



" Instructions for the Electrospinning Device "

Lab-scale Dual Pump Electrospinning Unit

(Electroris Duas)

Model: ESDP30





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Bone & Joint Research Lab



Main features

Features	
Device name	Laboratory Electrospinning Device 2 pumps
Model	ESDP30
Manufacturing Country	Iran
Manufacturer company	Fanavaran Nano-Meghyas
Chassis	Metallic body with 3 doors for easy access
Input power	100-240 V AC/50-60 Hz
Heating system	Adjustable from room temperature up to 45 via HMI panel
Weight	140 Kg
Ventilation	A programmable fan adjustable by HMI panel
Safety	Voltage cut off in case of door opening
Dimensions	131*80*96 cm
Spinneret	
Number of syringe	4 syringes
Scanning rate	0-30 mm/s
Scanning range	0-30 cm
Syringe pump injection rate	10 μ l/h to 500 ml/h
Usable syringe size	1-25 mm
Collector	
Collector type	Rotating drum
Rotation speed	300-3000 RPM
Spinning distance	5-20 cm
Material	Stainless steel



High voltage power supply	
Model	HV35P OV
Max output voltage	35 kV
Power	35 Watt
Voltage monitoring	Digital, accuracy: 0.1kV

Introduction and application

The laboratory electrospinning device with two pumps is used for producing polymer/carbon/ceramic nanofibers with a diameter ranging from 50 nanometers to microns. The device includes a metal body, a syringe pump, a spinneret system, a collector system, and a high voltage power supply. Two different materials can be electrospinning simultaneously in these devices. In addition, electrospinning of the polymer material can be performed on one side of the device and additives such as drugs on the opposite side, providing the possibility of producing composite nanofibers containing desired components. Therefore, this device is suitable for pharmaceutical, medical, and biological applications. The electrospinning device has a panel for controlling electrospinning parameters. The electrospinning device provides very good safety measures for users regarding working with high voltage power supplies and chemical solvents.

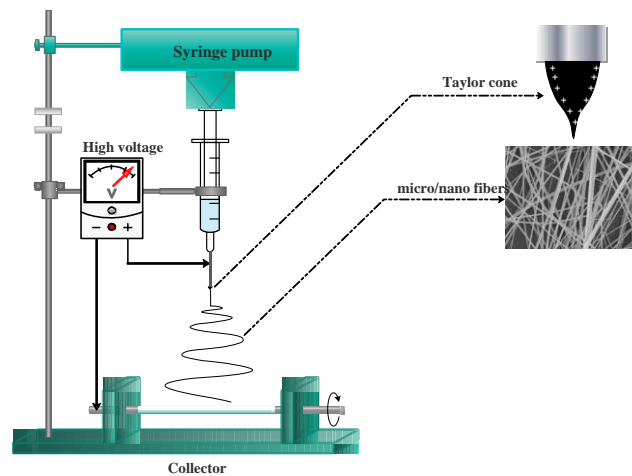


Figure 1. Schematic view of the electrospinning process

Procedures for working with device

- Turn on the device using the black key on the right side of the device
- Connecting the cable to the power outlet and the device's power input
- Earth cable connection

Solvent preparation

- First, the specified amount of the desired substance should be weighed on a scale based on the sample type.
- The weighed polymer or desired substance should be poured into glass containers (containing a magnet) and an appropriate solvent should be added to it based on the sample type.
- Then, the container should be placed on a magnetic stirrer under a chemical hood and stirred at an appropriate speed to completely dissolve the polymer particles in the solvent. The



container lid should be tightly closed to prevent the penetration and diffusion of solvent vapors into the environment.

- After preparing the solution, it should be poured into a syringe using special needles (different needles with specific diameters based on the sample size and color)

Device setup

- Turn on the device by pressing the power button to mode 1.
- Turn on the device lamp by pressing the Light button.
- Select the appropriate collector and rotating drum according to the sample size, and fix the drum in place using special wrenches (clockwise from both sides).
- Place the syringe containing the solution in the device and secure the syringe in place using the adjusting screws (always place an empty syringe next to it to maintain balance).
- After checking the parameters and desired program, press the Run button to start the device (to optimize the sample quality and prevent adhesion to the surface, you can spray the drum surface with Teflon before starting the electrospinning process).
- Connect the voltage cable to the needle of the syringe as shown in the diagram, close the device door, and turn on the voltage buttons.
- Check the device periodically during the electrospinning process to ensure that the needle tip is not blocked.

Note: If the needle tip is blocked, turn off the voltage button first, then open the device door and clean the needle tip with a paper towel.

