



TL-20M

Modular Electrospinning System for Batch Production

Process development and batch
production of highly uniform fibrous
membranes

TL-20M-200 / TL-20M-400

SHENZHEN TONGLI TECH CO LTD.



Batch Production with High Membrane Uniformity

Process flexibility with practical batch-production capability

High Uniformity

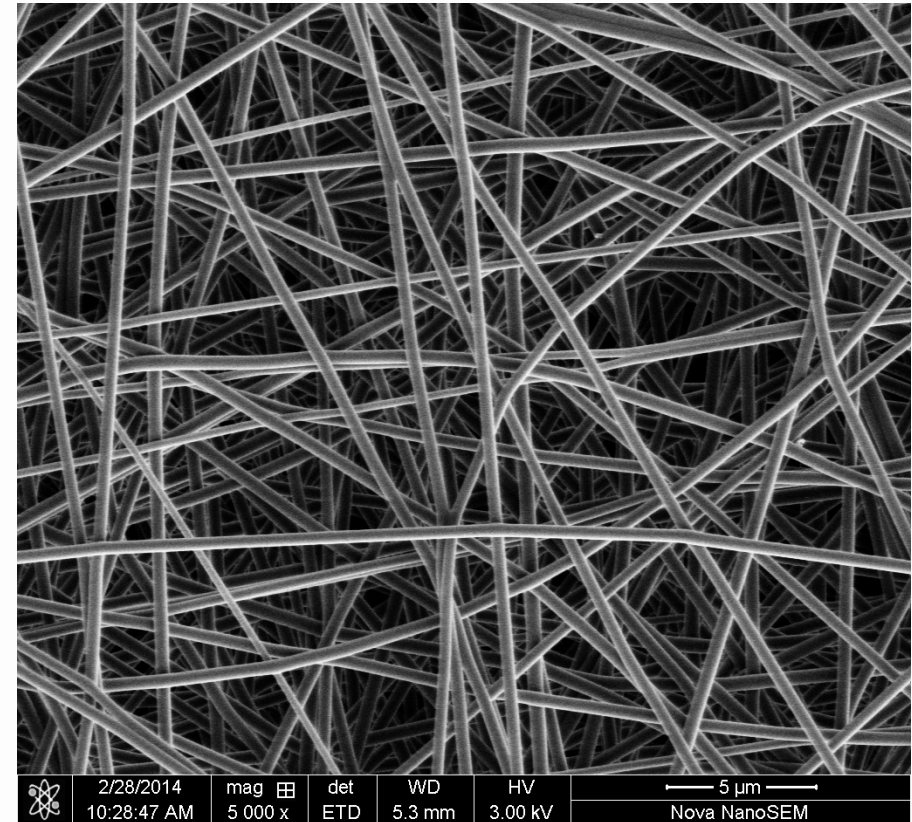
The core value of the TL-20M

Adjustable Deposition

Customizable, fine-tunable needle arrays
Reciprocating spinneret modules

Versatile Production Modes

Continuous rolls and fixed-length thick mats



Combine modules to suit each membrane process

Coordinated Control for Uniform Deposition

Spinneret layout, motion and solution delivery work together

Customizable Needle Arrays

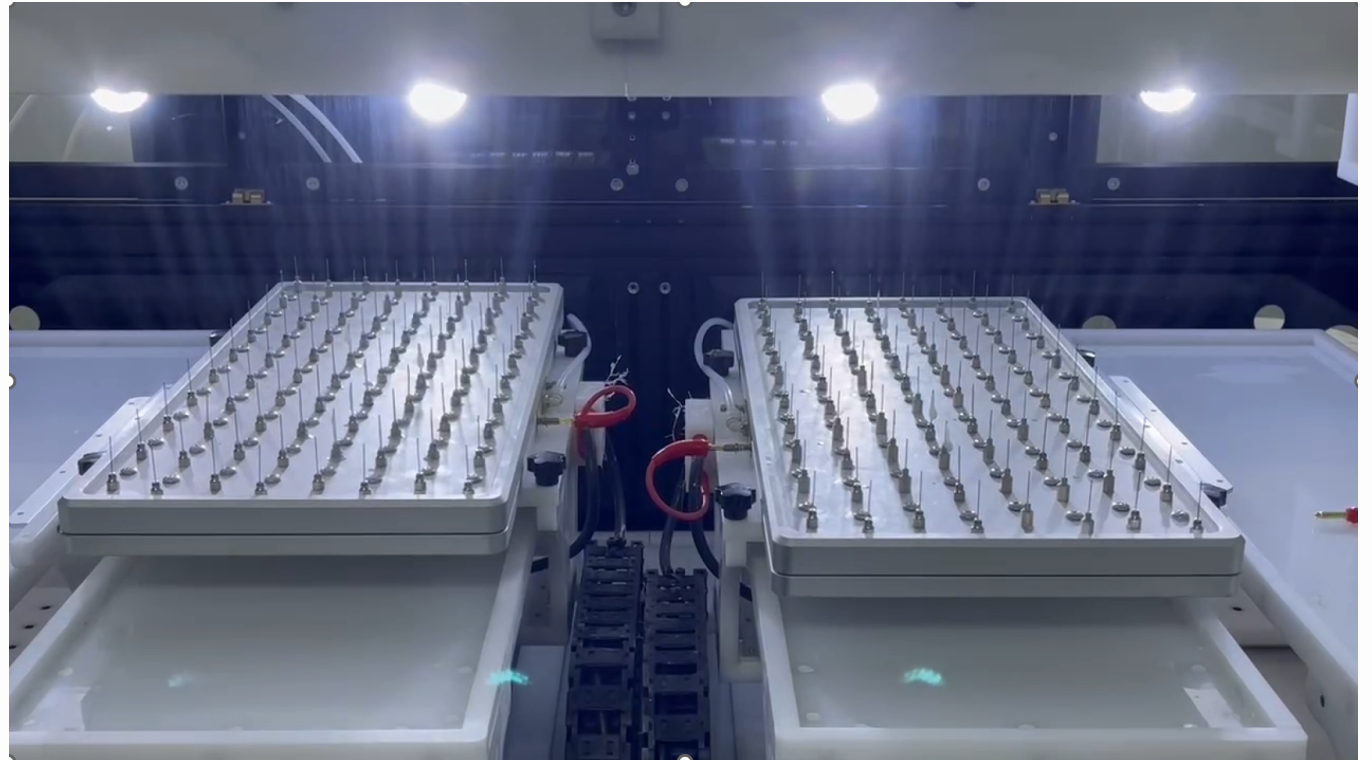
Adjust needle density for the collection width and edge deposition profile.

