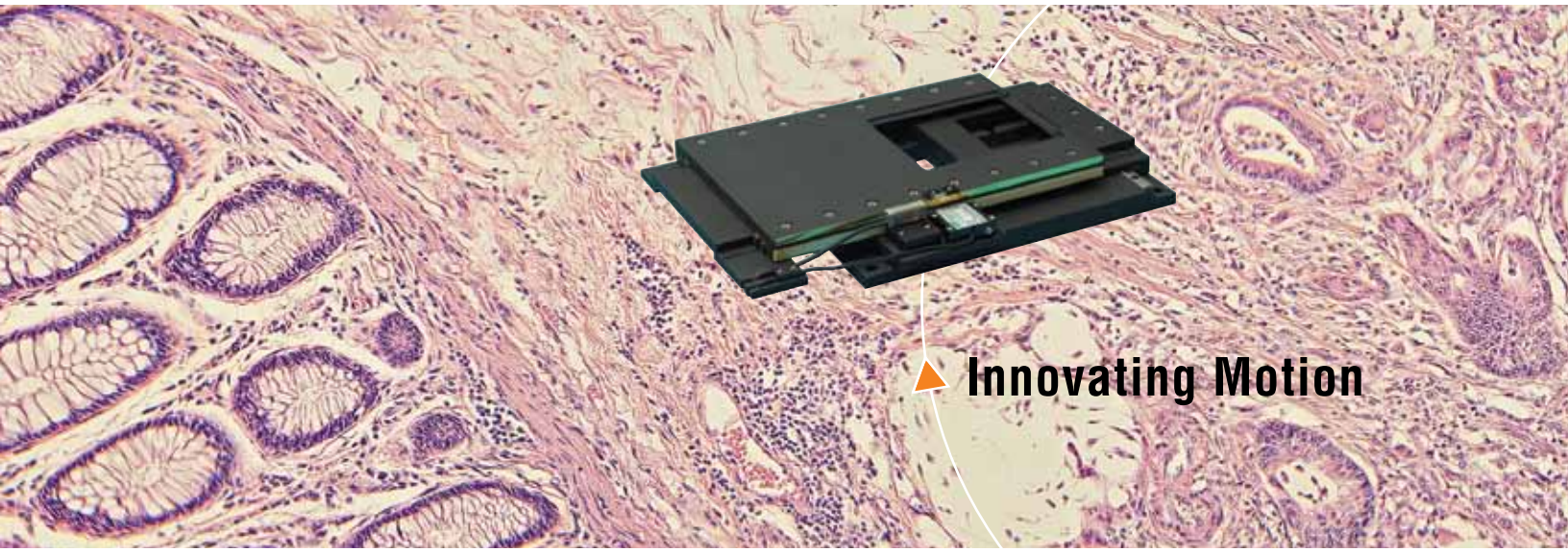
Solutions for High Throughput, High Resolution Digital Microscopy



JOHNSON ELECTRIC

NANOMOTION

A Johnson Electric Company

Nanomotion® platforms deliver high throughput, high resolution digitalization of diagnostic samples

Meeting the Challenges of a Demanding Market

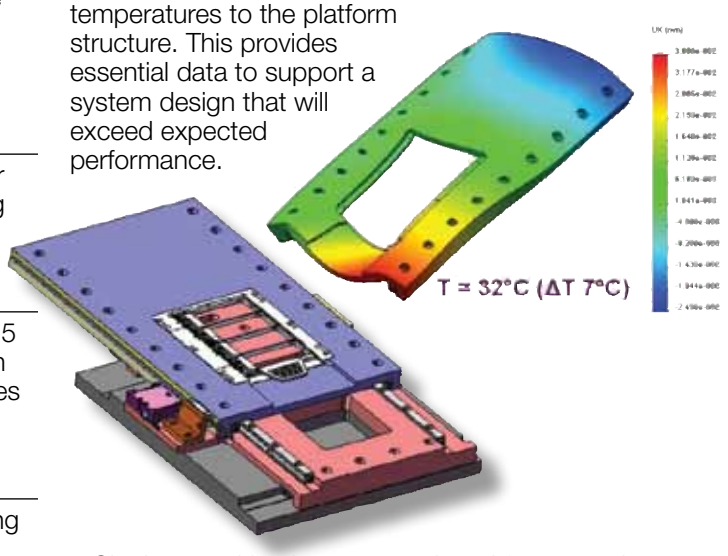
Microscopy applications push the limit between motion performance and stage construction. Configuring a thin cross-section motion platform, with the necessary speed and precision to manage image accuracy, requires the utmost in mechanical design and analysis.