- At the end of the electrospinning process, turn off the voltage first and then open the drum using special wrenches (counterclockwise). Be careful not to touch the sample surface with your hand.



- Place the produced material in a 90% ethanol solution and after a few minutes, gently remove the material from the drum using your hand pressure.

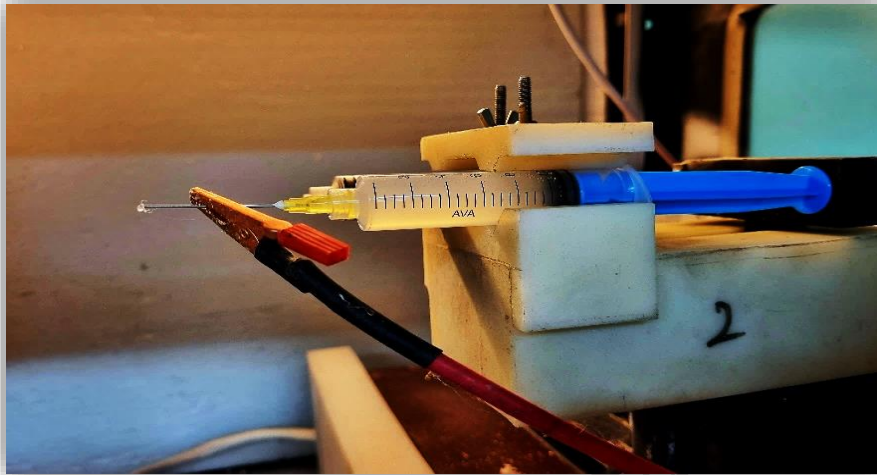


Figure 2. How to place the syringe and connect the voltage cable

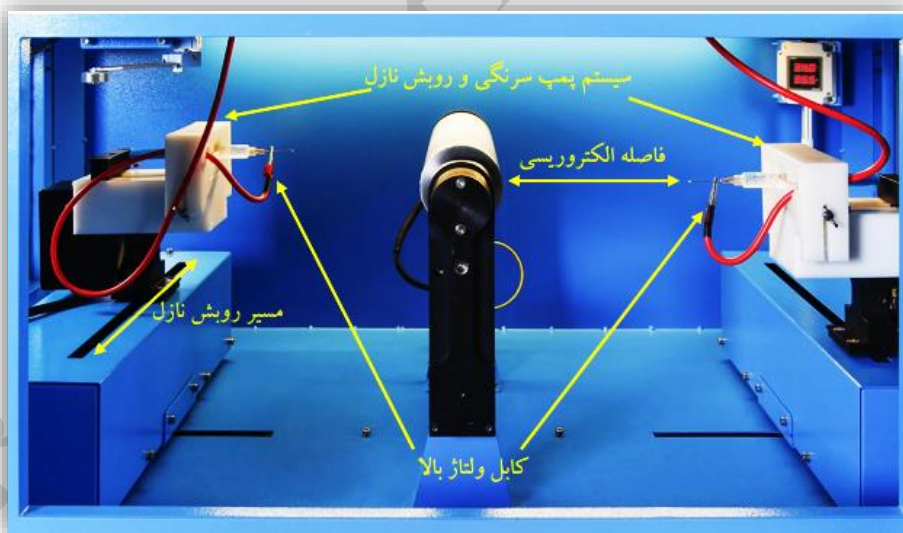


Figure 3. Internal view of the electrospinning machine



Programming

The device includes a menu for adjusting the electrospinning process parameters, such as parameters related to syringe pumps, nozzle rotation, and electrospinning distance.

According to Figure 5, by pressing the Menu button, you can enter the corresponding parameter menu.

By entering each menu, you can adjust the corresponding parameter. These parameters include:

- Setting the syringe pump system (Set injection)
- Setting the scan system (Set scan)
- Setting the electrospinning distance (Set distance)
- Setting the drum rotation speed (Drum speed)
- Setting the temperature inside the chamber (Temperature control)

After changing the corresponding parameter, to confirm, press the Menu button again and press the Return button to return to the main menu.

