, which may generate sparking and catch fire.

Installation of collectors

Turn off the breaker at the bottom of the front panel of the equipment.

- Plate Collector ⇒ p.2-5
- Drum collector ⇒ p.2-6
- Disc collector ⇒ p.2-6
- Mandrel collector ⇒ p.2-7
- Cleaning rope and Tray setting ⇒ p. 2-9



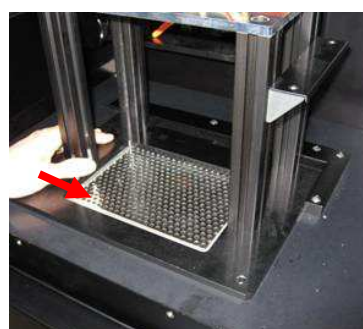
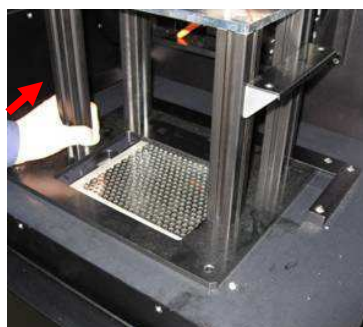
[Plate Collector]

Open the front door.

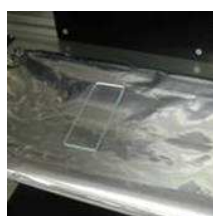
Apply the collector base to the positioning bracket on the bottom of the chamber, then slide it to the right.

Fix it with bolts.

Cover the collector surface with base materials such as aluminum foils.



Tips: It is convenient to place a few pieces of slide glass on the left end of the collector for observation with a microscope.



⇒ p.2-9

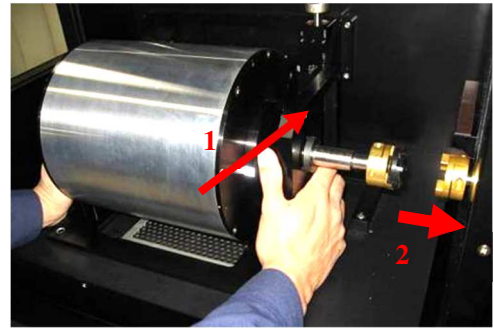
[Cleaning rope and trays setting]



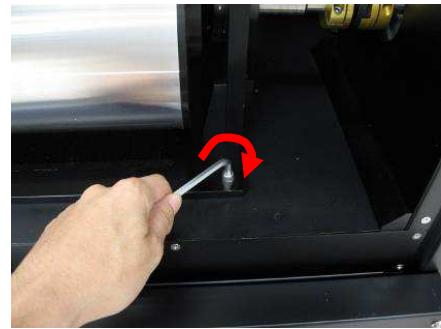
[Drum collector]

- (1) Press the collector base against the positioning bracket on the bottom plate of the spinning chamber and slide it to the right.

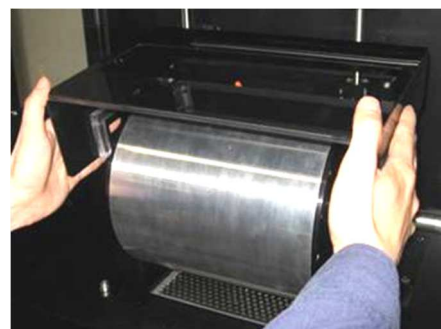
At this time, install the collector so that the coupling of the motor shaft and the collector rotation shaft engages.



- (2) Fix the collector base to the spinning chamber with bolts.

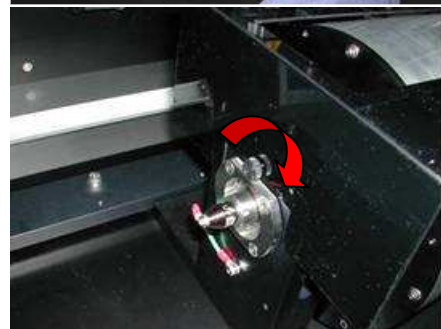


- (3) Attach the collector hood (when the rotation of the drum collector is more than 1000rpm). Tighten the screws on both sides to fix the hood to the collector body.



⇒ p.2-9

[Cleaning string and tray setting]



[Disk collector]

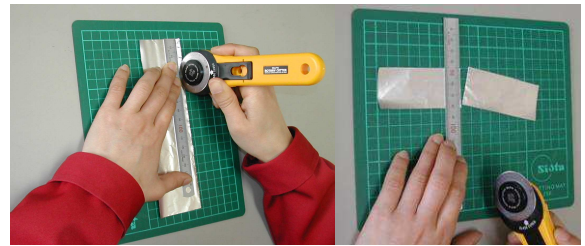
Installation methods of the disk collector is the same as the drum collector.

⇒ p.2-9

[Cleaning rope and tray setting]

[Mandrel Collector]

(1) Make two small pieces of substrates such as aluminum foils to match the diameter of the mandrel.

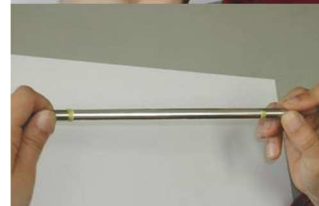
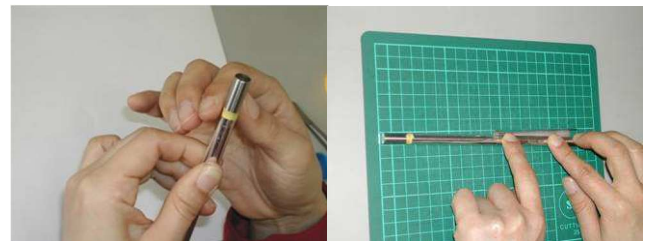


(2) From the center of the mandrel, wrap the substrate one by one in the right half and the left half.

