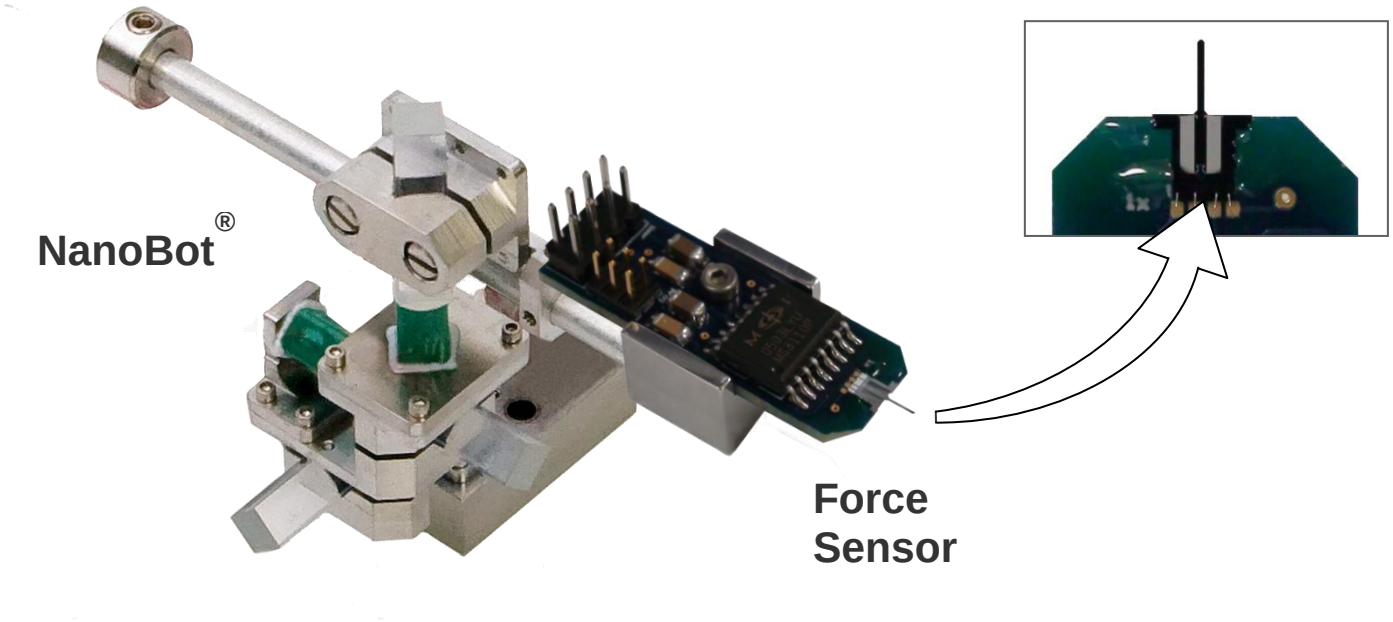
Xidex Force Sensor End Effector for the NanoBot® System



Description

Force sensors are available as optional attachments to the positioning arms of Xidex's NanoBot® nanomanipulator. These force sensors operate as load cells for measuring forces with nanoNewton resolution. The Model FS-2000 accommodates loads up to 2000 µN. The Model FS-180 accommodates loads up to 180 µN. Both compression and tension forces can be measured. The sensor element, which is based on single crystalline silicon, measures small forces with high precision. Unlike most other load cells based on strain gages, the force sensors available for use with the NanoBot measure the load by a change of capacitance. The readout electronics integrated in the sensor package convert the load into an output voltage proportional to the force. A LabVIEW™ based application for force feedback display is installed on a laptop computer running Windows OS which is provided with the system. Users can also create custom LabVIEW applications and add these to the applications library provided with the NanoBot.

Applications

Force sensing combined with nanomanipulation enables a variety of important applications, including hardness testing, nanoindentation, fabrication and testing of micro- and nanodevices, and controlled force probing of biological cells. The Model FS-2000 is shown below pushing on an AFM cantilever (Fig. 1). An experiment like the one shown in this example can be performed to directly measure the spring constant of an AFM cantilever by observing its force vs. displacement.

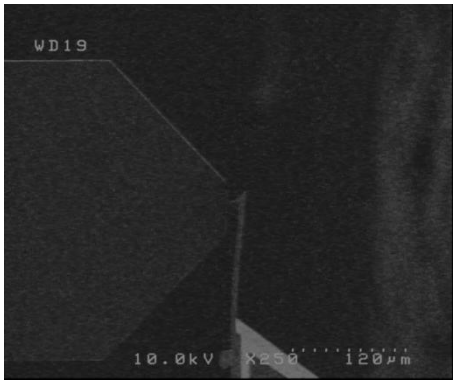


Fig. 1 – Deflecting an AFM cantilever with an FS-2000 force sensor mounted on a NanoBot

Control and User Interface

The controller for the force sensor is integrated into the same compact desktop module (Fig. 3) that controls the NanoBot. The joystick that controls the NanoBot (Fig. 3) can be used to simultaneously control the force sensor. Force feedback is displayed graphically in both the time and the frequency domain (Fig. 4) using the built-in LabVEW application. The data acquisition system is able to sample the force feedback signal at up to 100 kHz. Force sensors are individually calibrated and the sensitivity is provided for each device. New sensitivity calibration values can be entered via the graphical interface when different devices are installed.