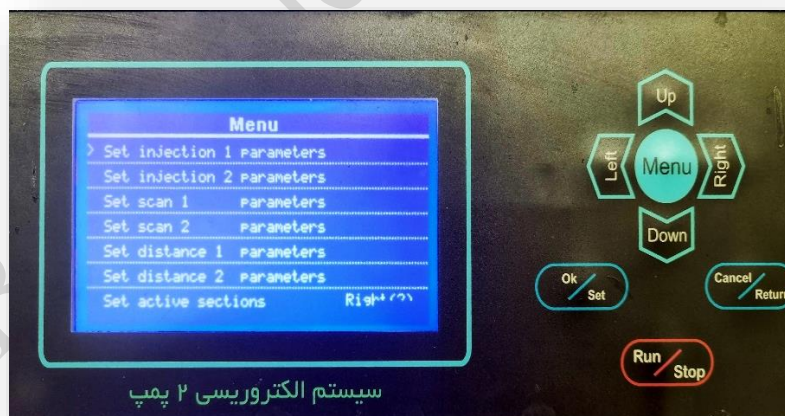


Figure 4. The main menu of the device



Syringe pump system

According to Figure 5, by selecting the Injection menu, all settings related to syringe pumps (left and right) are displayed, and using the Up and Down keys, you can select and change each of the parameters.

The available parameters are:

- Rate: The feed rate of the solution, which indicates the amount of solution volume that is dispensed from the nozzle per unit time.
- Dia: The inner diameter of the syringe, which calculates the cross-sectional area of the syringe and calibrates the pump for the syringe.
- Target: The desired volume of the injected polymer solution, and the device stops operating when the injected solution volume reaches the final amount

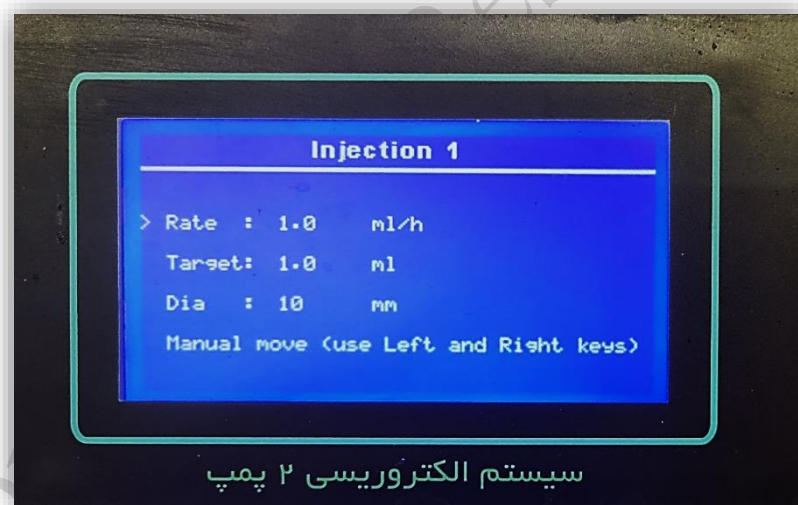


Figure 5. Syringe pump system settings



Scan system

By selecting the Scan menu, you can change the settings related to the scan of each syringe pump (start point, endpoint, and scan speed). Using the Up and Down keys, you can select and change each of the parameters.

To manually move the electrospinning units on the right and left sides along the scan path, use the Right and Left keys.

The available parameters are:

- Rate: The scanning speed in millimeters per minute.
- Min Pos: The starting point of the scan in millimeters. Use this parameter to set the starting point of the scan (this point cannot be greater than the endpoint).
- Max Pos: The endpoint of the scan in millimeters. Use this parameter to set the endpoint of the scan (this point cannot be less than the starting point).

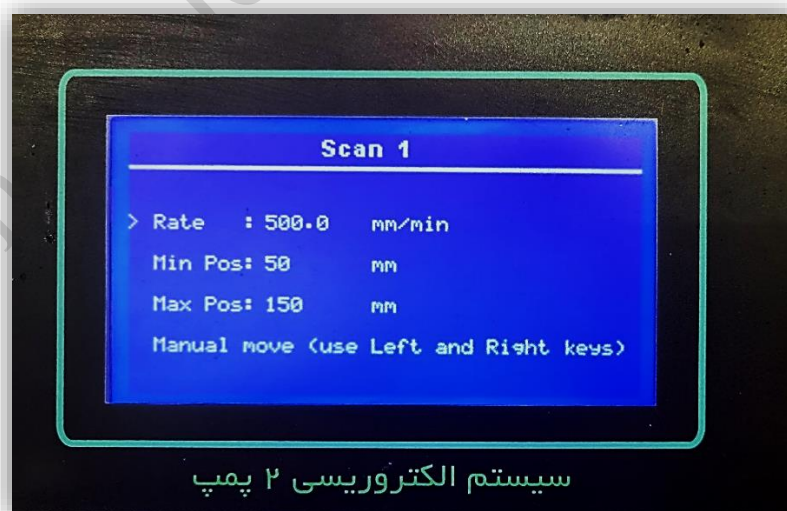


Figure 6. Configuration of the scanning system



Distance system

- By selecting the Distance button, as shown in Figure 7, you can adjust the distance of each syringe pump relative to the collector.
- To manually adjust the distance of the electrospinning units on the right and left sides, use the Right and Left keys.