After wrapping, glue the ends.



(3) Attach both ends of the base material to the mandrel with tape, etc. to fix them.



(4) Turn the orange handle counterclockwise to unlock.



(5) Slide the block on the left side to increase the spacing between the chucking.



- (6) Turn the chucking clockwise to widen the spacing between the chucking nails and insert the mandrel.



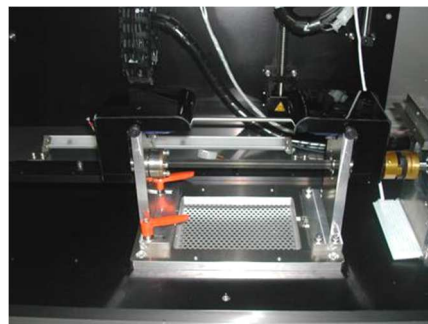
- (7) Slide the block on the left side to return it to the original position.  
Turn the chucking counterclockwise to hold the mandrel firmly with the chucking.  
Once the mandrel is secured, turn the orange handle clockwise to lock.



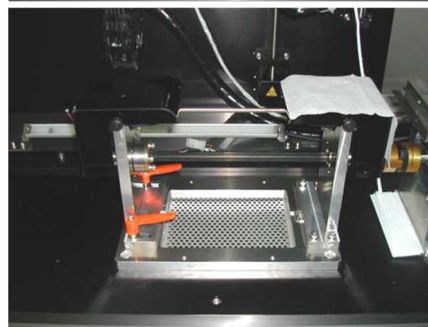
- (8) Put the resin cover.



- (9) Install it on the equipment in the same way as the drum collector.



- (10) Cover the top of the right cover with paper towels or aluminum foil.

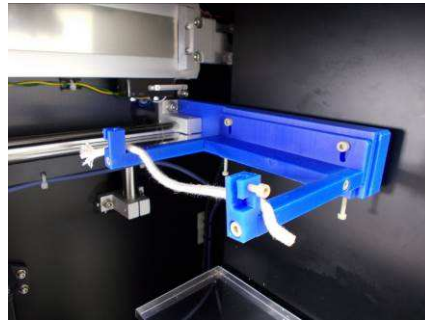


⇒ p.2-9  
[Cleaning rope and tray setting]

[Cleaning rope and tray setting]

[Cleaning jig]

- (1) Place the rope on the cleaning jig.  
Draw the rope from the back to the front.



- (2) Pass the rope through the slit in front of the jig.  
Fix it by tightening screws with fingers.

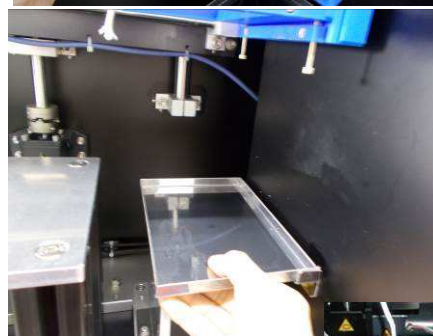


- (3) Pass the rope through the slit in the back of the jig.  
Tighten the screw and make the rope strained.



[Solution pan/tray]

Place the solution pan between the collector and the motor. As shown in the photo on the right, covering it with aluminum foil or putting a paper towel on it will make cleaning easy.



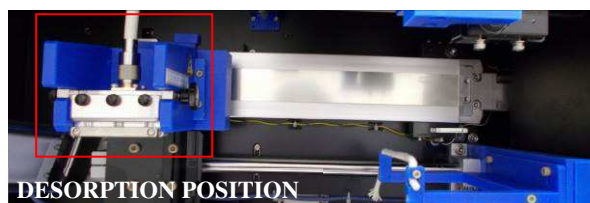


◆Installation of the spinneret

(0) Move the slider arm to the left end of the slider manually.

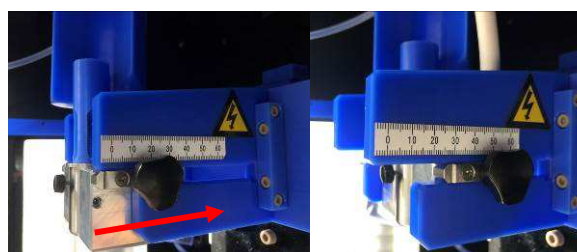
- \*1 It cannot be moved when the breaker is off.
- \*2 The slider arm can be moved to the left end of the slider with the CL key on the operation panel when both the breaker and the power are ON.

- Clip Spinneret → p.2-10
- Core Sheath Spinneret → p. 2-13
- Tubeless Spinneret → p.2-16



[Clip spinneret]

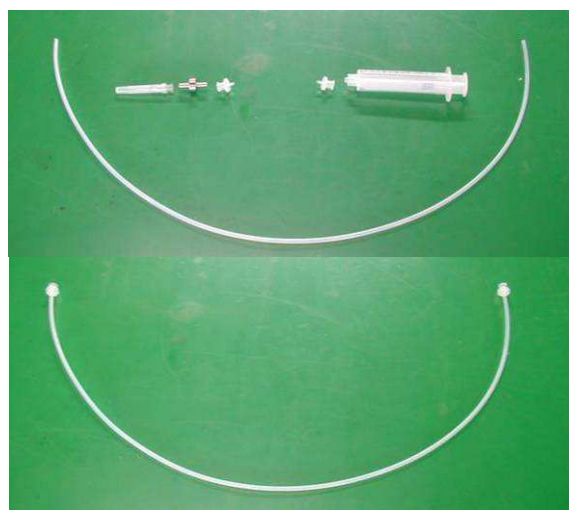
(1) Insert the spinneret to the slider arm and connect the high voltage cable to it.