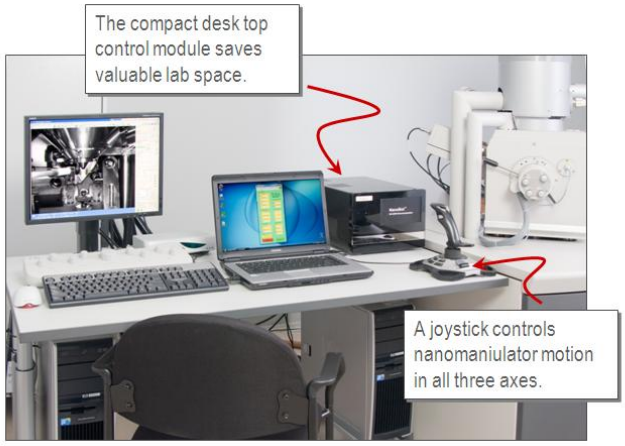


Fig. 3 –Controller, laptop and joystick

Performance Specifications

	FS-2000	FS-180
Force range (μN)	2000	180
Force resolution (nN)	400	50

Mounting Options

The force sensor can be mounted horizontally, in line with the NanoBot system's Y axis as shown on Page 1, horizontally in line with X, or vertically, in line with Z. The different mounting options allow the force sensor to approach objects from different directions.

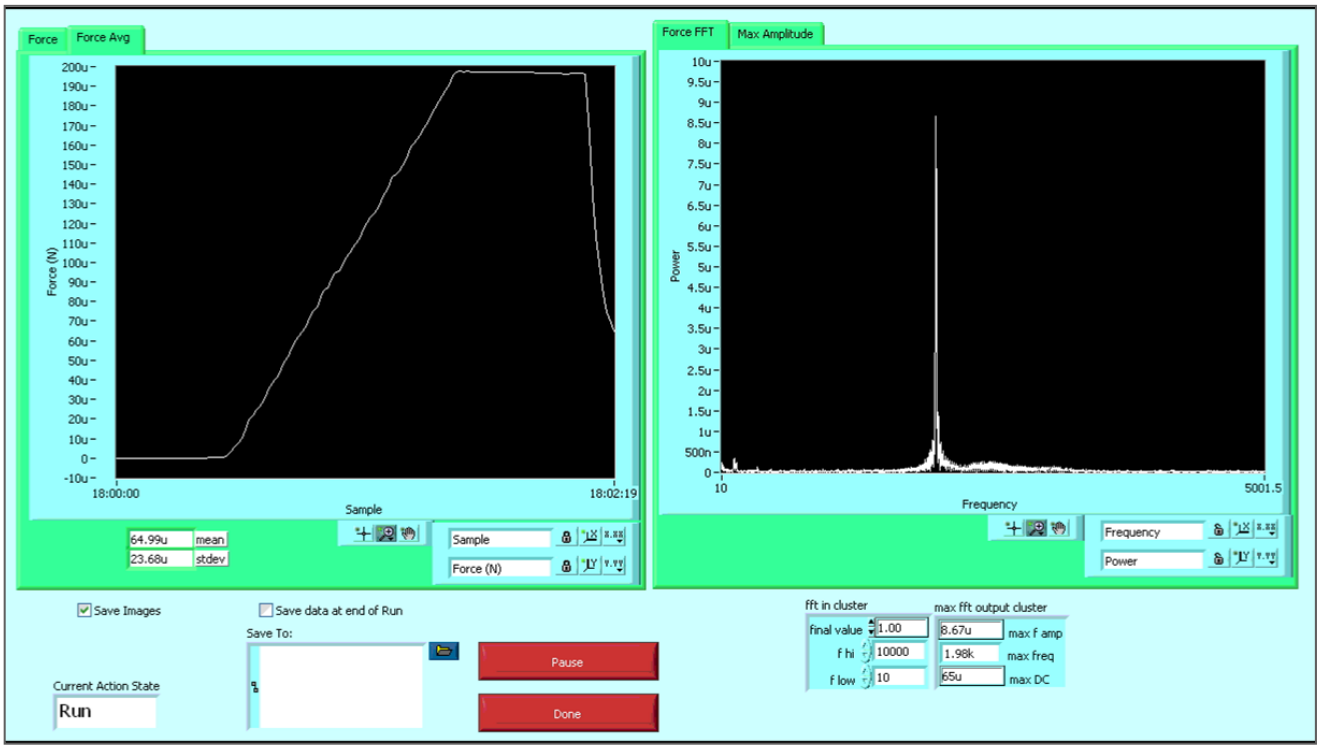


Fig. 4 –LabVIEW application for force display.

Xidex Corporation

Xidex manufactures and sells the NanoBot system, an easy-to-use, highly versatile, user-programmable nanomanipulator built for use inside scanning electron microscopes (SEMs) and focused ion beam (FIB) tools. The NanoBot system transforms a SEM or FIB into a workshop for nanodevice fabrication and testing.

Xidex Corporation was founded in 1997 as an Austin-based Texas Corporation by Vladimir Mancevski, President and Chief Technology Officer and Dr. Paul F. McClure, CEO.

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