



TL-EHD

Electrohydrodynamic Micro/Nano Printer

Microscale printing and direct writing
with programmable electric fields

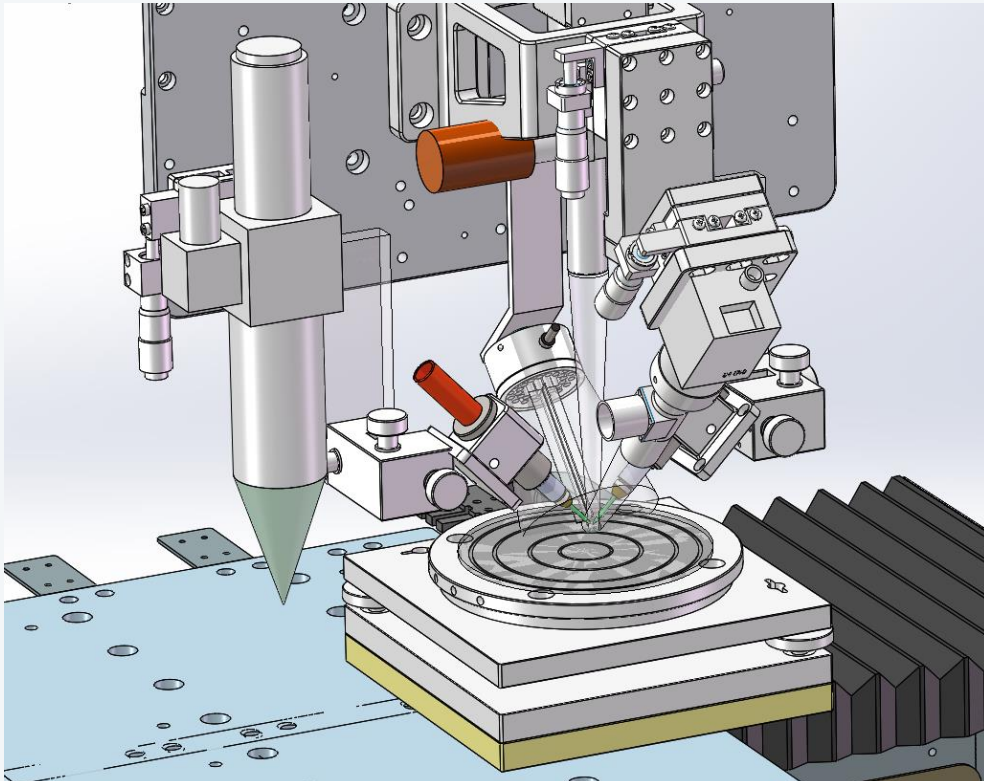
Electrohydrodynamic Jet Printing

SHENZHEN TONGLI TECH CO LTD.



Integrated Printing and Process Control

Process development for microscale dots, lines and multilayer patterns



Programmable electric field

Voltage waveforms control droplet ejection and deposition.

Vision and motion control

Four camera views with closed-loop motion control.

Direct pattern-to-path conversion

Pattern import, drawing and parametric editing.

1–45 μm dots and lines / Actual feature size depends on the material and process

Near-Field Droplet Printing

TL-EHD deposits discrete droplets as dots and overlaps adjacent deposits to form complex patterns

Small nozzle-to-substrate gap

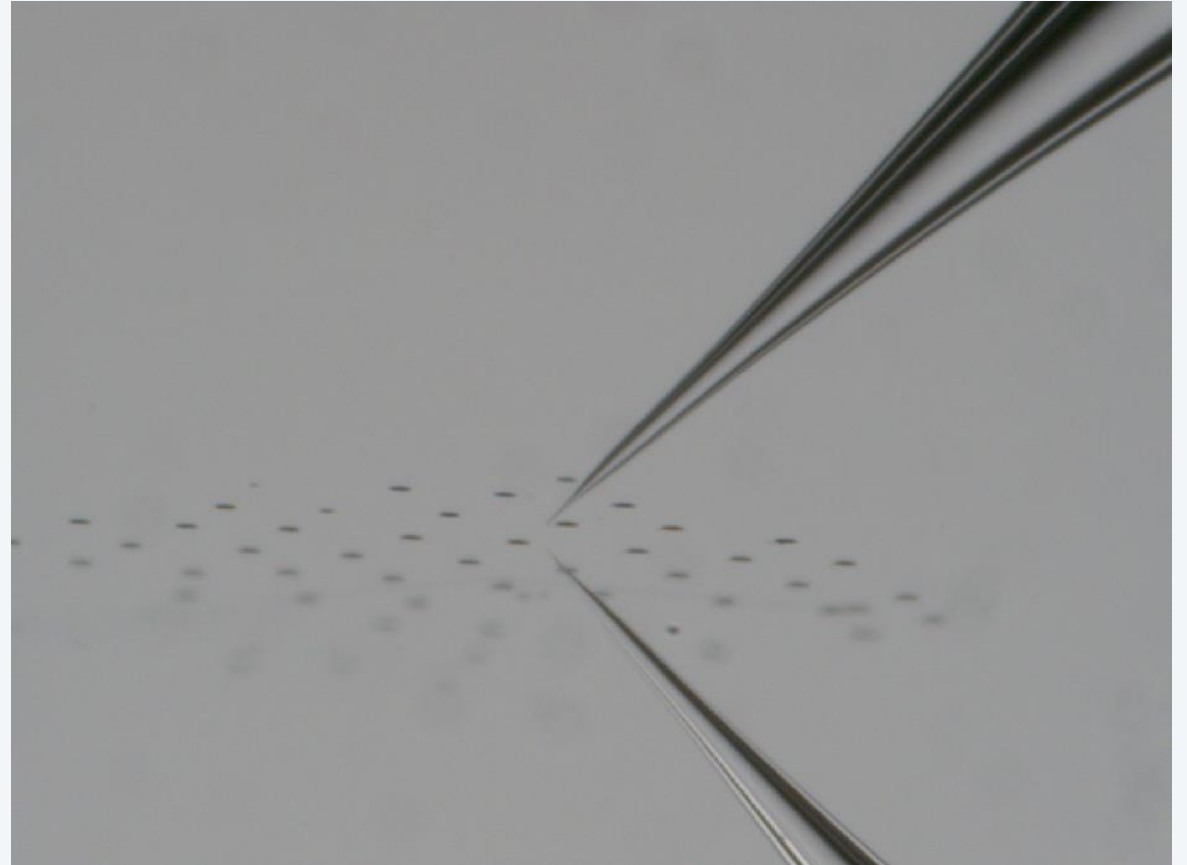
A gap of tens to hundreds of micrometers places the nozzle tip close to the substrate.

Discrete droplet deposition

The electric field ejects microdroplets onto defined positions on the substrate.

Overlapping deposits form lines

Synchronized motion and jetting place overlapping droplets along the print path.

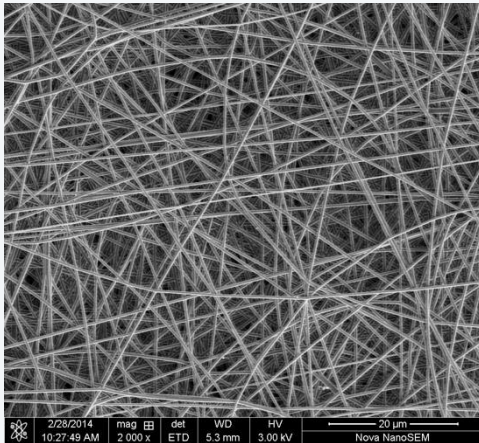


Three Electric-Field-Driven Processes

TL-EHD focuses on dot and line patterning and microstructure fabrication

Electrospinning

Fiber membrane fabrication

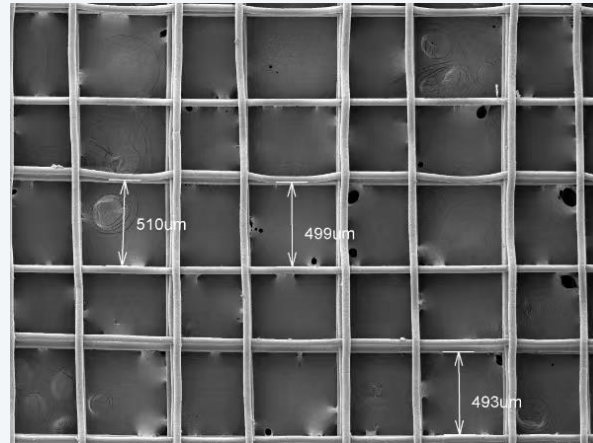


Fibrous membranes

Multiple fibers form a membrane.
Typical fiber diameter: 100–1000 nm.