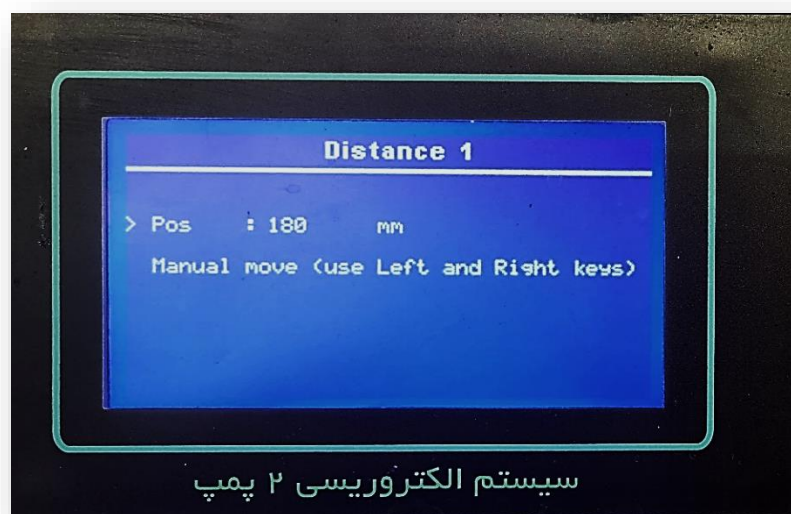


Figure 7. Settings related to the electrospinning distance system

Drum speed

According to Figure 8, depending on the type of electrospinning, the minimum and maximum rotation speed of the drum can vary from 350 to 3000 rpm. By selecting the Drum menu on the main screen and placing the option in the ON state, the collector drum starts to rotate, and the speed of rotation can be adjusted in rotations per minute (RPM) by entering the desired value in the Drum speed field.



Figure 8. Settings related to drum rotation speed

Adjusting the temperature inside the chamber

In the Temperature Control section of the device panel, as shown in Figure 9, there are lights for the heater and ventilation fan. By placing the switch in the ON position, the heater and ventilation settings menu will open, as shown in the figure. Using this section, you can adjust the temperature inside the chamber up to 45 degrees Celsius above the ambient temperature. To set the desired temperature inside the electro-rheology device, the temperature must be entered in Celsius.

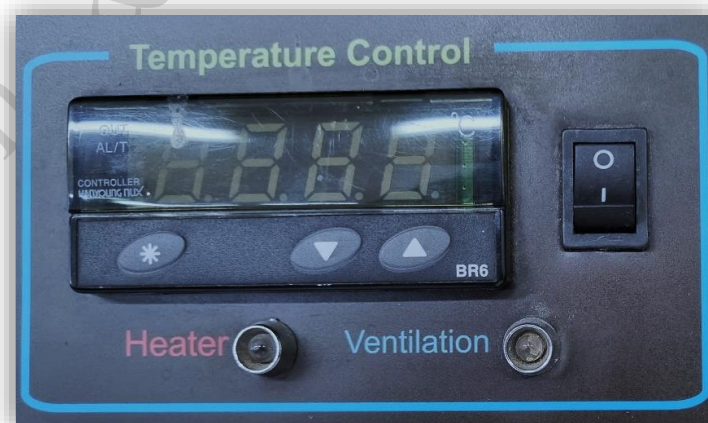


Figure 9. Settings for the temperature inside the chamber



Safety and important points

- Before turning on the electrospinning device, make sure that the high voltage power supply switch is in the off position.
- The electro-rheology device operates at a high voltage of around 30 kilovolts, which can discharge to any point, including the human body, from a few centimeters away. Therefore, never open the device door when the high voltage power supply is on, and never connect the high voltage cable to any place other than the nozzle.
- The solution inside the syringe (especially when using narrow diameter nozzles) is under pressure, which can cause the nozzle to come out of its connection and spray the polymer solution around. When using the device, always keep the device doors closed to prevent the polymer solution from spraying or wear protective goggles and face shields.
- The maximum adjustable temperature is set at 45 degrees Celsius, but it is possible to set higher values. However, due to the possibility of damage to electronic components and the power supply potential difference, it is recommended not to use high temperatures and to set the device temperature below 45 degrees Celsius if possible.
- If you hear or see a spark, immediately stop the device and check the device's connection to the ground.
- After finishing the work, it is necessary to completely clean the spinal needles and wash them with acetone to prevent the polymer from drying and sticking. It is also necessary to leave the needles in acetone until the next electrospinning step.