Stable Solution Delivery

Precision metering maintains stable flow in each channel.

Flat Collector Surface

A flat, conductive collector surface promotes a uniform electric field.



Customizable, Fine-Tunable Needle Layout

Adjust local deposition according to the membrane thickness profile

Adjustable Needle Count and Position

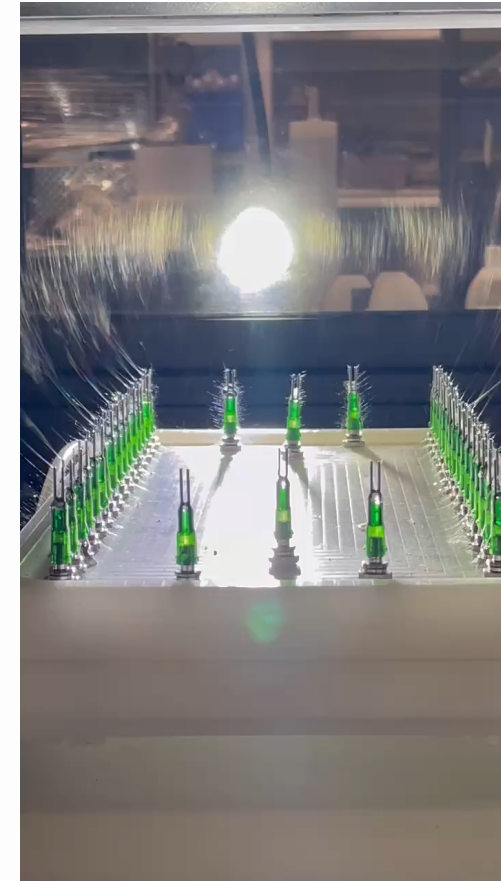
Configure needle count, spacing and placement.

Optimized Edge Deposition

Adjust array density at the edges or in selected areas.

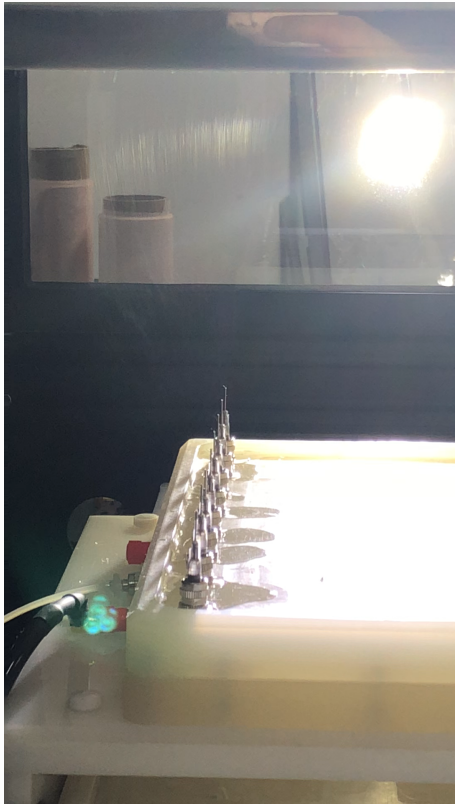
Stepwise Process Optimization

Validate with fewer needles, then expand to multi-needle operation.



Reciprocating Spinneret Modules

Modules reciprocate in opposite directions to improve cross-web coverage



Photographs during operation



Adjustable Motion

Set motion parameters for the material and target thickness profile.

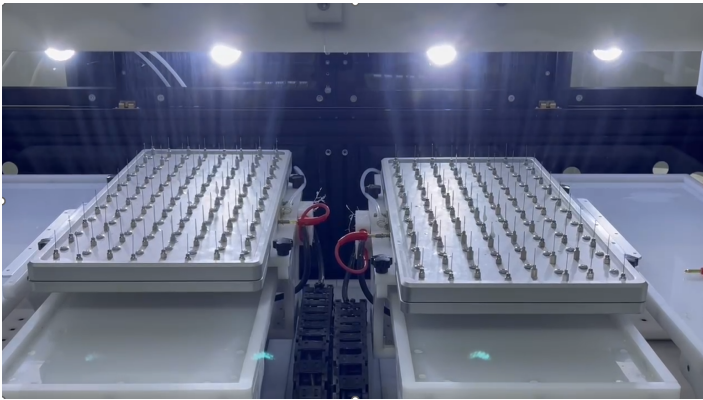
Spinning Distance

Adjust spinneret height from the touchscreen.