Electrostatic Direct Writing

Controlled fiber placement



Ordered fiber structures

Individual solution or melt fibers
placed directly, layer by layer.

EHD Jet Printing

Droplet-based patterning



Dots, lines and fine patterns

Droplets form dots and, by overlap,
lines and complex micropatterns.

Machine Architecture

Multi-side access, a marble base and a dual-monitor workstation

Access from all four sides

Easy sample loading, maintenance and functional upgrades.

Marble base

Supports a precision multi-axis motion system.

Dual large-format displays

Motion, four camera views, waveforms and signal feedback.



Dimensions: 1613 × 908 × 724 mm / Approximate system weight: 500 kg

X–Y–Z–K Closed-Loop Motion Control

Axis-specific travel, speed and positioning specifications

Axis	Travel	Maximum speed	Positioning specification
X	>180 mm	200 mm/s	Repeatability: $\pm 1.5\text{ }\mu\text{m}$
Y	>180 mm	200 mm/s	Repeatability: $\pm 1.5\text{ }\mu\text{m}$
Z	>80 mm	20 mm/s	Positioning accuracy: 100 nm

Linear motors on X, Y and K. A rotary servo motor drives the Z axis.

Closed-loop control supports coordinated positioning and path execution.

100 nm and $\pm 1.5\text{ }\mu\text{m}$ describe stage positioning. Actual print placement accuracy depends on the material and process.

Adjustable High-Voltage Output

Controlled electric fields drive the jetting process

0–2000 V

High-voltage output range

0–10 mA

Continuously adjustable output current

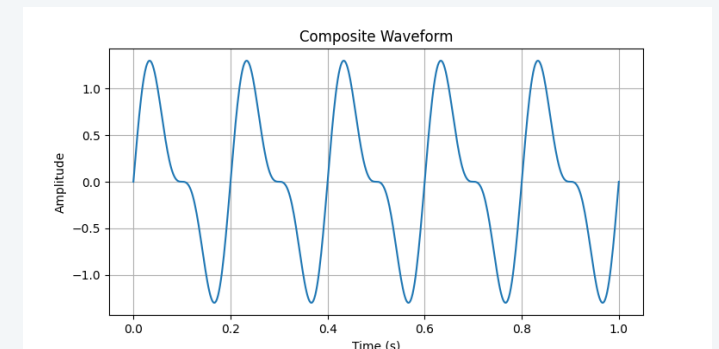
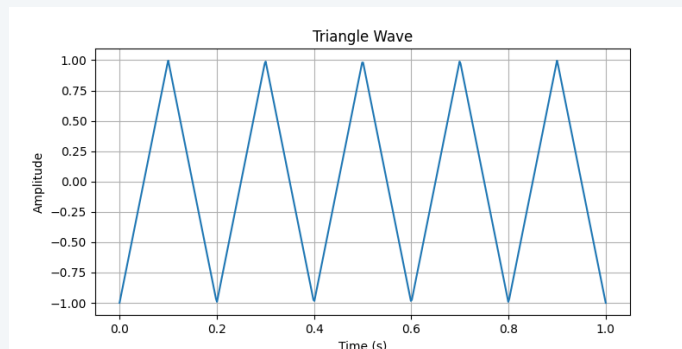
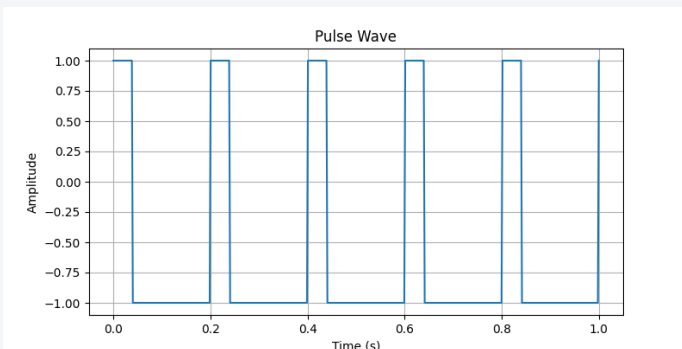
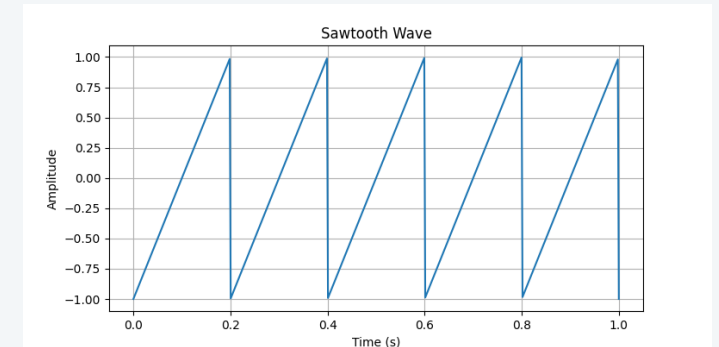
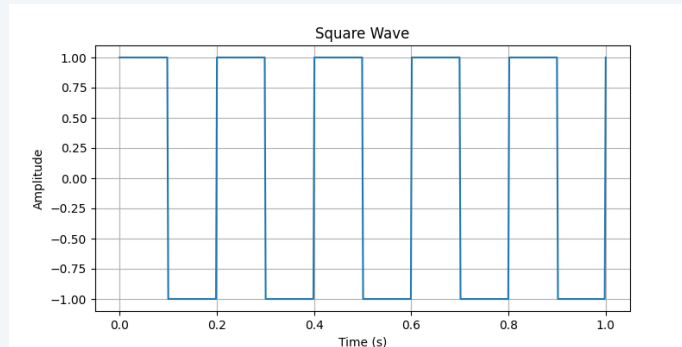
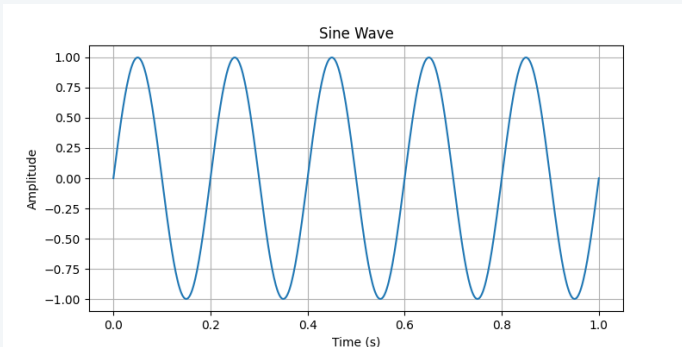


Digital control with stable, programmable voltage output.

Programmable High-Voltage Waveforms

PC control of frequency, duty cycle, amplitude and DC offset

Standard and composite waveforms



Custom waveforms with Chinese and English software interfaces.

Digital Oscilloscope Monitoring

Voltage and pulse monitoring for process adjustment

Dual channel / 50 MHz

USB oscilloscope with 50 MHz analog bandwidth.

Up to 200 MSa/s

Sampling rate for capturing signal changes.

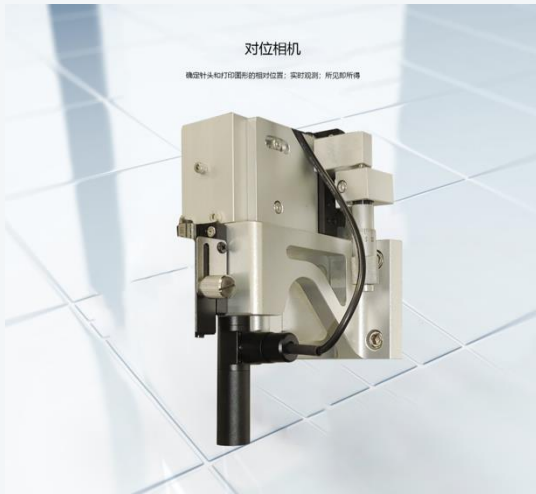
Sensitivity and input range

10 mV/div–2 V/div
–100 V to +100 V (DC + AC)



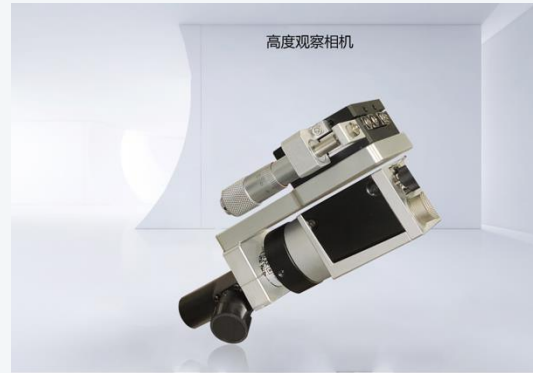
Four-Channel Microscopic Imaging

Dedicated views for alignment, nozzle height, droplet dynamics and surface morphology



Alignment camera

Locates the nozzle relative to the pattern.



