NanoScanTechnology

reasoned innovations

Certus Standard

Basic Configuration of Scanning Probe Microscope

Basic Datasheet

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Certus Standard - basic configuration of scanning probe microscope, designed to solve a wide range of research and analytical tasks.

Certus Standard includes:

- ► Scanning head Certus;
- ► Video microscope with USB camera;
- ► Integrated mechanical XY-stage for sample adjustment;
- ► Digital SPM controller EG-3000;
- ► NSpec software package;
- ► Head approach system with 3 motorized actuators.

Certus Standard features:

► Implementation of all basic SPM techniques: Atomic Force Microscopy (AFM, contact and non-



Advanced Research grade software controlled system.

Controller: control and monitor electronics of instrument including self diagnostic board, 32 bits floating points DSP boards, lock-in amplifier with adequate frequency range, 8 or more 16 bit data acquisition channels, 4 or more 20 bit DACs control for X,Y,Z positioning or Bias voltage application, suitable PCI interface. Noise level < 0.05 nm rms.

Atomic Force Microscopy (AFM, contact and noncontact), shear force AFM, force spectroscopy, Scanning Tunneling Microscopy (STM) etc.

- ► Plane-parallel scanning (in X-Y plane) allows imaging with minimal distortion;
- ► Parallel head approach system;
- ► Open design of scanning head simplifies observation of the sample and probe at any angle from 0° to 90°;
- ► Certus Standard is suitable for installation on the optical microscope (upright or inverted), and can also be modified to Certus Optic and Centaur.



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Formace control 0 2 4 6 0 Image: Control Image: Control Image: Control Image: Control Image: Control Image: Control	Wee Control	
Notes Canad Motors States : Total Stopped		
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FB DPLT SIGNL (SM HOCE) Image: Signl (SM HOCE) Probe Magnitude "Tapping Mode" Image: Signl (SM HOCE) F81 F81	Scan, Ma	
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The Si/SiO₂ periodic structure and probe. Video screenshot. NSpec window.



The image of DNA molecules on mica. Semi-contact mode.

Topography. 0.9x0.9 µm, 512x512 points.



▲ Latex microspheres on glass surface, dehydrated sample. Semi-contact mode. Images size 5x5 µm, 300x300 points. Topography 3D



▲ Latex microspheres on glass surface, dehydrated sample. Semi-contact mode.

Images size 1x1 $\mu m,$ 300x300 points. Topography and profile in arbitrary cross-section. \blacktriangleright







	Main parameters		
1	SPM head		
1.1	Built-in XYZ scanner		
1.1.1	Scanning/positioning XYZ range (Closed Loop Large Probe) 85x85 µm		
1.1.2	Vertical Z	7 µm	
1.1.3	Scanning/positioning XYZ range (low voltage mode for atomic resolution - better resolution)	10x10x2 µm	
1.1.4	XY stage resonant frequency	1 кHz	
1.1.5	Z rezonant frequency 7 KHz		
1.1.6	SPM resolution/noise level (XY lateral) open/close loop <0.1 nm / 1 nm		
1.1.7	SPM resolution (Z vertical, noise level) <0.03 nm		
1.1.8	Residual nonlinearity Better than <0.03%		
1.2	Displacement sensors		
1.2.1	Sensors type Capacitance		
1.2.2	Measuring principle	Time-to-digital convertion	
1.3	Scanning head approach system		
1.3.1	Minimum step 1 µm		
1.3.2	Coarse approach implementation Stepper motors		
1.3.3	Number of stepper motors 3		
1.4	Sample positioning		
1.4.1	Sample coarse positionig range 5x5 mm		
1.4.2	Positioning Micro screws		
1.4.3	Positionig accuracy ~ 5 µm		
1.4.4	Sample size 0100 mm Ø; 0 20 mm height		
1.5	Probe Holders	Cantilever type (AFM, MFM mode), Tune Fork type	
1.6	Probe deflectometer system	Includes PSD, 670 diode laser with manual positioning	
1.7	Vibration isolation table with acoustic isolation and shielding Implemented		
1.8	Temperature control:	-30 to 250°C	
2	Options		
2.1	Scanning thermal microscopy Option		
2.2	Nano indenting option		
2.2.1	Hardness range 1-100 GPa		
2.2.2	Young Modulus range 1-1000 GPa		
2.3	Vacuum attachment for moist samples to obtain increased sensitivity and maintain homogeneous environment around the samples	min. 10 ⁻² torr pressure	
2.4	Surface potential microscopy Option		
2.5	Scanning Tunneling Microscopy Option		
2.6	AFM lithography and Lift mode Option		