(2) Preparation for tubes and nozzles:  
Connect a plastic (luer-lock) connector (female) to both ends of a tube.

In case of a stiff PTFE tube, spreading the inner diameter by inserting a thin rod and wearing rubber gloves will make the connection easier.

Prepare a long tube so that too much tension will not apply on junctions of the tube and connectors, or the tube will be removed.  
(Recommended length: 650mm or longer)



Insert a metal connector to the plastic connector and set a nozzle (needle) on the other end.

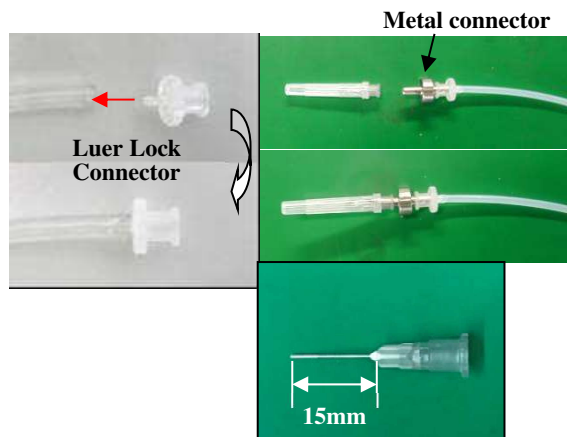
Length of the nozzle should be 15mm and the tip be straight by being ground.

Recommended products:

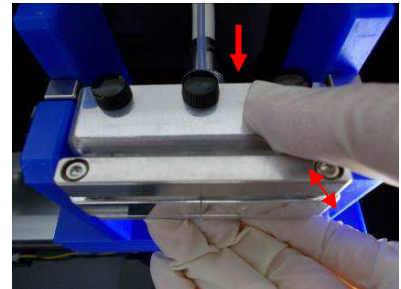
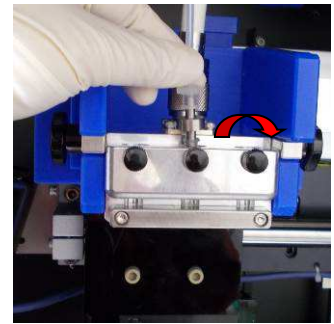
Tube: Teflon BT Tubing 1/8B 10m  
Model: 7-304-01 (Nichias)

Luer-lock connector: Luer lock connector scalpel 1/16" (1.6mm) ID  
EW45500-00 (Cole Palmer)

Nozzle: Terumo Injection Needle 27G  
Model: NN-2719S (Terumo)



- (3) Connect the nozzle, the metal connector the tube to the clip spinneret.  
 Fix the spinneret to the slider arm with bolts on the side while checking the Y-axis position with a measure.  
 When spinning cannot be made onto the center of the collector, adjust the position.



- (4) Suck up spinning solutions into the syringe.  
 The spinning solution is drawn up into the syringe.

\*Recommended product:

Luer Lock Syringe

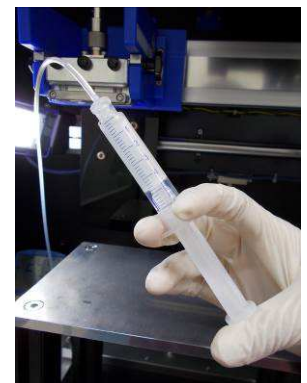
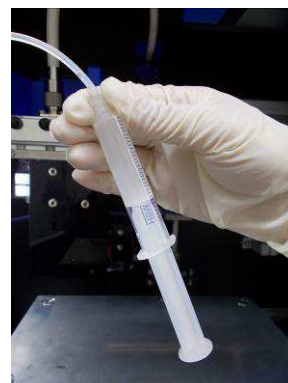
Model: NORM JECT® 5ml (HENKE SASS WOLF)



- (5) Wipe off the solution on the outside of the syringe carefully.



- (6) Connect the syringe and the tube firmly with the luer-lock connector.  
 Push the solution in the syringe to the tip of the nozzle.

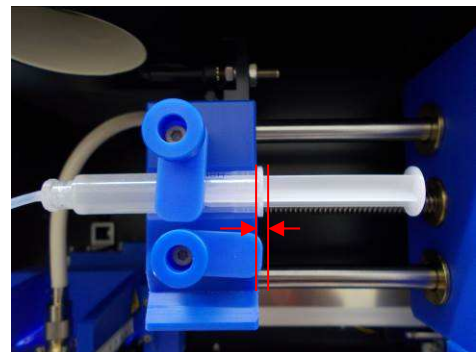
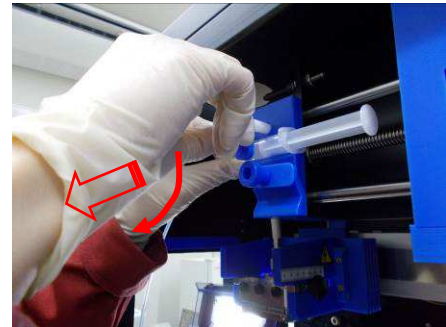


- (7) Confirming solutions come out of the tip of the nozzle, mount the syringe to the syringe pump.