Gap measurement

Observes and measures the nozzle-to-substrate gap.



In situ microscopy

High-magnification surface inspection without removing the sample.

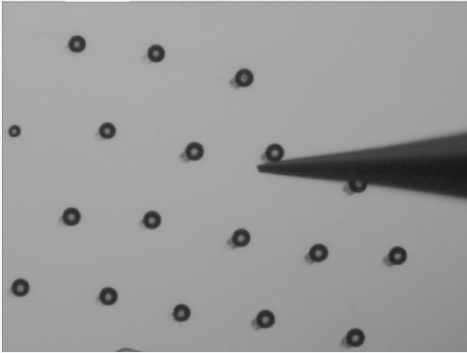


Droplet imaging

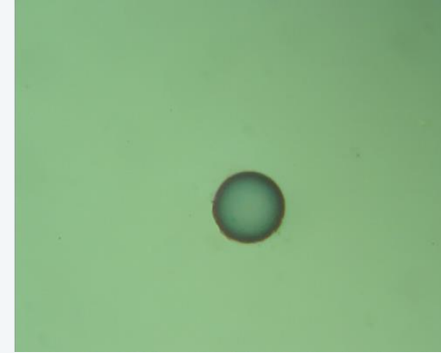
Synchronized recording of droplet dynamics as images or video.

Nozzle Alignment and Droplet Imaging

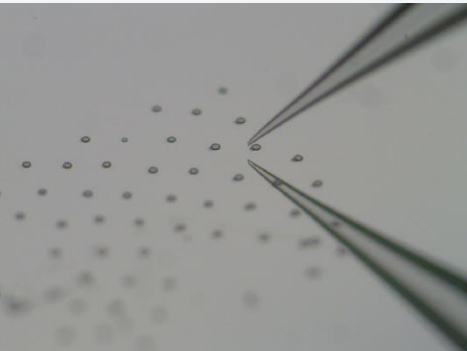
Microscopic views at different scales during printing



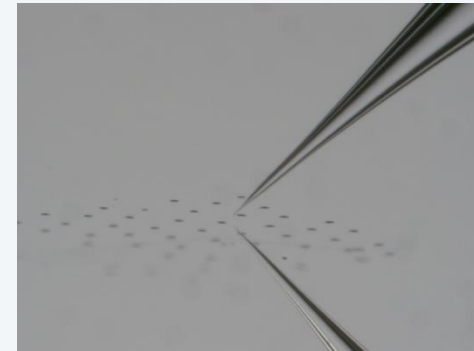
Alignment view ×4



In situ surface view ×15



Nozzle height view ×2



Synchronized droplet imaging

Camera and Printhead Positioning

Independent adjustment for observation and process setup

Four independent camera views

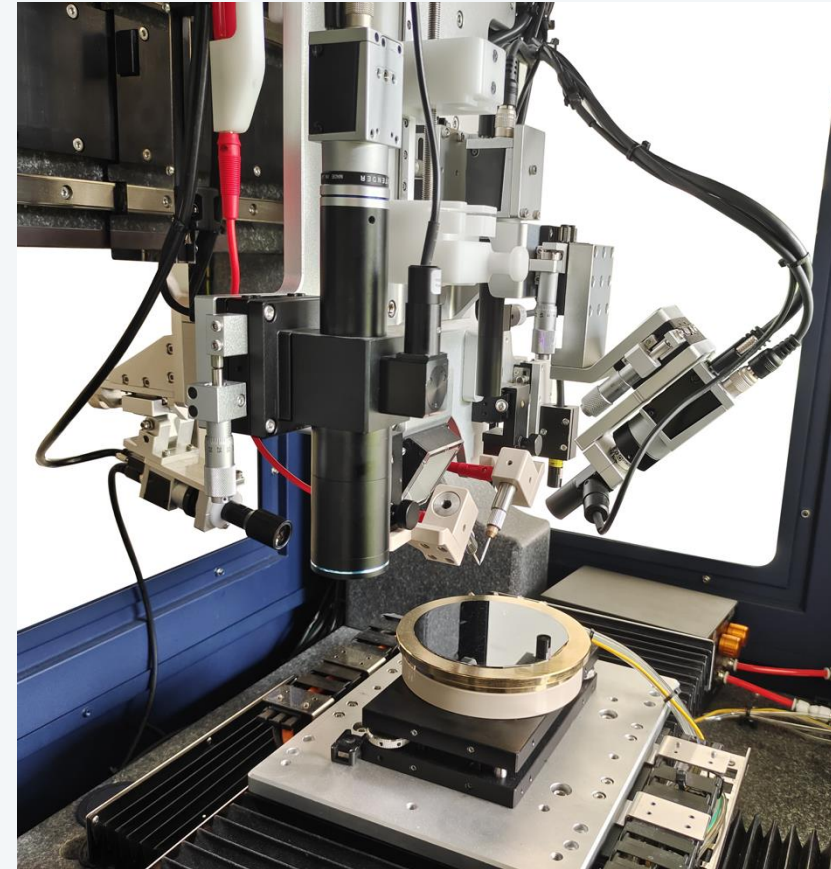
Select the view required for each task.

X–Y–Z adjustment

Adjust camera and nozzle positions independently.

Electrical clearance

Appropriate separation between the optics and printhead.



Materials and Ink Selection

Solution inks, stable dispersions and liquid curable formulations

Material class	Ink type / Examples	Potential applications
Conductive inks	Silver nanoparticle and silver-ion inks, PEDOT:PSS dispersions	Microelectrodes, conductive traces
Polymer solutions	Solutions of insulating or functional polymers	Insulating patterns, functional microstructures
Particle dispersions	Stable dispersions, e.g. semiconductor nanoparticles	Functional layers, microscale patterns
Photocurable inks	Jetable UV-curable resins or prepolymers	Localized curing, microstructure fabrication

Formulation and process compatibility

Assess viscosity, conductivity and surface tension.
Check dispersion stability, settling and clogging.

Match substrate wetting, drying and curing conditions.
Photocurable inks require a compatible light source.

Selection guidance only. Validate each formulation with the nozzle, waveform, feed settings and substrate.

Microscale Nozzles and Holders

Nozzle selection according to ink viscosity and target pattern

1–100 μm

A range of micrometer-scale nozzle sizes.

Ink and nozzle compatibility

Smaller bores are generally used for lower-viscosity inks.

Dedicated holders

Compatible with the fluid delivery system.



