

# miBot™ BT-14

Positioning, manipulation and sensing at micro and nano scales finally made truly fast and easy.

With 4 degrees of freedom in an ultra compact and light body, the miBot is a unique piezo-based positioner. Contrary to a traditional manipulator, the miBot is a **mobile robot**. It is virtually untethered and free to move over the surface of the base where your sample is placed. Since it has no mounting screws, the miBot can be coarsely positioned by hand and naturally adapts to changing sample size and geometry.

The miBot moves along its natural axes; no rotational and translational motion are coupled. This makes it **extremely intuitive to control** and everyone in a lab will only need a few minutes of training before starting to get results. The miBot ease of use also greatly contributes to reduce the risk of damaging your samples and gives confidence to carry out delicate positioning maneuvers.

The miBot moves in two different modes, providing **scalable positioning resolutions from the micrometer to the nanometer**. In stepping mode, the piezoelectric actuators are operated with AC voltage. The range of displacements of the miBot are several centimeters with a resolution up to 40 nm. No signal is applied on the actuators to maintain the position. In scanning mode, DC voltage is applied and maintained on the actuators with the amplitude defining the displacements. The range of displacements is a few hundreds of nanometers with a resolution up to the nanometer.

The high stiffness of the miBot monolithic design makes this high precision instrument very robust to vibration and guarantees that **motion are smooth even at high optical magnifications**. Additionally, the small size of the miBot provides better mechanical and thermal stability than manipulators with larger lever arm caused by their serial design.

## Benefits

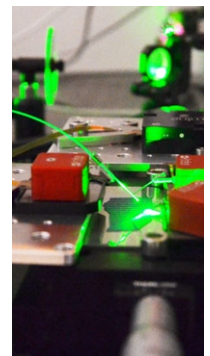
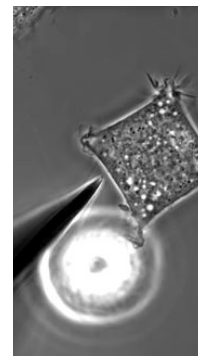
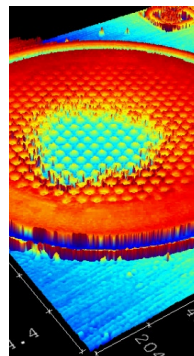
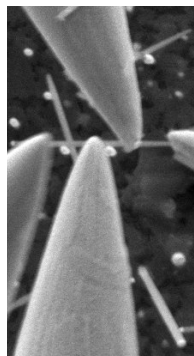
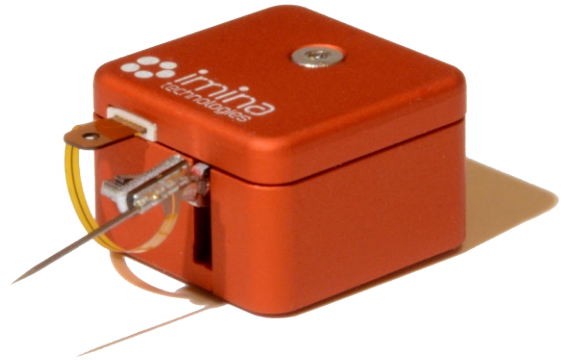
- Probe large samples with vibration free nanometer resolution motion
- Experiment faster while reducing the risk of damaging your samples and getting more results
- Reduce footprint of positioning instruments on your test bench or microscope
- Protect your investment over time with a versatile system designed for upgradability

## Features

- Scalable positioning resolution ( $\mu\text{m}$  to nm)
- Centimeter range displacements
- Compact and robust design
- Decoupled movements
- Operates under high vacuum
- Compatibility with multiple tools and probes

## Applications

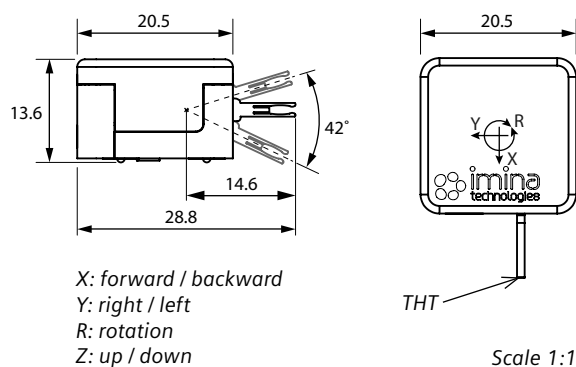
- In situ material characterization
- Micro / nano handling
- Electrical transport measurements
- SEM / TEM sample preparation
- MEMS / NEMS testing
- Local collection of light
- Liquid dispensing