Interchangeable Spinneret Modules

Combine multi-needle, needleless and coaxial needle-array modules to suit the process

Multi-Needle Array



Precision solution metering
Customizable needle layout

Needleless Spinneret



Linear or annular design
Easy cleaning

Coaxial Needle Array



Independent core/shell feeds
Core-shell fiber production

Select each module to match the solution system and required fiber architecture

Multi-Needle Array System

For processes requiring precise solution delivery and batch-to-batch consistency

2–4 Spinneret Modules

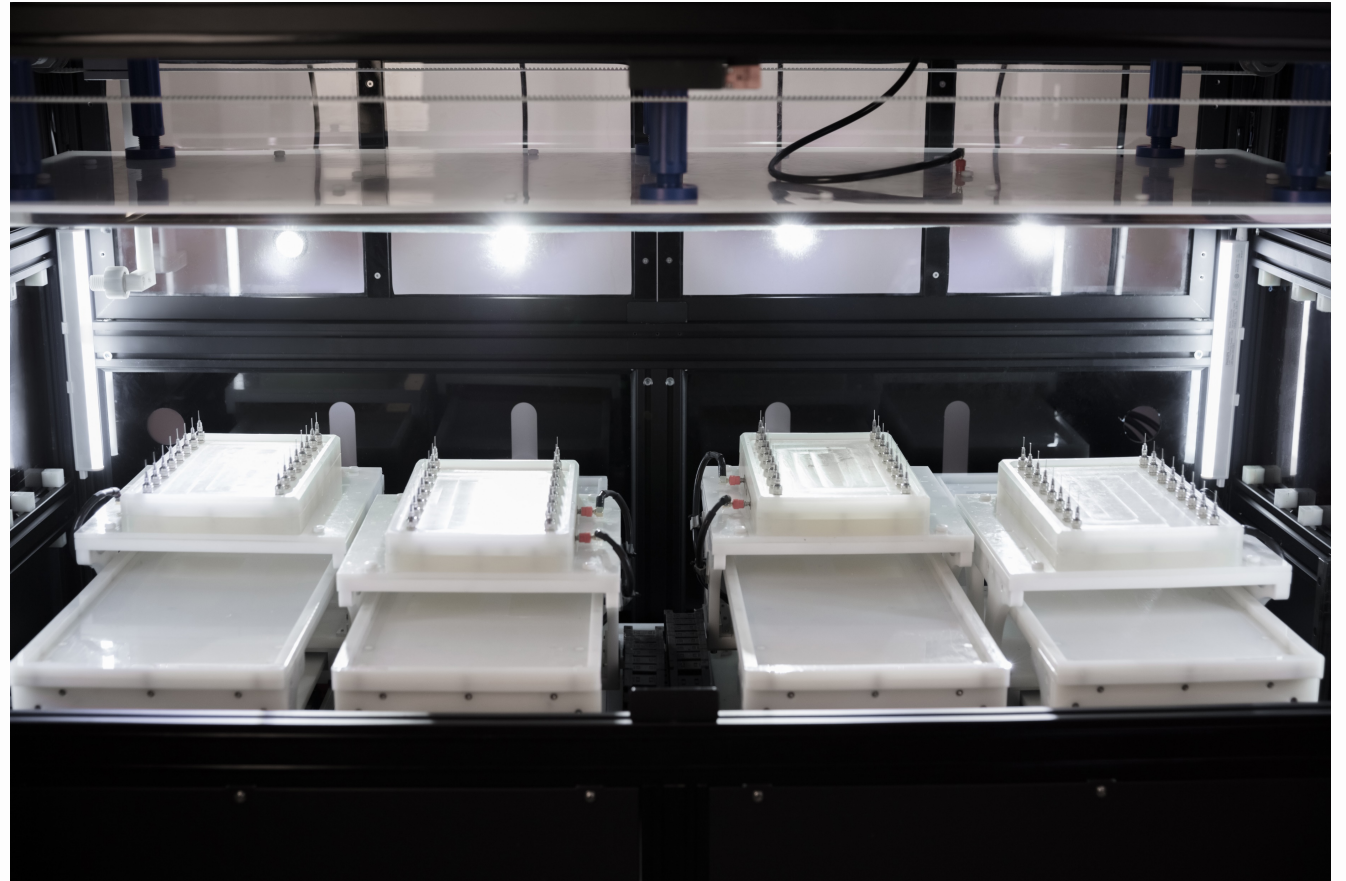
16–150 needles per module, depending on configuration.

Multi-Material Spinning

Process 2–4 different solutions simultaneously.

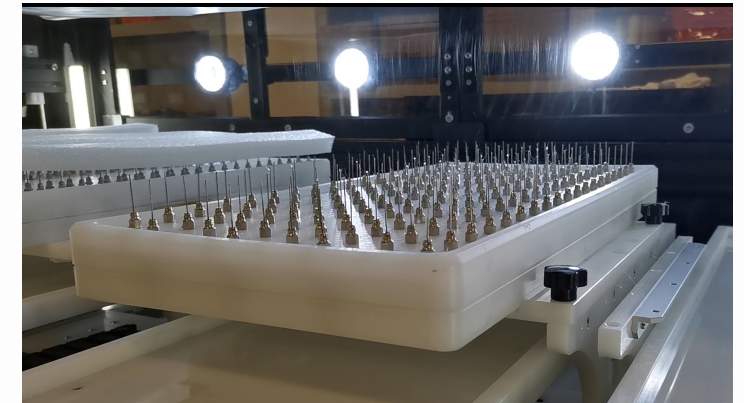
Relative Module Motion

Combine module motion and needle layout to improve deposition uniformity.