Dual Printheads with Manual Switching

Two microscale nozzles for combined printing processes

Dual-nozzle configuration

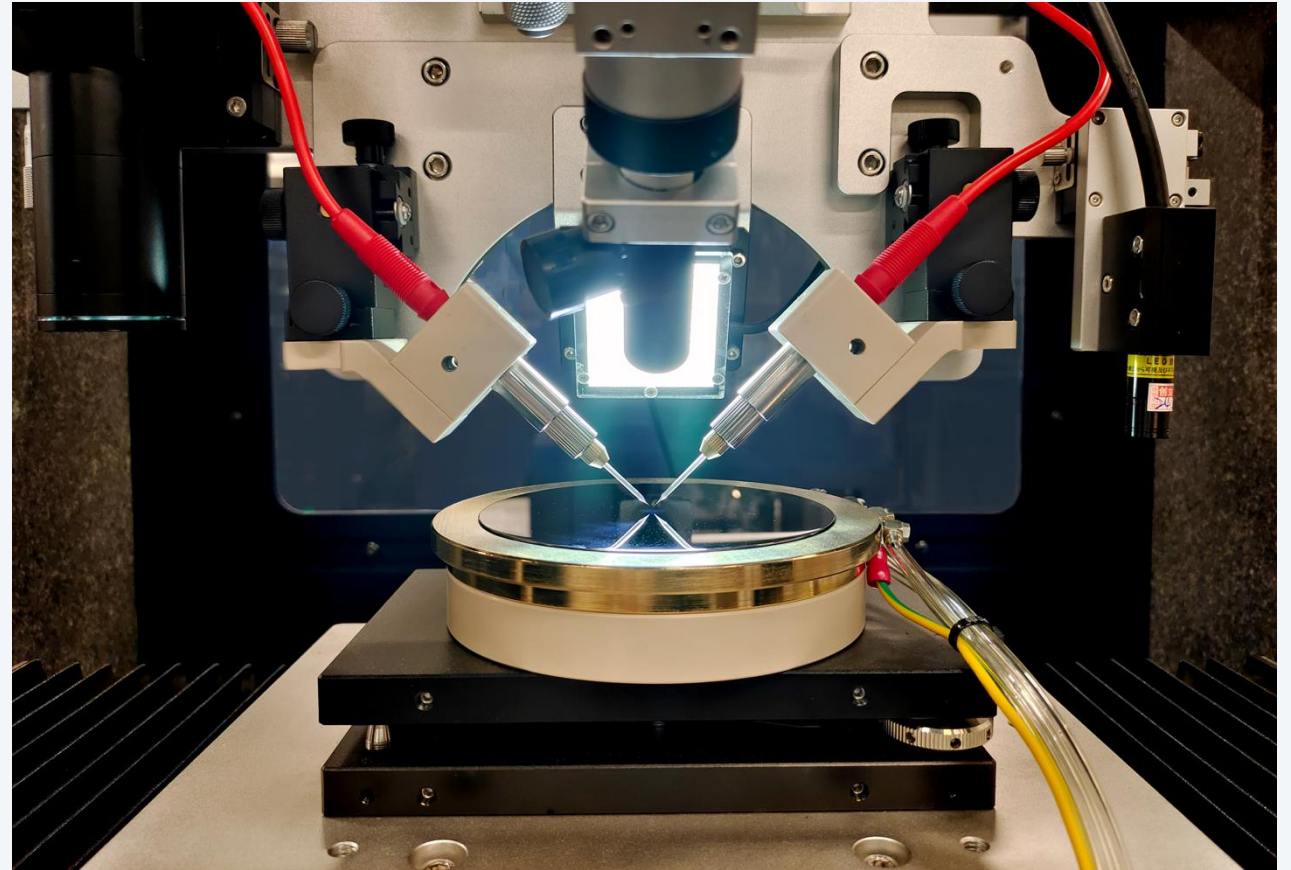
Simultaneous or alternating operation.

Independent 3-axis adjustment

X–Y–Z adjustment for each nozzle.

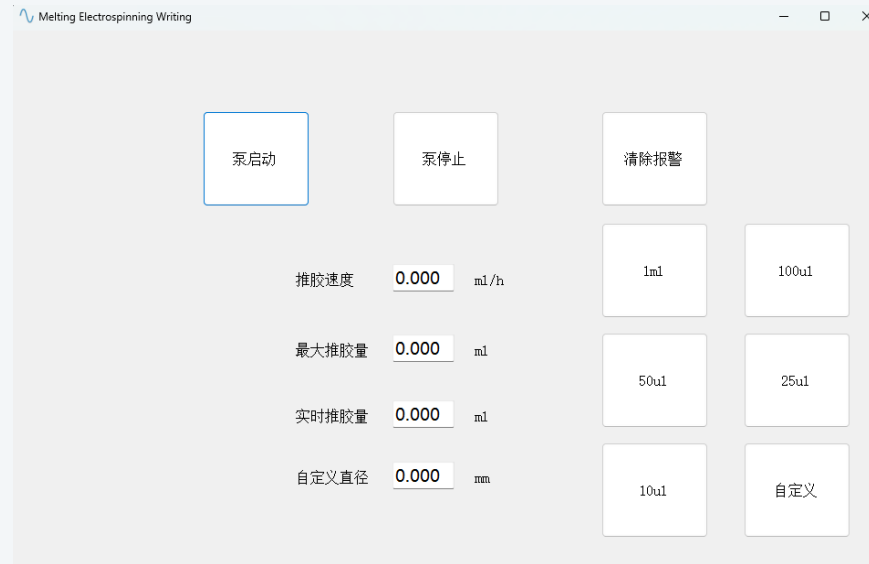
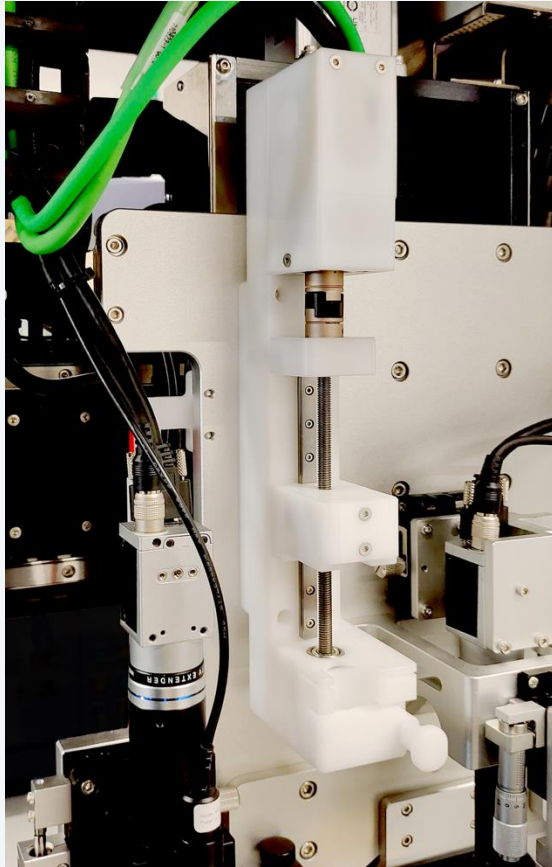
Multi-view process monitoring

Supports alignment and in-process inspection.



Precision Syringe-Based Ink Delivery

Controlled fluid delivery for dot and line printing



**0.01 $\mu\text{L}/\text{h}$
to 99.9 mL/h**

Flow rate range

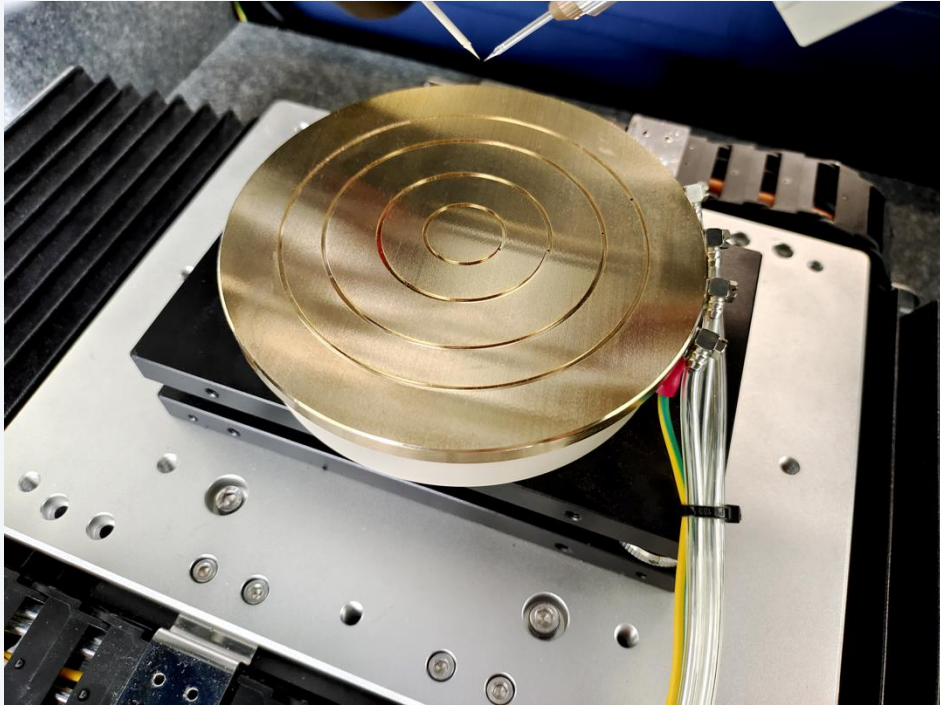
**300–5000 cP
Fluid viscosity range**

1, 10 and 20 mL syringes

Luer-tip stainless-steel needles with bores selected to suit the ink.