Pull the handle forward and pointing the plate up and down.

Put the syringe along the triangular groove and rotate the plate 90 degrees to hold the syringe with the flat plate.

Be careful not to create a gap between the outer circumferential portion of the syringe and the outer wall of the syringe pump.



⇒ p.2-18 [Height adjustment of a cleaning rope]2

[Coaxial spinneret]

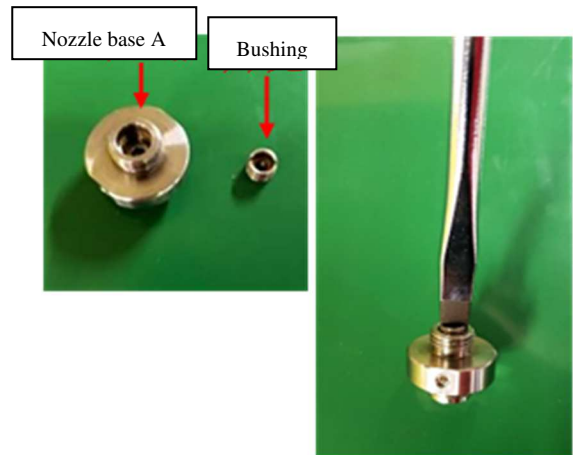
- (1) Connect the core-side fitting and the metal connector with a resin washer between, and connect a core-side needle to the tip of the metal connector.



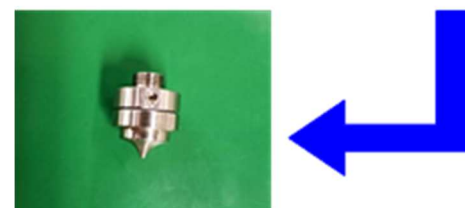
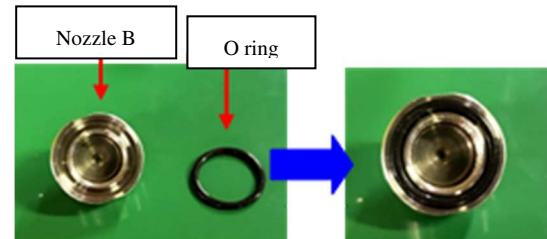
\*Recommended needles

- 18G Cylinder Length: 24mm
- 22G Cylinder Length: 24mm
- 27G Cylinder Length: 24mm

- (2) Attach the bushing to the nozzle base A with a slot screw driver.



- (3) Insert the O-ring into the groove of nozzle B and attach it to nozzle A with fingers. Tighten until there are no gaps. No tools are needed.



- (4) Mount the piece of (3) to the nozzle holder.





- (5) Attach the nozzle (4) to the nozzle base. Assemble it so that the part to mount the shell-side connector comes to the back.

This is because:

- To prevent contact with a shell-side tube.
- To allow the shell-side tube to go upper through behind the spinneret.



Front



Back

- (6) Mount the shell-side fitting with a resin washer in between.



- (7) Connect a tube to both end of core-side and shell-side fittings.

The tube length depends on devices to use or spinning distance.

Typical length is as follows:

- Core-side: 720mm
- Shell-side: 450mm



Insert the core-side nozzle into the center of the spinneret and tighten the screw to fix the metal connector.

The protruding amount of the nozzle can be changed by changing the position to fix the core-side nozzle.

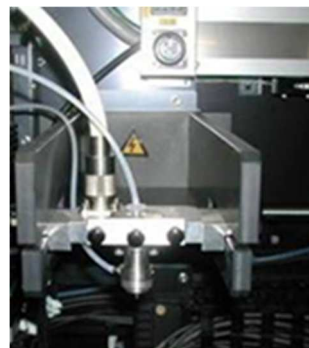
\*Recommended nozzle protrusion: Approx. 0.5mm



- (8) Mount the spinneret to the spinneret holder that is loaded to the slider arm.

Connect plastic connectors to the tip of the tube on the opposite side of the fitting of the core-side and the shell-side.

Connect the syringe containing solutions to the tube and set it to the syringe pump.



Connect the syringe containing the solution on the core-side to the plastic connector.

Mount it on the syringe pump installed on the top panel of the NANON.



- (9) Insert a plastic connector into the shell-side tube and mount a syringe in the same way as (5)-(7) (p.2-11,2-12).

⇒ p.2-18 [Height adjustment of cleaning rope].2

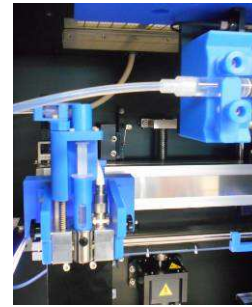


[Tubeless spinneret]

There are 2mL and 5mL types for the tubeless spinneret.

This chapter describes the 2mL type.

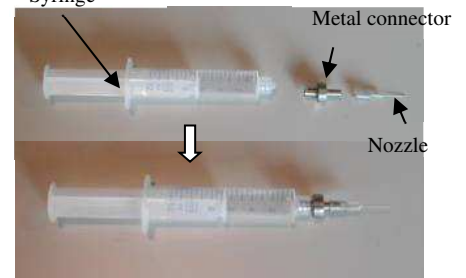
- (1) Insert the spinneret into the slider arm and connect the high voltage cable to the high voltage connector.  
Set the hydraulic syringe to the syringe pump.



- (2) Connect the metal connector to the solution syringe and suck up solutions to the syringe.  
After defoaming, connect the nozzle to the metal connector.  
Note: Solution volume must be less than 2ml.