Multi-Needle Arrays in Operation

Example configuration: 100 needles × 4 modules



Needle count is based on the solution formulation and process stability.

Linear Needleless Spinneret

Optional module



Linear Spinneret Geometry

Structural tips concentrate the local electric field.

Easy Cleaning and Maintenance

Reduces needle consumables and individual needle maintenance.

Selection by Solvent System

Validate solvent evaporation rate and spinning stability.

Annular Needleless Spinneret

Optional module

Annular Spinneret Geometry

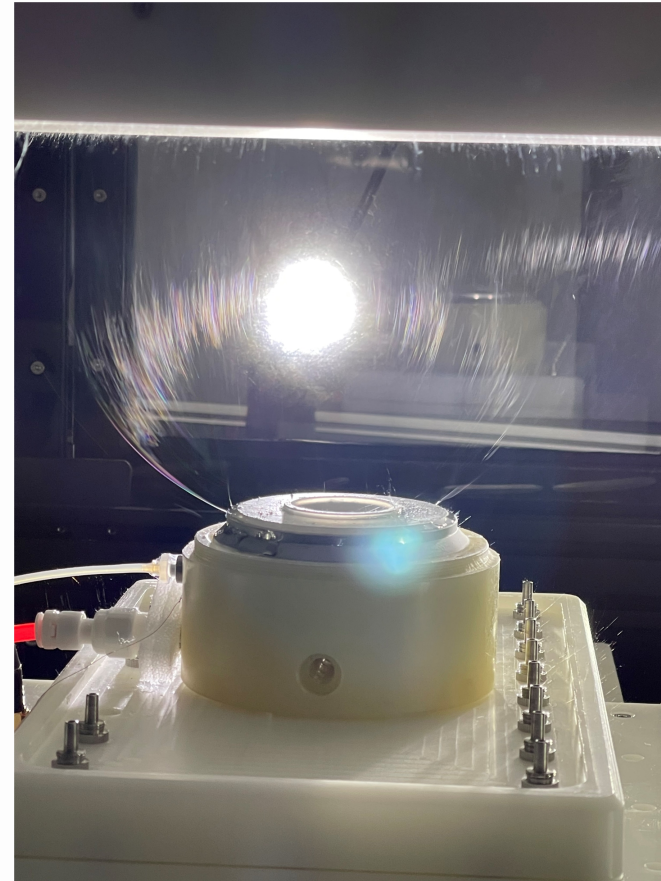
Supports needleless electrospinning.

Easy Cleaning

Suitable for processes requiring frequent maintenance.

Compatible with Other Modules

Combine modules to match the material and production requirements.



Coaxial Needle Array

Optional module for batch production of core-shell nanofibers

Independent Core and Shell Feeds

Set flow rates separately for the core and shell solutions.

Concentric Geometry

Replaceable inner and outer needles maintain coaxial alignment.

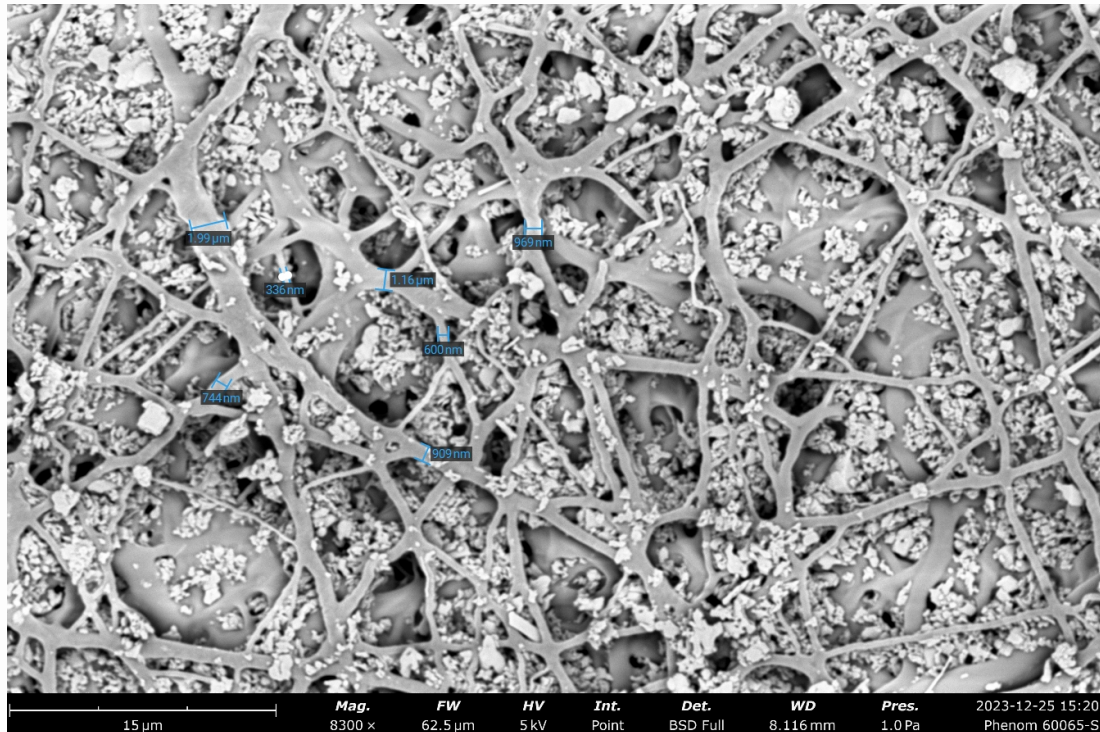
Configurable Array Size

Select the number of coaxial needles to suit the process.