Nanomotion® platforms optimize performance for extremely challenging microscopy packages such as:

Travel	Stage travel ranges from 50 mm or 200 mm per axis based on viewing 25 mm x 75 mm glass slides or multiple slides, with the ability to have a load position
Z Stage	Z (Focus) stage travel ranges from 5 to 15 mm, with most of the work in <1 mm area. Z Stage motion ranges from steps 100 nm in 20 msec. to 10 µm in 30 msec. at continuous duty cycle.
Velocity	Stage velocity ranges from scanning at <1 mm/sec up to 30 mm/sec.
Positioning Resolution	Resolution ranges from 10 nm to 50 nm to support 0.23 µm/pixel
Positioning Accuracy	Accuracy ranges from ±0.5 µm to ±2 µm, to support both scanning and discrete image acquisition and tiling
Axis Orthogonality	Orthogonality ranges from 2 to 5 arc-sec
Straightness/ Flatness of Motion	Ranges from 0.25 µm/mm to 1 µm/25 mm

All of these requirements are coupled with mechanical constraints of providing an open frame construction with a thin cross section ranging from 30 to 35 mm for the two axis assembly.

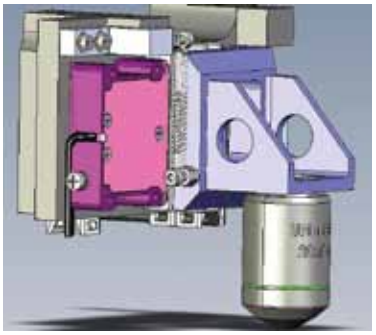
Nanomotion platforms utilize extensive Johnson Electric corporate resources in the design, analysis, manufacture and testing of complete solutions for microscopy. Every platform design is analyzed to understand the impact of load and operating temperatures to the platform structure. This provides essential data to support a system design that will exceed expected performance.



Single or multi-axis, open or closed frame motion platforms are configured with high resolution position sensors and motor performance that supports high speed, high resolution motion. Our ultrasonic piezo, direct drive motors offer unique characteristics for unprecedented high throughput image acquisition. These motors are supported with proprietary position sensor technology and high performance motion controllers that simplify the integration to your operating system and user software.

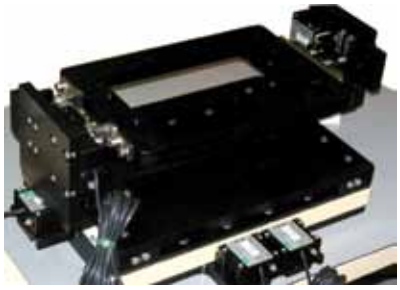
Vertical axes are configured specifically to minimize the moving mass and to position a 20/40 X objective at high speed to follow the variable terrain of the sample.

The ability to maintain focus is critical. This requires both mechanical considerations to the stage design and motion considerations for high speed move and settle over a limited travel range.



Complete Motion System Solutions

An open frame X-Y designed to optimize both step/repeat and constant velocity is coupled with a high speed Z-axis to scan multiple slides of 25 x 75 mm. The open frame stage must operate from 0 to 55 ºC and maintain an accuracy of ±1 µm for 20,000 hours of operating time.



A 4-axis scanning application consists of an open frame X-Y Stage designed to provide critical scanning between 20 and 40 µm/sec with dynamic position error of less than 100 nm. Managing a larger sample size, the Z-axis incorporates a tilt mechanism to level the sample over the length and position the sample vertically.

This Z Focus stage provides rapid move and settle for discrete imaging of cells. While another Nanomotion stage indexes the sample, the Z-axis requirements are:

- 5mm travel
- 210 grams moving mass (vertical)
- 0.1 µm operating resolution
- ±2 µm total position error
- 15 to 32 ºC operating temperature
- 2.5 billion steps of life
- Operation requirements are 1650 moves, ranging from 1 to 300 µm in 3 minutes

Additional Motion Systems for Microscopy

Atomic Force Microscope

Our standard FB Series motor is ideal for AFMs, providing a very high natural frequency stage with zero servo dither at rest.

Ion Beam Microscope

Vacuum and UHV compatible motors and motion systems are used extensively in E-Beam and Ion Beam Microscopes. These systems range from 5 to 50 nm positioning resolution and support very compact designs. In some instances stages are configured for vacuum with non-magnetic materials.

"Traditional" Microscope Stage

The size/weight of a Nanomotion motor makes it well suited to minimize the mass and potential deflection in a traditional (thin) microscope stage. A motor with 16 N force weighs only 73 grams, replacing a much heavier ballscrew and rotary motor.

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