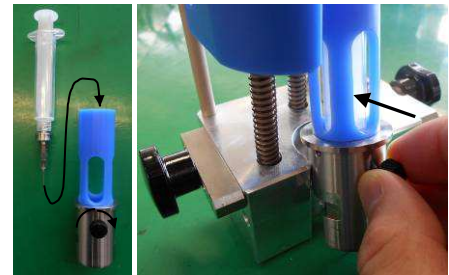
Hydraulic syringe  
Syringe



CAUTION

The metal connector is made of SUS316.  
**Don't use solutions that may cause corrosion.**

- (3) Push solutions to the tip of the nozzle and mount the syringe  
To the tubeless spinneret.



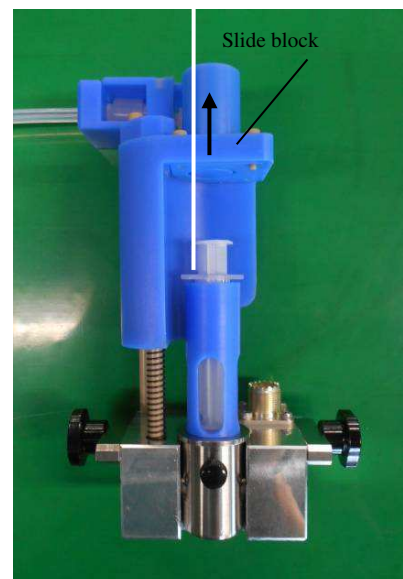
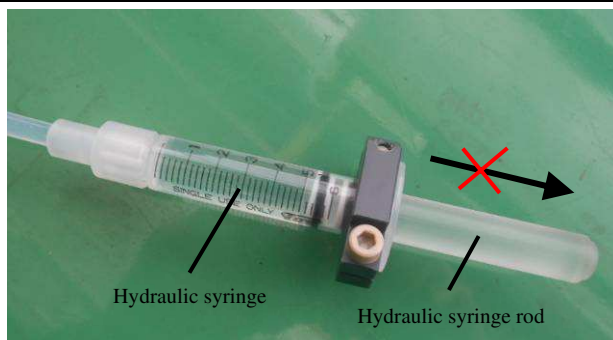
CAUTION

Before starting spinning, check no solution clogging on the tip of the nozzle.  
Use nozzles with no collapsing, bending or clogging.  
If solutions are clogged, **oil may leak and cause malfunction of the spinneret.**



CAUTION

The slide block will not return with a spring.  
Reset it manually.  
**NEVER grab and pull the syringe rod when resetting,**  
which generates bubbles and the device will be of no use.  
Push up the slide block to reset.





CAUTION

Avoid extreme bending of tubes in operations, which may apply too much pressure on the hydraulic oil and cause leakage. The spinneret may malfunction.  
**Radius of bending of tubes should be 50mm or more.**



CAUTION

The hydraulic oil may leak from the portion of the O ring. Fill the oil and replace the O ring when necessary.



CAUTION

**Allowable pushing force of the syringe is up to 80N (80kgf).**  
 High viscosity and/or feed rates of solutions create high pressure on the hydraulic oil and may cause leakage of the oil and malfunction of the spinneret.  
 Use nozzles of larger diameters in such a case.

Table Solution viscosity and allowable flow rate for each nozzle (Reference)

Viscosity [mPa · s]	Feed Rate [ml/hr] (Max)		
	27G	22G	18G
50	20	20	20
100	12.8	20	20
200	6.4	20	20
400	3.2	20	20
800	1.6	20	20
1600	0.8	12.8	20
3200	0.4	6.4	20
6400	0.2	3.2	20
12800	0.1	1.6	20

Conditions: Syringe Internal Diameter. = φ12.5mm



CAUTION

The pressure relief ball holder has an O-ring used for pressure relief.  
 When the O-ring deteriorates, the pressure relief function does not work properly, and **hydraulic oil may leak and it may cause damage.**  
 Replace the O-ring when necessary.

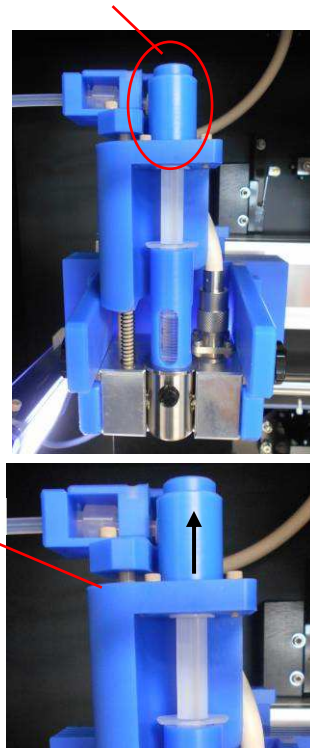
- (4) When the pressure relief ball shaft comes off  
 When excessive pressure is applied to the hydraulic oil, the pressure relief ball shaft comes off and relieve pressures.

There are some reasons for the action, such as too high feed rates, too high viscosity and clogging of a needle. Clarify and remove the cause of the problem. If unknown, please consult our sales representative.

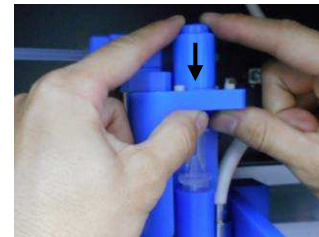
- (5) How to return the pressure relief ball shaft

① Push the slide block up to the top.