Vacuum Chuck and Substrate Mounting

Level adjustment and support for multiple wafer sizes



1–4
inches



Multi-ring gold-plated vacuum chuck

For 1, 2, 3 and 4 inch silicon wafers.
Electrically insulated for high-voltage operation.

Quiet dual-channel vacuum pump with adjustable suction for sample holding and exchange

365 nm UV Curing

Printing-synchronized or independent control

Sequential or synchronous curing

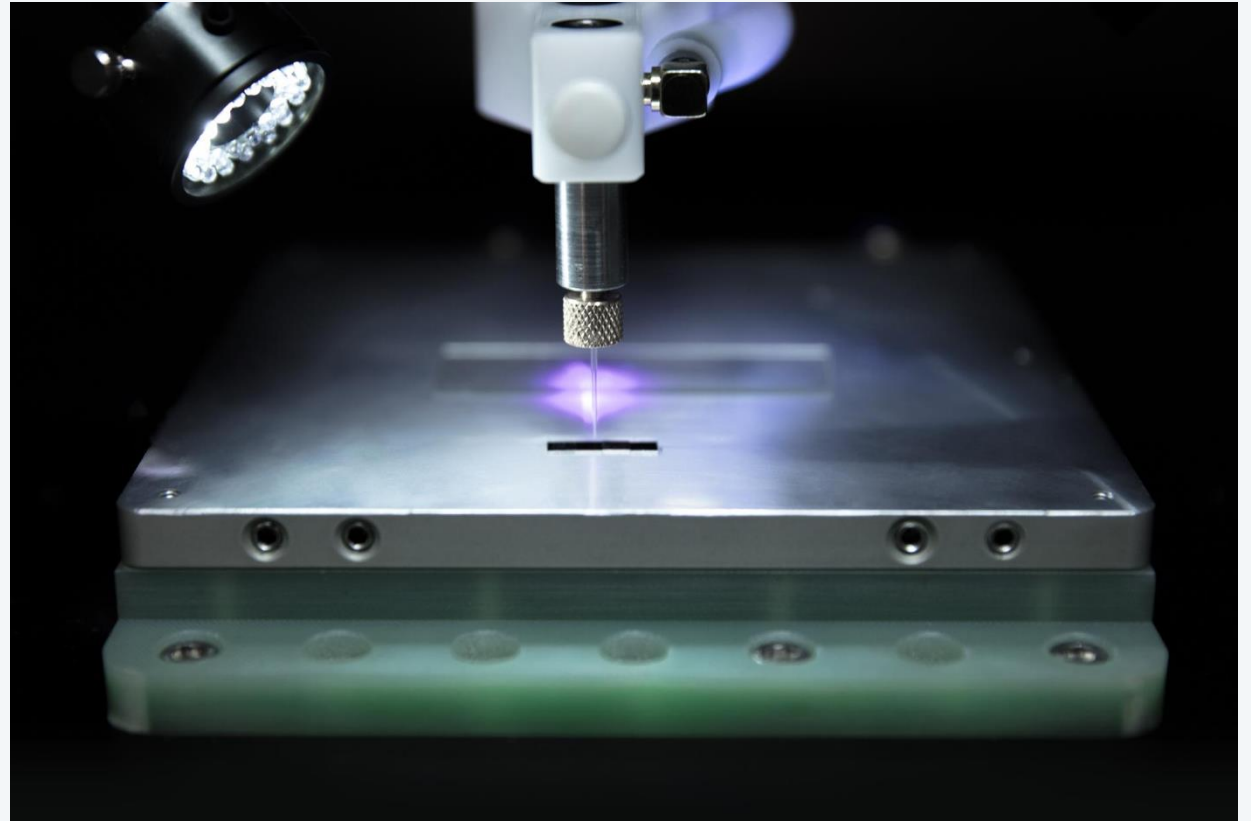
Programmable curing along the print path.

Synchronized Z-axis motion

Fine adjustment of the offset from the nozzle.

Stored operating positions

Switch between four stored lateral positions.



Pattern-Based Printing Software

Visual pattern editing and job setup without manual G-code programming

Visual pattern editing

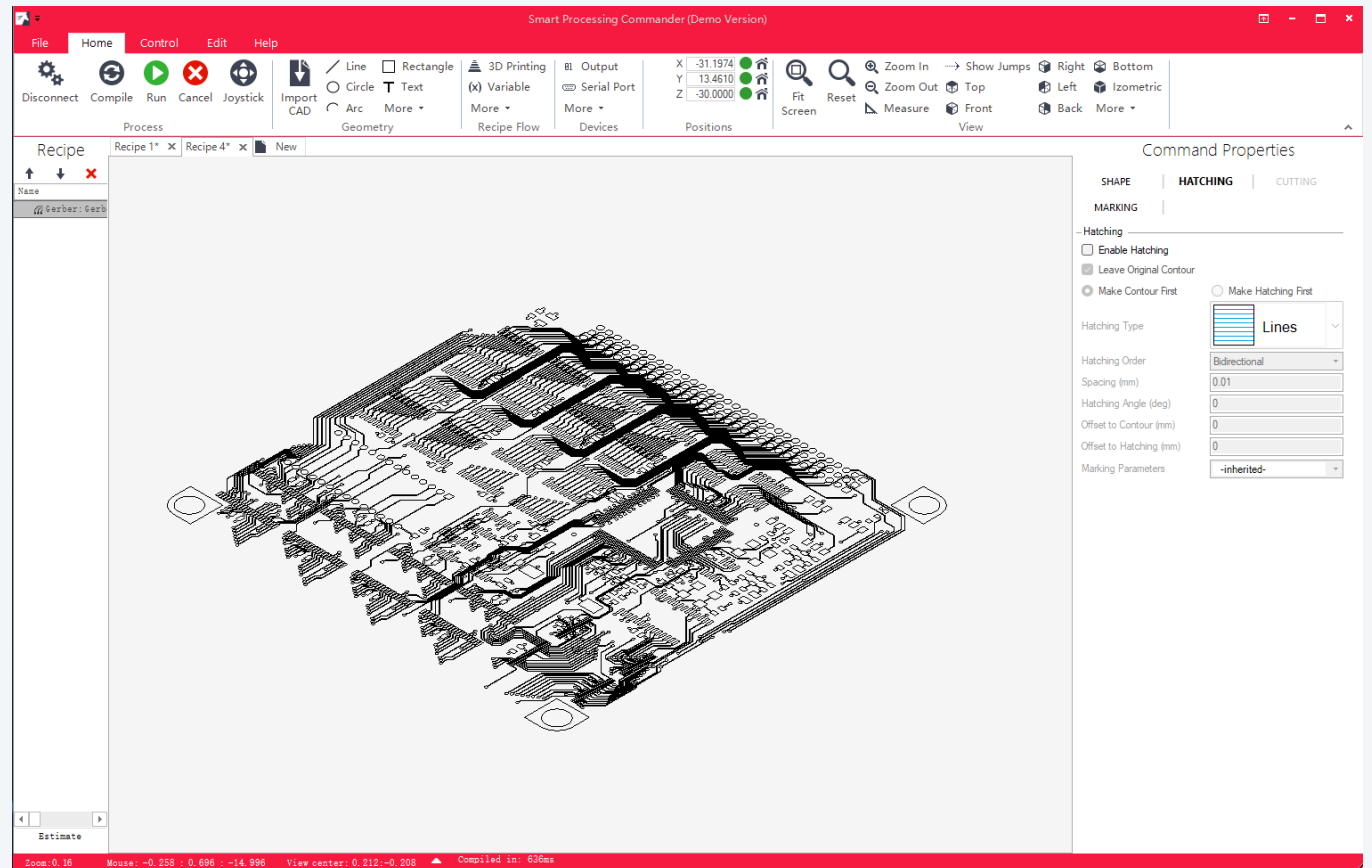
View patterns, toolpaths and operating status.

Automatic code generation

The software generates and executes motion commands.

Closed-loop position feedback

Real-time X–Y–Z position display.