## Technical Specifications

Degrees of Freedom	4: 2 translations (X & Y → body) 2 rotations (R & Z → body & arm)
Dimensions & Weight	body: 20.5 x 20.5 x 13.6 mm <sup>3</sup> arm: 8.3 mm (without tool) weight: 12 g (without tool)
Motion Range *	stepping: X, Y: typ. 5 cm <sup>7</sup> R: ± 180° <sup>7</sup> Z: 42° (arm rotation)  scanning: X: 440 nm Y: 250 nm Z: 780 nm
Positioning Resolution *	stepping: 50 nm (X, Y), 120 nm (Z) scanning: 1.5 nm (X, Y), 3.5 nm (Z)
Speed *	X and Y: up to 2.5 mm.s <sup>-1</sup> Z: up to 150 mrad.s <sup>-1</sup>
Forces & Torques *	X and Y: push: 0.3 N    Z: lift: 0.7 mNm (5 g) hold: 0.2 N        hold: 0.9 mNm (6 g)
Temperature Range	273 K to 353 K
Humidity	< 95% (non condensing)
Lowest Pressure	10 <sup>-7</sup> mbar <sup>1</sup>
Probing Signal	voltage: ± 100V current: < 100fA <sup>2</sup> – 100mA frequency: < 25MHz <sup>2</sup> resistance: typ. 3.5 Ω

\* Specifications are measured at tool-holder tip (label "THT" on shema) and measured at 300 K. All technical specifications are approximate values.



Front Connector Pinout	Configuration Modes <sup>3</sup>		
	Probing	DC Voltage	Sensor
Pins 1+6	–	-185 – 185V DC <sup>5</sup>	5V DC
Pins 2+5	GND	GND	GND
Pins 3+4	Signal / GND <sup>4</sup>	Signal / GND <sup>4</sup>	0–5V <sup>6</sup>

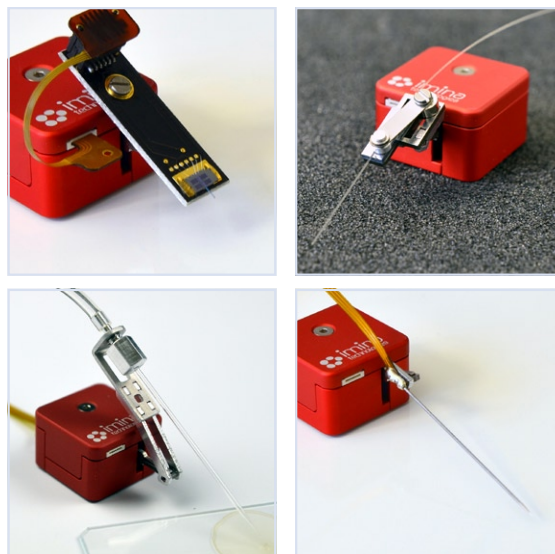
- <sup>1</sup> Vacuum compatible version required (miBot BT-11-VP).
- <sup>2</sup> Low current, low noise probing accessories and suitable measuring environments required.
- <sup>3</sup> Select and adjust parameters from software. Available with miBase BS-43 & MultiBot MB-43.
- <sup>4</sup> Set pin to probing signal or ground.
- <sup>5</sup> Adjust amplitude from software (resolution: 1.5V). Drive capacitive loads only.
- <sup>6</sup> A/D signal output available from software (resolution: 10 bits).
- <sup>7</sup> In stepping, actual motion range in X, Y, R are limited by the size and shape of the stage where the miBot moves, and the length of the driving cable. This varies depending of the solution package.

## Probes, Micro-Tools & Sensors

Extend the use of your miBot to various types of applications thanks to its compatibility with several tools and sensors. In fact, the miBot is equipped with a proprietary tool holder mechanism that makes the exchange or replacement of tools fast and convenient. In minutes, turn the miBot from an electric probe or optical fiber positioner into a manipulator of nanoparticles or biological samples.

Tool holders are available for the following tools:

Probe tips	Tip radius: 0.10 to 20 μm Materials: Tungsten, Gold Plated, Tungsten Carbide, BeCu Shank diameter: 0.51 mm (0.020") Overall Length: 15 mm (0.6") and 38 mm (1.5") Probe orientation with holder: 0° and 30°
Optical fibers	Outer diameter: typ. 250 μm
Microgrippers	Initial (max.) gripper arm opening: typ. 60 μm Stroke: typ. 60 μm
Micropipettes	Glass capillary: typ. OD = 1 mm, ID = 10 μm
Your tools	Do you need to position other tools like for example a MEMS, multiprobes, miniforks, AFM probes, or force sensors? Contact us, several OEM tool holders are available upon request.



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