

The New NanoScope V Controller:

New Power and Capabilities for MultiMode V, Dimension V, NanoMan VS, and PicoForce

Fast, Dependable Data Capture

The new NanoScope® V controller utilizes advanced electronics, including A/D and D/A converters operating at 50MHz, to deliver reliable, high-speed data capture. This state-of-the-art fifth-generation controller allows measurement of tip-sample/cantilever dynamics, enabling researchers to study the influence of mechanical properties on the physics of probe-sample interactions at timescales previously inaccessible to SPM users. It also allows calibration of the cantilever spring constant at resonant frequencies up to 2MHz. High-speed data capture is simultaneous with imaging or ramping and independent of microscope mode.

Flexible Controller Features

The NanoScope V enables up to eight images to be simultaneously displayed



The NanoScope V controller.

in real-time (and captured for analysis) with unprecedented signal-to-noise ratio. The controller incorporates three independent lock-in amplifiers and provides thermal tune measurements of cantilever resonances up to 2MHz. It also affords easy access to most input and output signals through front-panel BNCs. Input of data into the controller from an external source (e.g., photomultiplier tube) is supported, as is user access to lock-in amplifiers and to signals to/from a microscope (e.g., XYZ sensors, amplitude, phase).

Highest Pixel Density

The ability to acquire up to 5120 x 5120-pixel images eliminates the need to capture several images at lower pixel densities as well as the requirement for offset adjustments to correlate information from multiple images. The high pixel density saves time when searching for low-density features distributed over large areas and allows observation of large structures and small features in the same image.

Outstanding Software Functionality

Veeco's NanoScript™ open-architecture option provides a growing list of functions to control the SPM for custom experiments and nanoscale research (e.g., nanomanipulation in X,Y,Z; automated scanning; nanolithography with different tip-sample interactions). These functions can also be called from any programming language that can act as a client of Microsoft's Component Object Model (COM), including LabVIEW™, MATLAB®, Visual Basic, Ruby, Python, C++/MFC, Excel®, and Word®.

Easy-AFM, Remarkable Simplicity

For the ultimate in streamlined operational simplicity, Veeco's Easy-AFM™, offers an intuitive, easy-to-follow graphic user interface for new or infrequent SPM users. It reduces the time for initial setup by engaging the sample with the probe (in air), automatically adjusting the scanning parameters, and obtaining high-quality TappingMode™ images on most samples at a push of a button. Easy-AFM is ideal for multi-user environments.

Highlights of Features and Benefits

- High-speed electronics enable recording and analysis of data from nanoscale events (e.g., force pulling experiments) at timescales previously inaccessible to SPM
- Easy-AFM simplifies operation for novice users by automatically adjusting scan parameters
- High-pixel-density images (up to 5120 x 5120) massively improve productivity
- Up to eight simultaneous channels in real-time-scanning and offline-visualization/analysis enable correlating information about unprecedented number of sample properties
- FPGA delivers feedback in 2µs, digital lock-ins, digital filtering and digital Q control
- Multiple lock-ins allow measurement of overtones and harmonics of vertical and lateral deflection for electrical and materials characterization
- Open architecture provides new options to design and run customized experiments, including with third-party software
- Closed-loop XYZ scanner compatibility utilizes the latest in scanner design and functionality
- Expandable modular design is forward-looking towards supporting additional functions in future
- Customizable signal access using software-controlled signal routing expands options for experimentation

Hardware

Electronics

High speed and expanded AC capabilities

- Two high-speed (50MHz) 14-bit ADCs sample and digitize the probe signal ($\pm 2V$)
 - High-speed data capture collects up to 64MB of data at a sample rate of up to 50MHz
- Two high-speed (50MHz) 16-bit DACs provide sinusoids ($\pm 10V$), plus 16-bit offset bias superposed ($\pm 10V$, adjustable up to 500kHz)
- Nine mid-speed (500kHz) 16-bit ADCs ($\pm 12V$)
- Seven mid-speed (up to 500kHz) DACs 16-bit ($\pm 10V$)
- Two independent high-speed lock-ins (1kHz – 5MHz) and one mid-speed lock-in (0.1Hz – 50kHz) allows determination of amplitude and phase of up to three independent signals, or analyzing higher harmonics of a signal (0.5kHz – 2.1MHz or 5Hz – 21kHz lock-in bandwidths)
 - Three independent reference signals available (2 at up to 5MHz, 1 at up to 50kHz)

User-accessible hardware input/output

- Three mid-speed ADCs, two high-speed ADCs
- Two digital inputs, two digital outputs (TTL compatible)
- Two high-speed and three mid-speed 16-bit DACs ($\pm 10V$)

Hardware options

- “Pico Angler” hand-held module for tactile feedback in force spectroscopy
- Signal Access Module for “MultiMode[®] V”

Software

- Exceptional Force Spectroscopy control and analysis
 - “Point and Shoot”: precisely located force or tunneling spectroscopy at any XY coordinate in an image, with a single click of the mouse
 - Force Volume imaging up to 256 x 256 x 256 data-points per image
- Easy-AFM, the “Expert System” graphic user interface, easy-to-follow for new or infrequent SPM users to set up (including probe, laser, and detector alignments); engage the sample with the probe in air; adjust the scanning parameters; and obtain high-quality, useful TappingMode images on most samples

- Expanded, enhanced image capture, visualization, and analysis
 - Flexible combinations of sample-per-line and lines-per-frame imaging (e.g., 512 x 512, 8192 x 3200, 16384 x 1600, 5120 x 5120)
 - Up to 8 channels of data can be simultaneously collected
 - Two- and three-dimensional image display options with 24 color tables
 - Full suite of image analysis at high pixel densities
 - Continuous data capture from successive scans of the same area
 - Automatic data capture for calibration
- Integrated graphic user interface for
 - Thermal tuning of AFM cantilevers with fundamental resonance frequencies up to 2MHz (e.g., for spring constant measurements)
 - Controlling lock-in hardware
 - Controlling cantilever Q
 - Adjusting scan rate, size, and offset (calibrations remain unchanged)
 - Disabling scanning along the slow scan axis
 - Adjusting gain, set point, drive frequency/amplitude/phase
 - Selecting AFM and STM feedback modes
 - Applying bias voltages to tip and/or sample
 - Adjusting Z drive voltage range (11V to 440V) commensurate with desired vertical resolution
 - Selecting and setting parameters for multiple auxiliary input channels
- Optional:
 - Torsional Resonance Mode (TRmode)
 - Nanomanipulation software
 - NanoScript open architecture provides easy-to-use Applications Programming Interface (API) and Component Object Model (COM)

Software Utilities

- ASCII, jpeg, BMP export
- Printing images, spectroscopy curves, cantilever tune plots, image analysis windows

Other Specifications

Computer	Premium computer system (call for current specifications)
Space/footprint requirement	20" x 30" footprint, 10" height clearance
Power requirement	520W peak power consumption
Weight	46 pounds

Note: Performance specifications are typical and subject to change without notice.



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