Distance-Based Jetting Synchronization

Controlled deposition spacing through corners and speed changes

Distance-triggered jetting

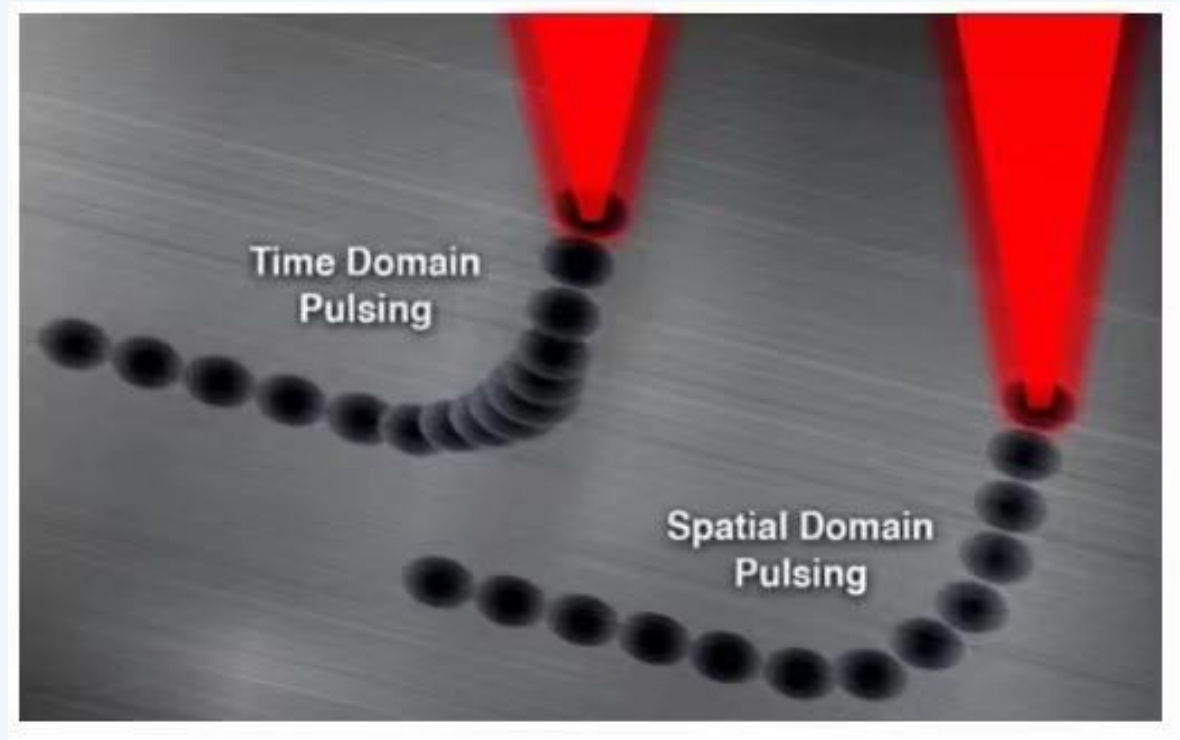
Coordinates droplet spacing with motion speed.

Corner compensation

Deposition spacing control improves line-width uniformity.

Constant-speed path planning

Speed-based corner rounding and lead-in moves.



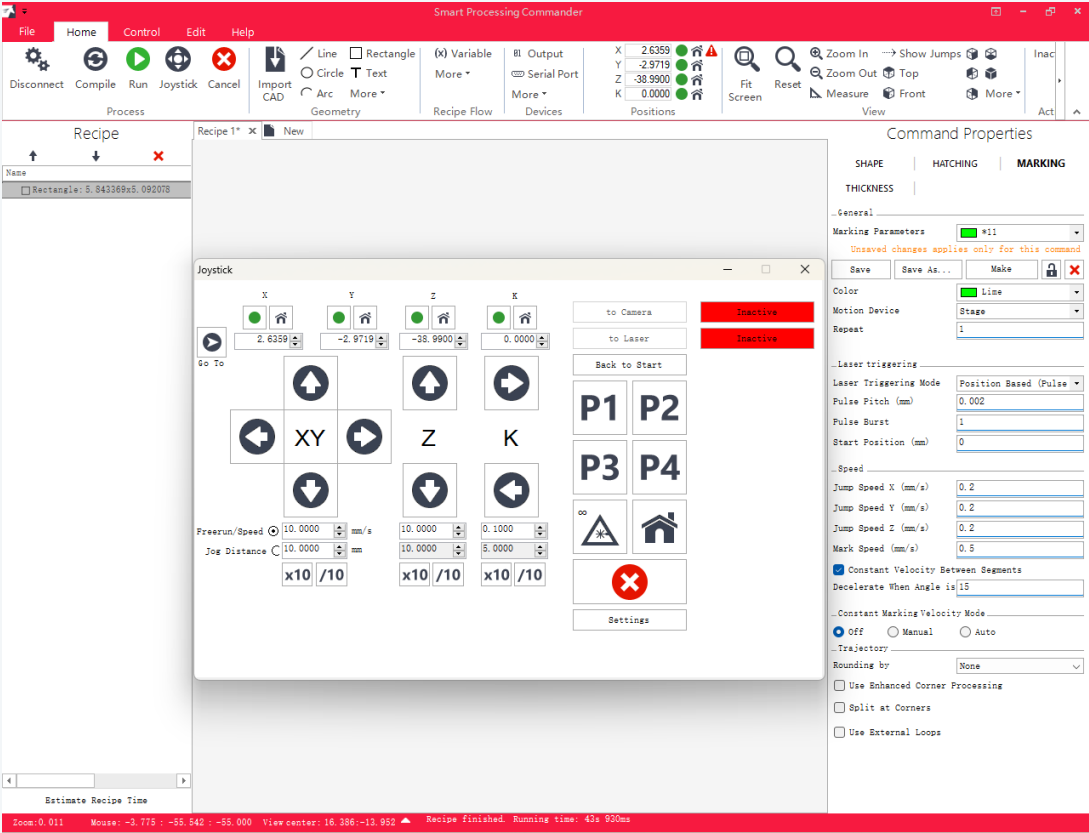
File Import and Job Management

Pattern design, process settings and motion execution in one workflow

Pattern source	Supported formats
CAD drawings	DXF / DWG
Circuit layouts	Gerber / NC Drill
Text data	TXT / CSV

Job queue and parameter backup

Save global settings for reuse, backup and recovery after unintended changes.



Parametric Drawing and Scripting

Drawing primitives, fill patterns and programmable logic

Drawing and marking

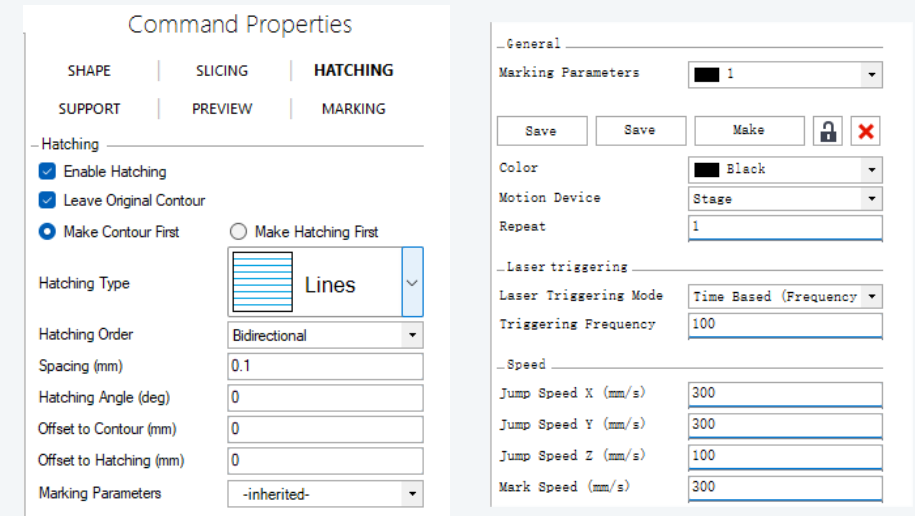
Points, lines, circles, arcs, ellipses, rectangles and polylines. Chinese and English text, barcodes and QR codes.

Eight fill strategies

Line, crosshatch, serpentine and sandwich fills, among eight available strategies.

Scripting and calculations

Loops, conditional logic, variables and trigonometry. Dimension measurement for CAD and 3D geometry.