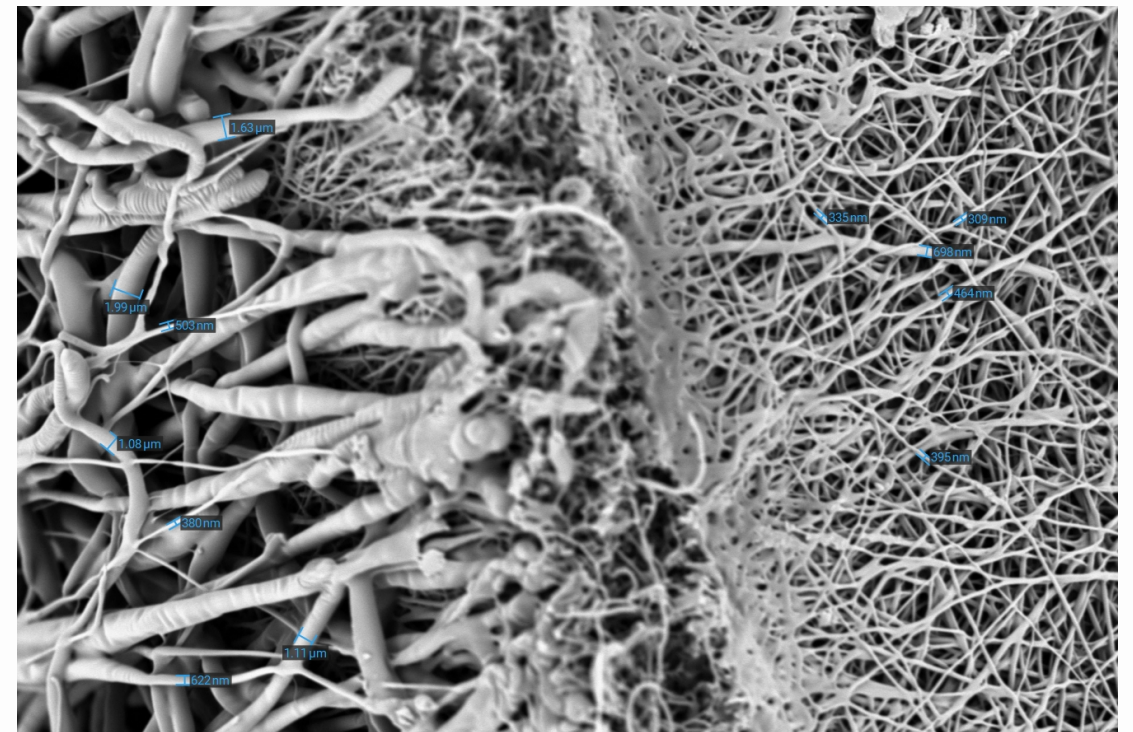


Multi-Material and Composite Fiber Structures

Spin 2–4 materials simultaneously or sequentially to produce composite structures



Combined Electrospinning and Electrospraying



Sequential Electrospinning of Different Polymers

Aqueous and Organic Solvent Systems

Match solution formulation and spinneret configuration to the material

Aqueous Systems

Fully dissolve the polymer

Organic Solvent Systems

Select suitable viscosity and evaporation rate

Material Compatibility and Process Selection

Consider material compatibility, process stability and operating conditions.

Examples of Common Solvents

Water, DMF, DMAc, DMSO, NMP, THF, HFIP, acetone and others

High-Capacity Precision Solution Delivery

Separate delivery unit for easier maintenance and expansion



Independent Channel Control

Set a different solution feed rate for each channel.

Servo Drive

Stable thrust and precise flow-rate control.

Expandable Channels

Configure channels for the number of spinneret modules and materials.

Independent Solution Delivery Channels

For multi-material and coaxial electrospinning

200–500 mL

Capacity per channel, depending on configuration.

Individual Channel Settings

Set a different solution flow rate for each channel.

Solvent Compatibility

Select wetted components compatible with the solvent in use.



Lower Operating Voltage

Needle-array and electric-field design support stable batch electrospinning

40–70 kV

Process Operating Voltage

Operating voltage depends on the material, spinneret and spinning distance. It differs from the rated output ranges of the positive and negative supplies.

Optimized Electric-Field Layout

Lower operating voltage helps reduce unintended sparking and discharge.

Installation in Conventional Facilities

Suitable for laboratories or production facilities with process-appropriate environmental controls.

Positive and Negative High-Voltage Supplies

Power control and protection functions

Positive / Negative Output Ranges

0 to +50 kV / 0 to -50 kV

Current Range and Protection

0–3 mA. Automatic shutdown above 3000 μ A.

Rapid Voltage Decay

Voltage falls from 50 kV to 0 in <0.5 s after switch-off.