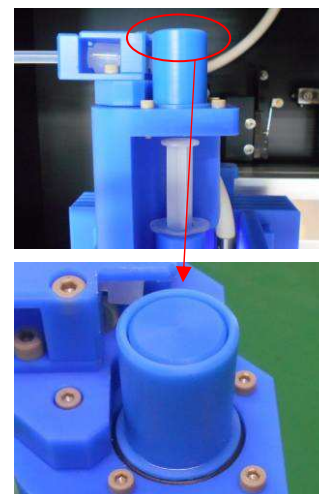
Slide block



② Push the pressure relief ball shaft into the holder.  
 After fixing the slide block firmly, push.



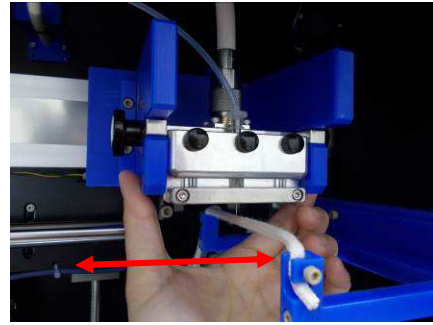
③ It is completed if the height of the surface of the pressure relief ball shaft and the holder is the same, as shown in the photo on the right.



[Height adjustment of cleaning rope]

- (1) Turn off the breaker and move the slider arm to the left and the right above the rope.

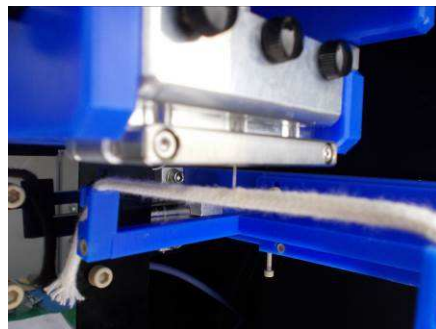
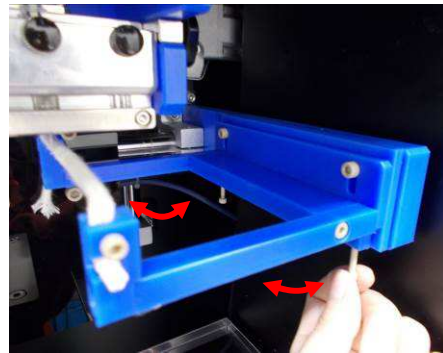
Check if a tube is not caught by other objects and the tube and a plastic connector are securely fixed.



- (2) Adjustment of the height of the cleaning jig:  
Adjust the height of the cleaning jig so that the tip of the nozzle hits the cleaning rope.

The cleaning rope can be up and down with the screws at the bottom of the cleaning jig. Reciprocate the nozzle over the cleaning rope to check the position. It is the best position that the tip snaps the rope lightly.

Return the slider arm to the right end (above the tray for split solutions) when setting of cleaning completes.





## 2-2-2. Spinning Procedures

- (1) Connect the AC plug to the AC outlet.
- (2) Turn on the breaker.

- (3) Press RESET, and the POWER lamp will illuminate.

Press POWER to energize the system.



- (4) Program each parameter.

- Applied Voltage
- Solution Volume
- Feed Rate
- Syringe Diameter
- Rotation Speed
- Spinneret Width
- Spinneret Speed
- Cleaning Frequency
- Cleaning Interval

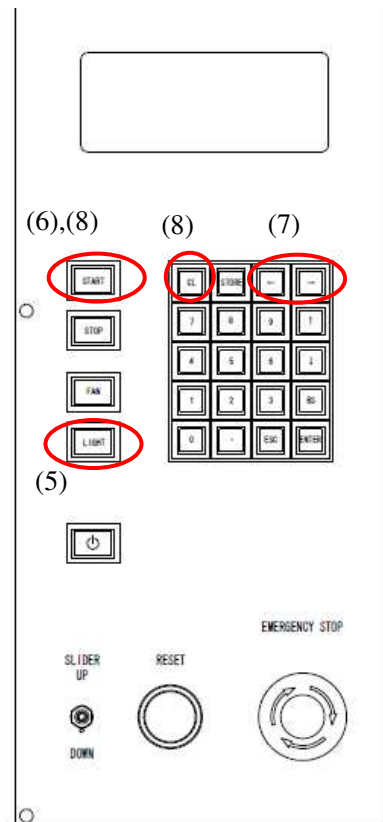
\*See p.1-2 and p.2-1 as for programming methods.



- (5) Press LIGHT key to turn on the light to check jet injection.
- (6) Press START key once to enter spinning stand-by mode.
- (7) Slide the push plate of the syringe pump with left and right cursor keys to supply spinning solutions to the tip of the nozzle.
- (8) Make sure that solutions to be supplied from the tip of the nozzle constantly by watching for 30 seconds to 1 minute.  
Press START once again, and spinning of nanofibers will start.  
When solutions are collected on the tip, clean it with CL button.
- (9) Spinning will automatically complete when spinning of programmed solution volume finishes.
- (10) When spinning completes, a fan will start automatically. Wait for at least 15 minutes to open the door and take out the fiber sample.