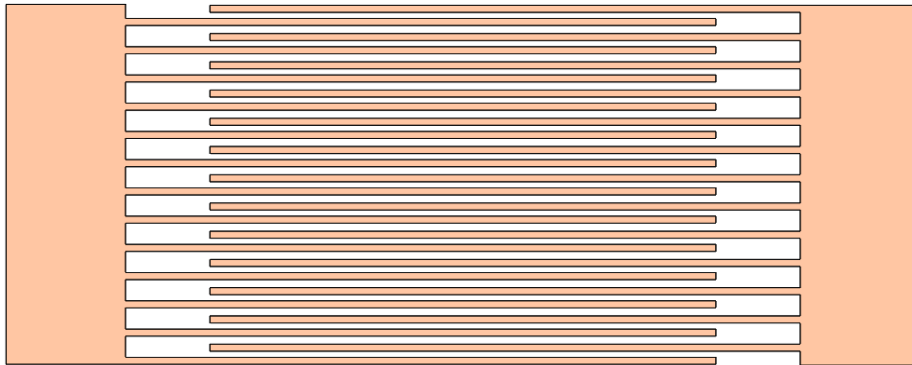
Parametric patterns and properties

Grids, circular arrays and standard patterns with real-time toolpath display.

Interdigitated Electrode Patterns

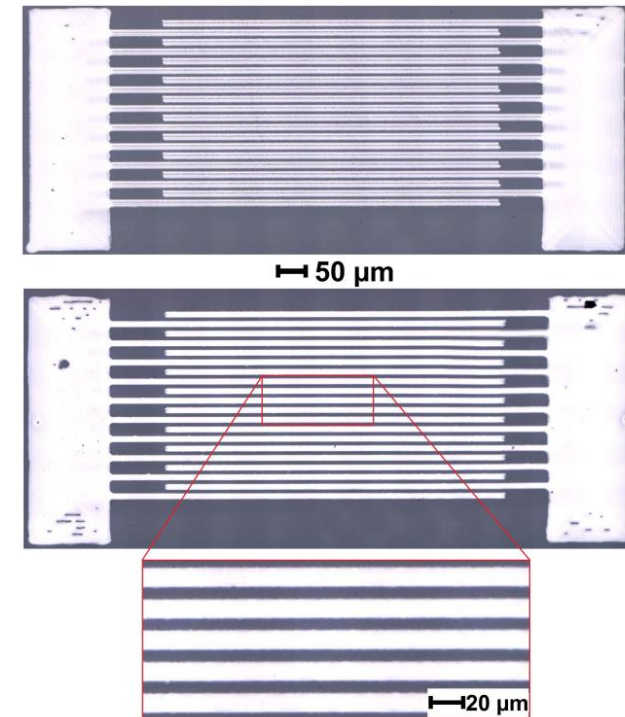
A layout schematic and micrographs showing overall geometry and local detail

Layout schematic



Two interleaved sets of electrode fingers with gaps between adjacent fingers.

Sample micrographs



Overview and magnified detail. Refer to the scale bars.

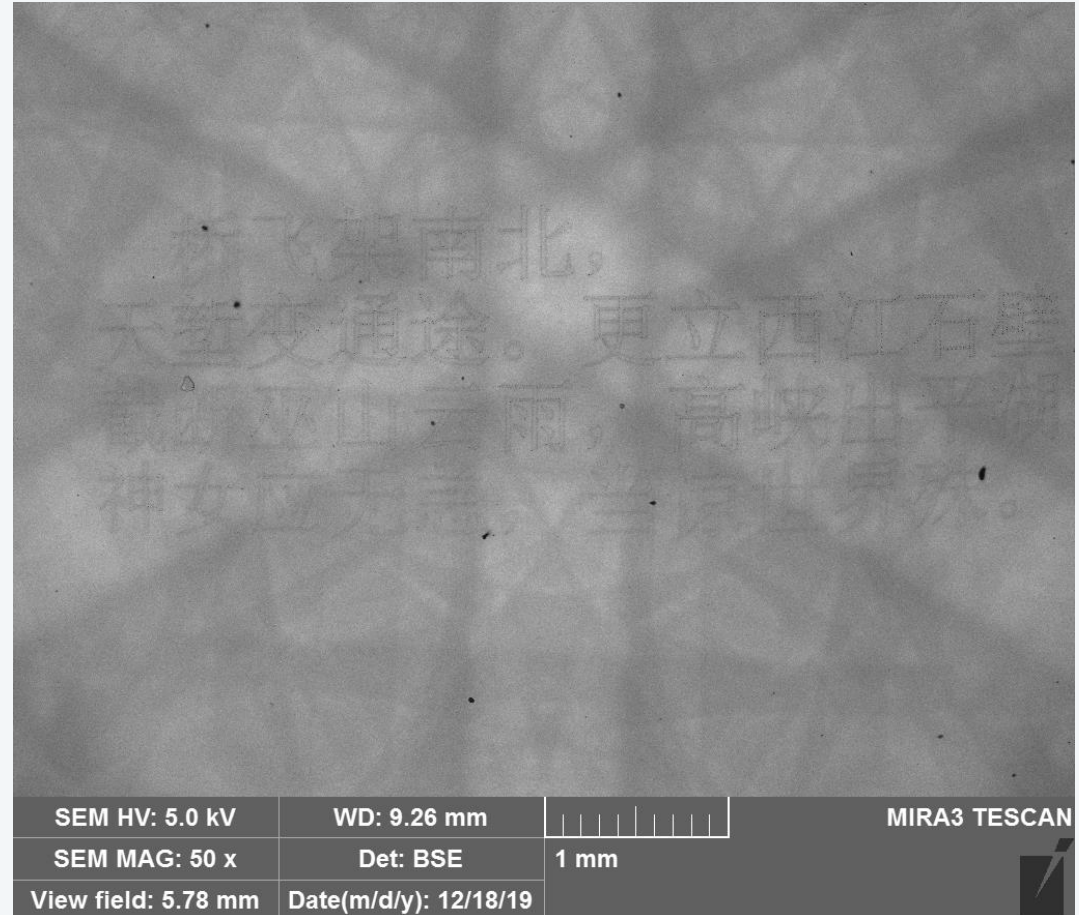
Complex Text and 2D Micropatterns

Detailed patterning through file import and toolpath editing

Chinese Poetry Pattern

Complex strokes and dense patterns converted into executable toolpaths.

Inspect overall shape, line connections and local deposition.



Continuous-Line Printing Demonstration

Planned paths and live deposition shown together

Line continuity

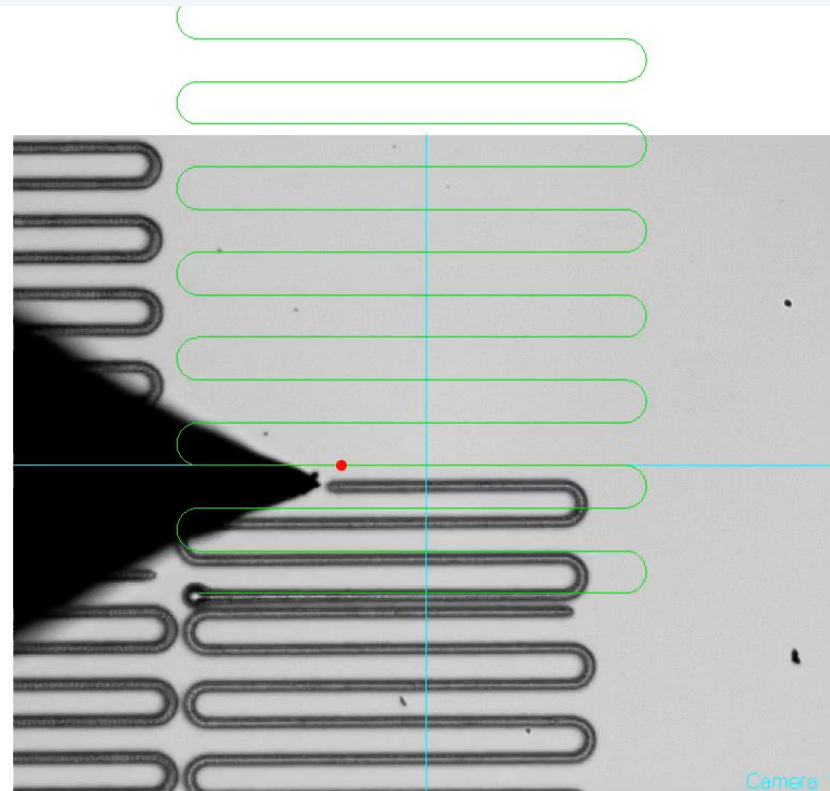
Observe serpentine paths and turns.

Toolpath overlay

Compare the planned path with deposited lines.

Process video

Click to play in slideshow mode.