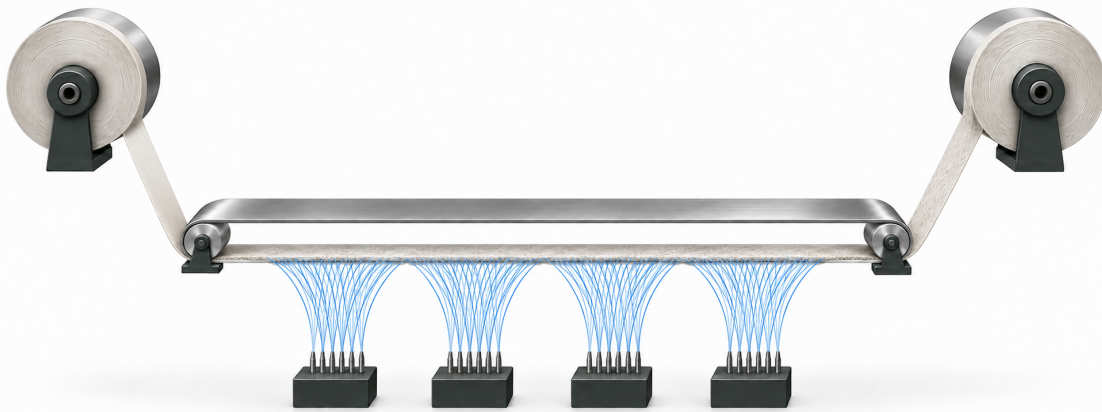
Power-supply accuracy: $\pm(2.0\% \text{ rdg} + 1 \text{ digit})$



Two Collection Modes

Upward electrospinning with spinnerets below and the collector above

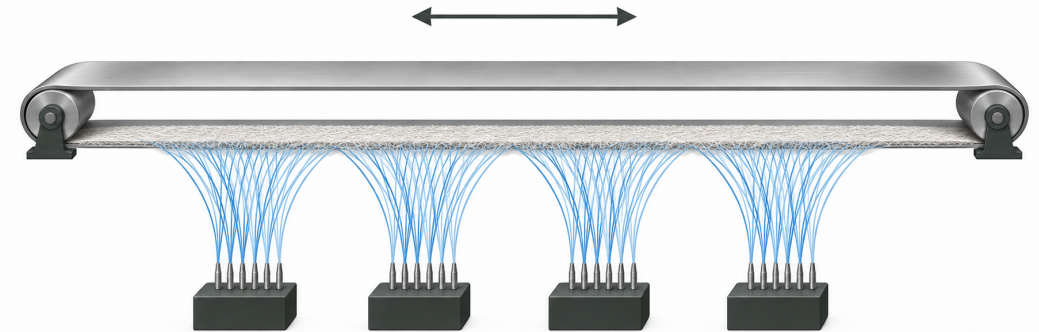
Continuous Roll Collection



Continuous membrane winding

Collection principle schematics, not equipment engineering drawings

Fixed-Length Thick Mats



Repeated deposition on a closed loop builds membrane thickness

Continuous Roll-to-Roll Collection

The membrane is wound immediately after leaving the spinning zone

Closed-Loop Stainless-Steel Belt

The belt runs around two rollers and supports the membrane in the spinning zone.

200–650 mm

Collection width, depending on configuration.

Approx. 200 m

Continuous winding length, depending on the collection configuration.

Max. roll diameter: 500 mm Winding speed: 0–20 mm/min



Fixed-Length Thick Fibrous Mats

Repeated deposition builds thickness over a fixed collection length



Up to 2.75 m

Fixed-length collection with the TL-20M-400.

Up to 1.6 m

Fixed-length collection with the TL-20M-200.

Thick-Mat Production

Collect on metal substrates such as aluminum foil.

Reference thickness: $\geq 50 \mu\text{m}$. Actual thickness depends on the material and deposition time.

Models and Batch-Production Configurations

Select for collection width, target thickness and stable solution-delivery capacity



Parameter	TL-20M-200	TL-20M-400
Spinneret modules	2	4
Maximum needle count	300	600
Reference solution throughput	Approx. 100–200 mL/h	Approx. 200–400 mL/h
Fixed-length collection	Up to 1.6 m	Up to 2.75 m
Collection width	200–650 mm, by configuration	200–650 mm, by configuration

mL/h denotes solution throughput, not dry-fiber output. Actual output depends on solution concentration, material and process conditions.

Spinneret Motion Specifications

Y–Z motion control supports thickness-profile optimization

Y-Axis Horizontal Travel

Travel: 300 mm Speed: 1–40 mm/s

Z-Axis Height Adjustment

Spinning distance: 8–30 cm, set via touchscreen.