\*When using a drum collector,

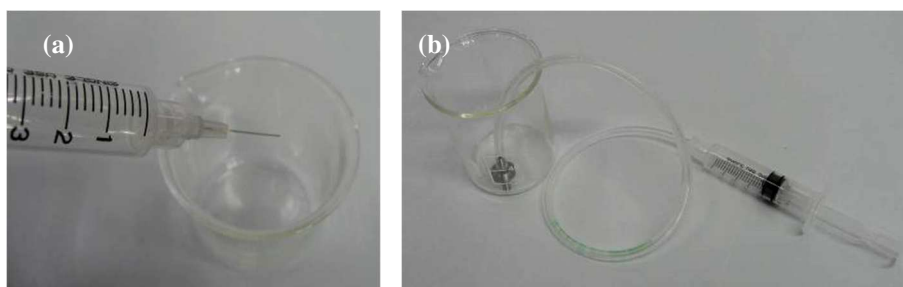
- (11) To remove a fiber sample use a knife along the groove running in the longitudinal direction of the drum.





## 2-3. Cleaning after sample preparation

- (1) Turn off the breaker and slide the slider arm to the position to detach a spinneret
- (2) Clip spinneret: Remove a syringe, a tube, a metal connector and a nozzle.  
Coaxial spinneret: Remove a syringe, a tube, a spinneret and a nozzle.
- (3) Remove the nozzle and extrude all solutions in the syringe and the tube.  
For a coaxial spinneret, disassemble all necessary parts when solutions are attached.
- (4) Immerse metal connectors and spinnerets in solvents of solutions and clean them with an ultra-sonic cleaner.  
After that clean them in water with an ultra-sonic cleaner.
- (5) After water evaporates put the parts in an oven to dry.  
Note: Brushing spinneret parts with water before putting in an oven will make them cleaner.
- (6) Clean the parts below.
  - Internal walls of spinning chamber
  - Surface of collector
  - Solution tray
  - Cleaning rope



**Fig. 2-2. Sample of cleaning**

**(a) Cleaning of a nozzle**

**(b) Cleaning of a syringe, a tube and a metal connector**

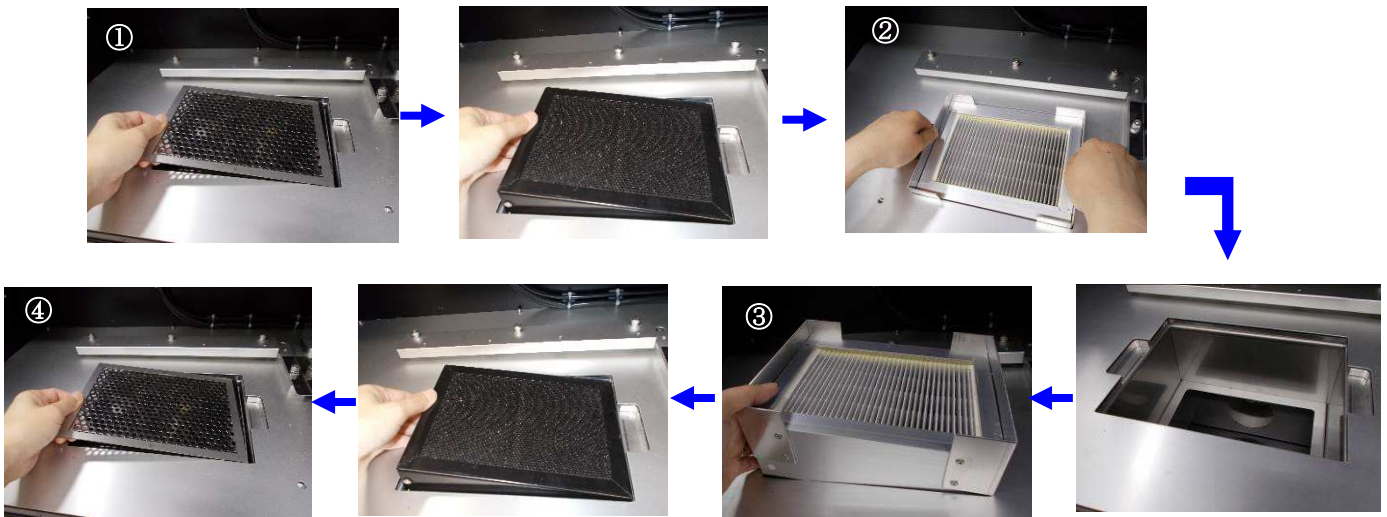
2-4. Procedures to replace filters

When the filter counter shows 0 (zero) in the display panel, replace the purification filter (active charcoal and HEPA filter) installed on the exhaust opening according to the procedures described below.

Replace the pre-filter if any contamination can be visually confirmed.

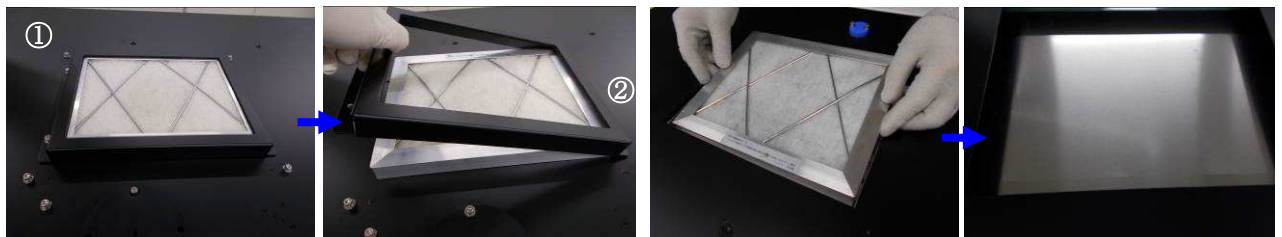
Activated Carbon/Medium Performance/HEPA/ULPA Filter

- ① Remove the filter cover and remove the black active charcoal filter by placing your finger on the frame.
- ② Hook your finger on the inside of the flat plate attached to the side of Medium performance/ /HEPA/ULPA filters and pull up the filter.
- ③ Attach new filters to the place. First, set Medium-Performance (or HEPA or ULPA) filter, and active charcoal filter, next.
- ④ Install the filter cover.