Dot-Pattern Printing Demonstration

Microdroplet arrays form complex patterns

Discrete dot patterns

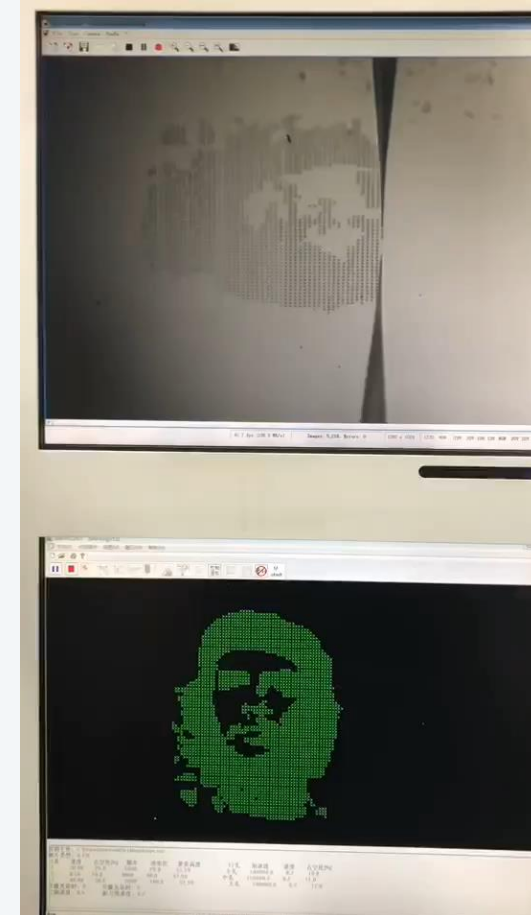
Converts graphics into arrays of individual dots.

Synchronized path and camera views

Microscopic observation of printing detail.

Process video

Click to play in slideshow mode.



Miniature Maps and Complex Contours

Compare the camera view with the planned toolpath

Complex boundaries

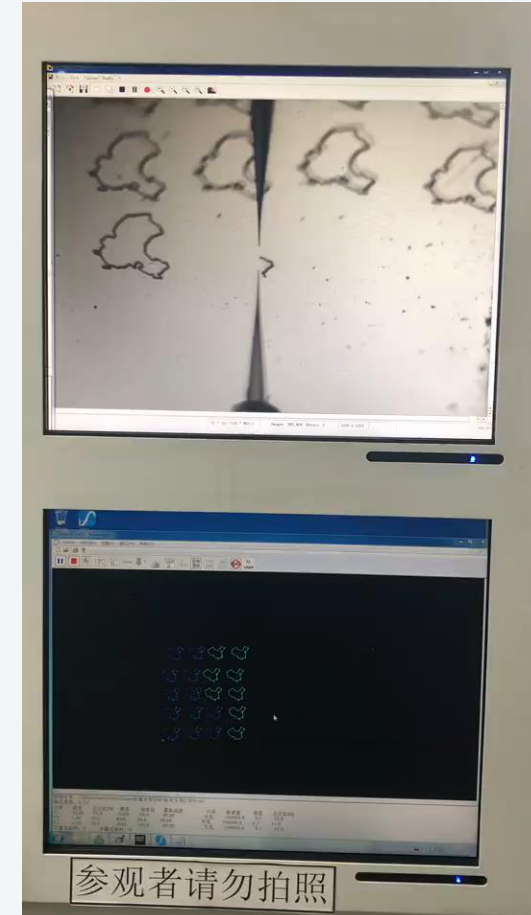
Continuous paths define curves and irregular contours.

Process comparison

View actual printing alongside the programmed path.

Process video

Click to play in slideshow mode.



TL-EHD Specifications

Key specifications from the equipment documentation

Parameter	Specification
Dot / line feature size	1–45 µm, depending on material and process
High-voltage output / Current	0–2000 V / 0–10 mA
Nozzle diameter	1–100 µm, multiple sizes
Fluid delivery rate	0.01 µL/h–99.9 mL/h
Substrate / Wafer size	1, 2, 3 and 4 inches
UV curing wavelength	365 nm
Dimensions / Weight	1613 × 908 × 724 mm / Approx. 500 kg

See the motion-control slide for positioning specifications and the ink-delivery slide for viscosity and syringe compatibility.

Applications in Microscale Patterning

Research in functional materials and microdevices, with processes matched to material and geometry

Printed electronics

Flexible circuits, thin-film transistors, touch electrodes, localized circuit repair and micro/nanoscale dispensing

Displays and micro-optics

Display devices, quantum-dot color-conversion layers, microlenses and micro-optical structures

Sensors and energy devices

Pressure and functional sensors, solar-cell patterning and electrodes for microscale energy storage

Biomaterials and 3D structures

3D printing of micro/nanostructures, tissue-engineering scaffolds and biomaterial research, including cell printing

Interdigitated and functional electrodes

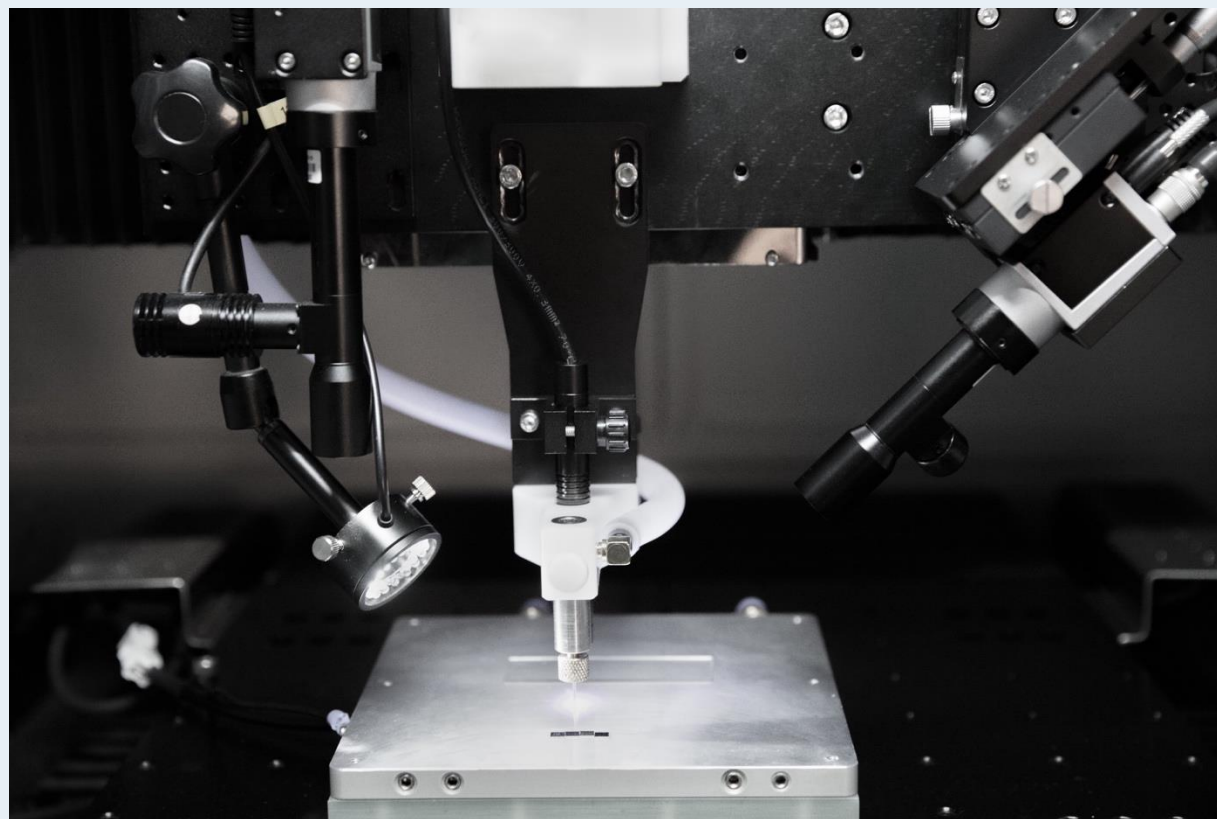
Fine electrode patterns for sensing, acoustic and electronic devices



TL-EHD

Electrohydrodynamic Micro/Nano Printer

For research in fine patterning
and functional microstructures



SHENZHEN TONGLI TECH CO LTD.

www.ejetprinting.com / www.electro-spinning.com

Tel: +86-18620351601

WhatsApp: +852-65920586

WeChat: TONGLITECH