Automatic In-Process Needle Cleaning

Reduces manual intervention during operation

Automatic In-Process Cleaning

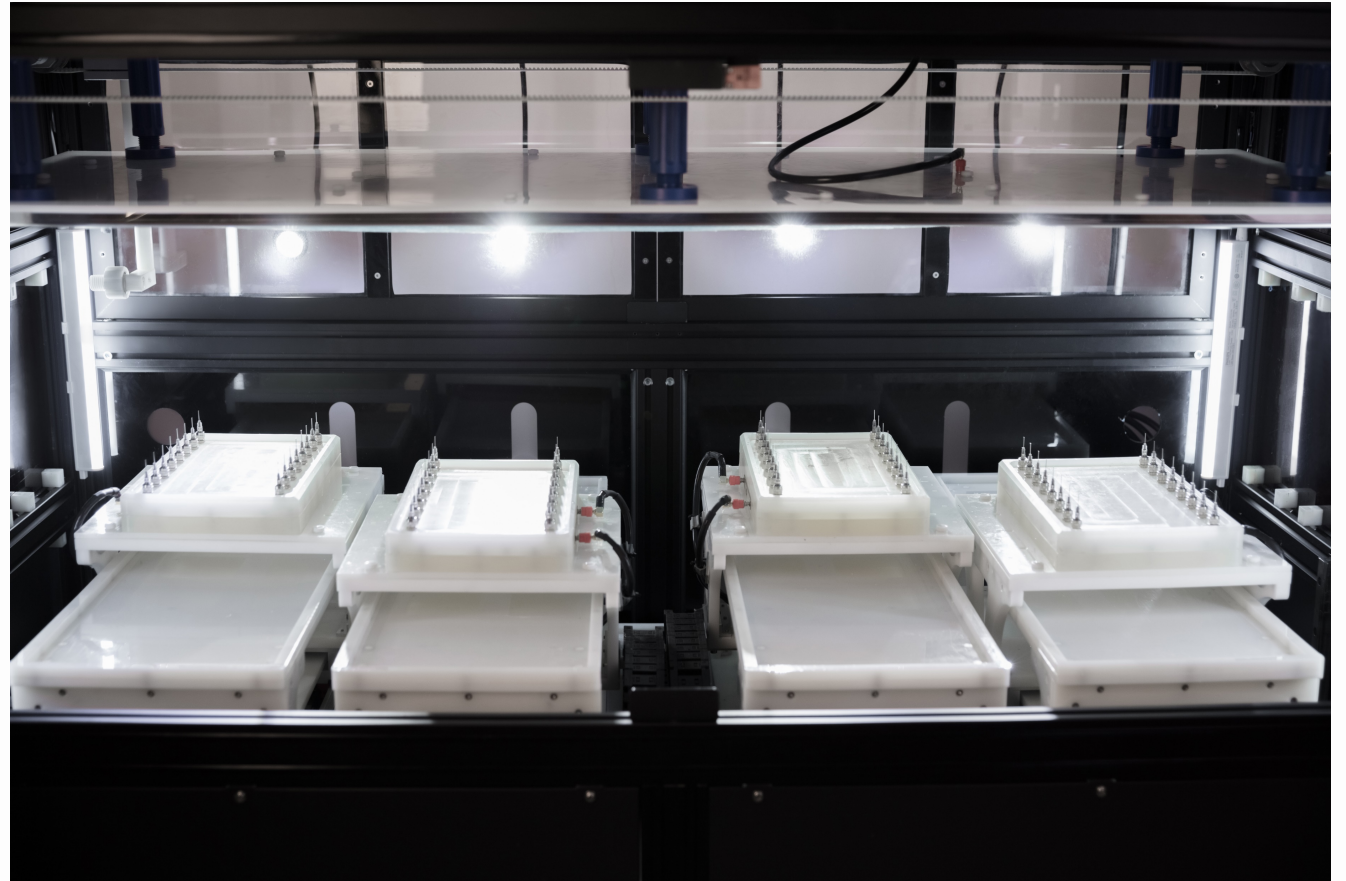
Clean needles according to the production cycle.

Adjustable Cleaning Frequency

Set cleaning frequency to suit the solution and clogging tendency.