Pre-filter

- ① Loosen bolts and remove the filter cover.
- ② Remove the filter.
- ③ Install a new filter and fix the filter cover with bolts.



## Chapter 3 Maintenance

Periodical maintenance is recommended to keep the system in good conditions.

## 3-1. Cleaning

## Outside

- ① Turn off the power and remove dusts with a soft brush.
- ② When extremely dirty, prepare a cleaning solution containing a small amount of neutral detergent. Soak a soft cloth in it, squeeze it thoroughly and wipe off the dirt. Wipe off water with a soft and dry cloth.

**CAUTION**

Don't allow water to enter the equipment.  
Moisture may cause a short-circuit, malfunctions, fire and electric shock.

**CAUTION**

Don't use a stiff brush or solvents. It may damage paints and peel prints off.

## Inside

Turn off the power and remove dusts with an air gun or a soft brush.

\*Clean inside of the equipment once every year to prevent malfunctions or fire. It is effective to do it before the rainy season.

**CAUTION**

Use of detergents or solvents to clean the inside will damage components and cause a malfunction, fire and electric shock.

## Lubrication

- ① All mechanical parts such as switches and relays inside do NOT require lubrication.
- ② Replace malfunctioned parts without lubricating contacts or using contact restoring agents.

## Chapter 4 Troubleshooting

The equipment is manufactured by integrating parts of high quality and reliability, however, there is a possibility of failure. See the table below for troubleshooting.

## 4-1. Trouble shooting

Symptom	Cause of trouble	Troubleshooting
POWER lamp does not illuminate by turning on POWER switch on the front panel.	Check connection of AC plug. (No or loose connection)	Connect the AC plug.
	Illumination of RESET (RESET switch is not pressed.)	Press RESET switch and turn on POWER.
	Off of the breaker	Turn on the breaker.
Collector doesn't rotate.	Disengaging of a coupling from the rotary shaft.	Engage the coupling and tighten bolts.
Loud vibration noise during rotation of a collector.	Removal of a bolt to fix the collector.	Securely fix the collector to the bottom plate of the spinning chamber with bolts.
No jets come out after applying voltages.	No/loose connections of a high voltage cable or a nozzle with the spinneret.	Check connections.
	Clogging of a nozzle.	Clean or replace the nozzle.

**Limited Warranty Policy**

This product is guaranteed for 12 full months after shipping from our factory in Fukuoka, Japan. When it is malfunctioned during the period, its repair will be done at our factory or a facility of our representative free of charge.

- This warranty policy is only to promise free repair service of a purchased product.
  - We will not be responsible for any damages or accidents by troubles with the product or by the use of the product.
  - This warranty policy will never limit any legal rights of a user.
  
- Price and/or warranty service of this product does not include any of the following items.
  - 1) Cost for dispatching engineers for troubleshooting including travel expense
  - 2) Freight to send repair parts
  - 3) On-site installation and adjustment fee
  - 4) Operation training fee
  - 5) Observation fee after installation of this product
  - 6) Periodical check, adjustment and/or calibration fee
  - 7) Technical training and/or consultation fee
  - 8) Spinning of samples on site or at our facility in Japan
  
- Exceptions of the warranty policy  
Following items will not be covered by the limited warranty policy.
  - 1) Malfunctions or damages by operations not described in the operation manual of this product.
  - 2) Damages or loss during transportation on a user's responsibility.
  - 3) Malfunctions or damages caused by the repair or the modification made by a user.
  - 4) Malfunctions or damages caused by disasters such as earthquake, typhoon and flood, lightning, salt damage, fluctuation of voltage, use of out-of-range powers.
  - 5) Physical damages or malfunctions caused by strike, falling or mechanical shock.
  - 6) Malfunctions or damages caused by the connection with external devices not described in the operation manual.
  - 7) Consumable parts (e.g. batteries and filters)
  
- Ownership of malfunctioned parts replaced in repair work belongs to MECC.
  
- MECC will not be responsible for any damages or loss of integrated software, memory data or firmware.  
*\* Periodical backup to be recommended.*
  
- Repair work may take a long time of period due to late delivery, shortage or discontinued production of parts and there may be a case we cannot accept a request for repair.

### **Service after Sales**

#### ■ Request for a repair service

Please tell the following items to our representative when repair service is needed.

- Name and contact (telephone number and e-mail address) of a user
- Product name (e.g. Electrospinning system)
- Model name (e.g. NANON-01A)
- Serial number (e.g. 27123J789)
- Symptom of the trouble (as in detail as possible)  
(e.g. “No high voltage output more than 11.5kV. Programming can be made but no actual output.”)
- Situation of operation when the trouble happened (as in detail as possible)  
(e.g. “The trouble was found when starting the system in the morning. It worked normally yesterday.”)

### **CAUTION**

This product is designed to be operated by a personnel who has knowledges and technique safely to handle electronic equipment, attachments, consumable parts and chemicals for spinning.

We will not be responsible for any damages or accidents by an unauthorized personnel’s access or use of the product.

#### **Manufacturer**

MECC CO., LTD.

196-1 Fukudo, Ogori-shi, Fukuoka 838-0137 JAPAN

Phone: +81-942-41-2900

E-mail: askmecc@mecc.co.jp URL: www.mecc-nano.com

#### **Sales Representative**

