IN-SITU SEM/FIB
NANOMECHANICAL TESTING

FT-NMT02
NANOMECHANICAL TESTING SYSTEM
Material research relies on accurate measurements of forces and deflections at the scale of the objects to be tested. In case of nanomechanics, this usually requires:

- the observation of the sample by a scanning electron microscope (SEM)
- force measurement and microassembly in the range from nanonewtons to millinewtons
- deflection measurement in the range of nanometers to micrometers

To fulfill these requirements, FemtoTools has developed the FT-NMT02 system for the micromechanical and nanomechanical testing of structures inside a SEM.

The FT-NMT02 consists of a 3-axis nanopositioning unit with 3-axis integrated optical encoders, a sensor head and a SEM sample holder mounted on a two-axis, motorized rotation platform. Furthermore, four electrical connections are available as plug or bonding pads next to the sample holder. Using e.g. wire bonding, this allows the electrical connection of the sample and thus enables the combined electro-mechanical testing in the nanoscale. (The electrical testing equipment, such as e.g. a picoammeter can be connected to the system controller which is not included in the FT-NMT02.) Due to its compact design (100 mm x 66 mm x 35 mm), it can be integrated into most SEM/FIB systems without causing a collision or obstruction of the various detectors or sources.

**FEATURES**

**Nanomechanical Testing Features**
- Highest flexibility: Compatible with a large range of mechanical testing tasks and samples
- Low-drift force measurement from 5 nN to 100 mN
- Hardware-level sensor protection mode to prevent overloading of the sensing probes
- Closed-loop position control in x-y-z direction with a range of 12 x 21 x 12 mm
- Displacement sensing resolution of 1 nm
- Can measure in multiple directions (in-plane, out-of-plane and in any angles relative to the sample)
- Axial force application (no tip-slippage)
- Automated control by a PC and manual steering by joysticks

**Nanohandling and Nanoassembly Features**
- Can handle sub-millimeter objects from 0.01 mm to 0.1 mm
- Automated gripper approach to the sample substrate
- Can measure and apply gripping forces from 5 nN to 100 µN
Three-axis, nanopositioning platform with high-resolution position sensors

Sensor / gripper head that fits the FT-S Microforce Sensing Probes or the FT-G Microgrippers

FT-S Microforce Sensing Probe (or FT-G Microgripper) sold separately

Sample holder with wire bonding pads and electrical connections (enables simultaneous electromechanical testing of the sample)

Sample rotation stage (pitch)

Sample tilt stage (yaw)

### SOFTWARE

The FT-W1002 Mechanical Testing and Handling Software Suite is provided together with the FT-NMT02. The software suite consists of three parts: FT-WFS Micromechanical Testing Software, FT-WGS Microhandling Software and FT-WMS Modular Mechanical Testing Software.

The FT-WFS and the FT-WGS are graphical user interfaces (GUIs) for MS Windows, which enable user-friendly plug-and-play type nanomechanical testing and nanoassembly. The FT-WMS is a library based on National Instruments’ LabVIEW for the creation of customized micromechanical testing programs. These software packages enable the user friendly control of automated measurement tasks such as:

- Compression/tensile testing
- Shear testing
- Cyclic testing
- Creep testing
- Automated line/array measurements, ...

### APPLICATION OVERVIEW