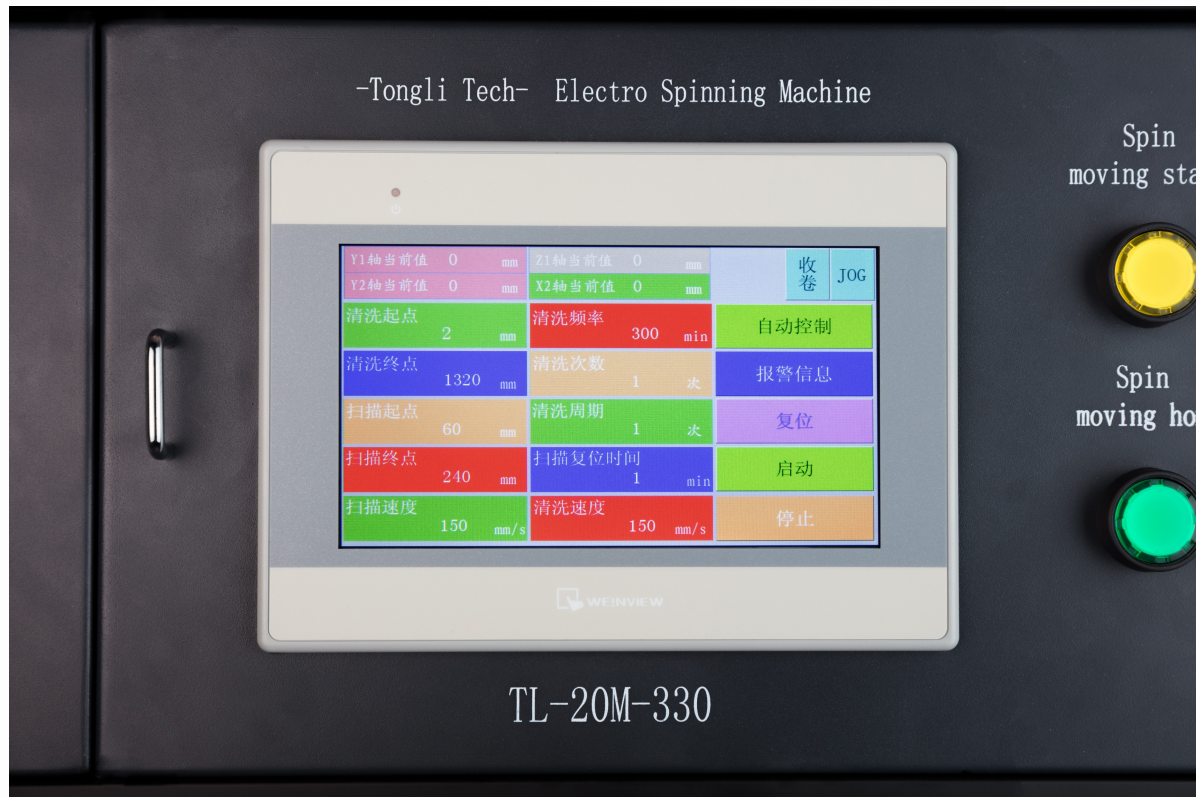
Disposable Cleaning Media

Easy replacement and routine maintenance.



Touchscreen Control

Centralized process settings support stable, repeatable production



Touchscreen process interface

Centralized Process Settings

Set motion, cleaning and other parameters via the touchscreen.

Selectable HV Control

Control high voltage separately or through the touchscreen.

Process Parameter History

Retrieve approximately one month of parameter history to support repeat production.

Direct Access to Operating Controls

Physical buttons provide direct access to frequently used functions



Frequently Used Controls

Spinning and collection start/stop
Spinneret positioning
Needle-cleaning control
Exhaust and lighting

A physical emergency-stop button allows prompt intervention.

Simple External Dehumidification

An external dehumidifier can reduce humidity to approximately 20%–30% RH

20%–30%

RH

External Unit

Easy installation and maintenance for conventional laboratories or production facilities.

Process-Based Adjustment

Adjust humidity to suit the material.

Achievable humidity depends on ambient conditions, enclosure sealing and operating conditions.



Example of an external dehumidifier

Safety Features

Power-supply protection, operating interlocks and static control

Power Protection

HV, Overvoltage and Overcurrent Protection

An alarm is triggered when parameter limits are exceeded.

Operating Interlocks

Door-Open Power Interlock

An emergency-stop button enables immediate intervention.

Static Control

Static Elimination

Multi-point grounding and proper operating procedures.

Match needle layout and operating voltage to the process, with protective devices and proper operating procedures.

Installation in Conventional Facilities

For laboratories or production facilities with utilities suited to the solvent and process



Ventilation and Exhaust

Configure ventilation for the solvent and production process.

Grounding and Static Control

Provide multi-point grounding and static elimination.

Environmental Conditions

Adjust humidity to meet material requirements.

Fibrous Membranes and Fiber Morphology

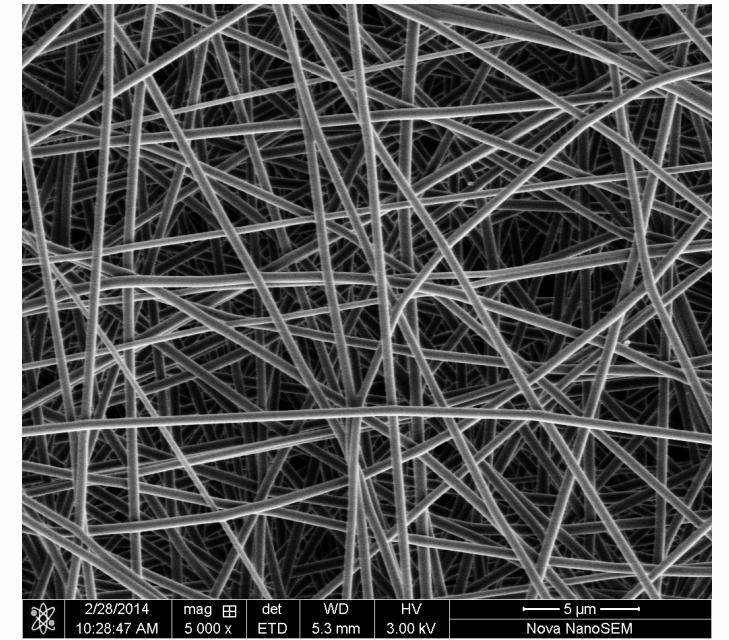
Membrane quality at the macroscopic and microscopic levels



Coated Nonwoven Substrate



Fibrous Membrane Roll



SEM Image of Nanofibers

Process Selection for Membrane Quality

For applications requiring high uniformity, batch consistency and controlled fiber architecture

01

Define the Product

Specify membrane width, thickness and structure, and choose continuous or fixed-length collection.

02

Select Spinneret Modules

Choose multi-needle, needleless or coaxial modules for the solution system.

03

Scale a Stable Process

Validate with fewer needles, then increase needle count and solution throughput.

Needle Maintenance and Replacement

Convenient cleaning and restart after continuous production

Seal After Production

Use dedicated needle caps for sealing.

Quick Replacement When Needed

Simple twist or pull actions for removal and replacement.

10–20 min

Full-array replacement time varies by needle count and configuration.





TL-20M

High-Voltage Electrospinning System

Consistent Quality Safe and Reliable



Small-Batch Production of Highly Uniform Fibrous Membranes