1	Operation modes	
1.1	Atomic force microscopy	
1.1.1	Contact mode	
1.1.2	Non-contact mode	
1.1.3	Phase imaging	
1.1.4	Lateral Force Microscopy	
1.2	Force modulation microscopy	
1.3	MFM mode	
1.4	Adhesion studies	
1.5	AFM operation in liquid under both contact and non-contact modes	
1.6	Liquid Mode	

1	Optical microscope	
1.1	Visualisation	Digital video microscope
1.2	Magnification (zoom) adjustment	Motorized 10x
1.3	Fine adjustment range	5 mm
1.4	Image visualisation	Color digital video camera
1.5	Illumination	Fiber illuminator
1.6	Optical parameters	
1.6.1	Numerical aperture	0.3
1.6.2	Camera sensor size	1/3"
1.6.3	Camera sensor resolution, px	1280x1024
1.6.4	Magnifiacation	85x/1050x
1.6.5	View field	4.50/ 0.37 mm
1.6.6	Resolution	<2 micron
1.6.7	Interface	USB



Certus Standard is the best choice for everyday laboratory SPM measurements. Certus Standard could also be interesting to researchers planning to integrate scanning probe microscope with optical and spectral equipment.

Measuring mode: Surface examination of polymeric materials at an atomic / molecular scale such as distribution of phase domains in polymer blends / alloys, modulus, phase miscibility, stiffness, hardness, adhesion, grain size & roughness etc. Use features like ability to change cantilevers without removing scan head should be included in the system. The relevant mode need to offer with the system which can able to measure elasticity to provide direct imaging of polymer domains and texture as well as direct measurement of young's modulus.



EG-3000 SPM drive digital controller



► Electronic controller EG-3000 is designed to control SPM or scanning confocal microscope. Controller provides data acquisition from internal sensors and external devices, applies control voltage to scanners piezoelectric actuators. All obtained information is transferring to PC workstation for visualization and processing.

► One of the most important parts of the EG-

3000 controller is closed loop feedback system realized by means of 20-bit TDC (Time-to-Digital Convertion) to measure displacement capacitance sensors. Controller is capable to operate 6 channels with feedback simultaneously, which allows to independently scan with tip and sample both.

Any available system signal can be used for SPM feedback.

► EG-3000 SPM controller contains 2-channel lock-in amplifier to provide resonant SPM techniques, for example non-contact SPM mode. Lock in amplifier includes high stable voltage generator based on digital frequency synthesizer. High speed data processing is implemented using programmable logic (FPGA). This allows to perform high quality lock-in detection up to 1.5 MHz band.

► EG-3000 has multy channel (up to 12) control for stepper motor with micro step option, for example, for adjustment of scanning head (stage).

► Controller has analog inputs and outputs for external equipment connections, synchronization inputs and outputs and USB interface for connection with PC. Controller is managed with NSpec software.

Compatibility:

- ► Centaur and Centaur HR
- Snotra
- ► Certus Optic
- Certus Standard
- Certus Light
- ► Ratis



NSpec – Universal software for all NST devices. Nspec controls all EG-3000 functionality, and all devices connected to controller (SPM Certus, scanning stage Ratis, stepper motors etc.). Software has capability to operate CCD detectors and spectrometers, connected to PC workstation. Multithread core of the program is build with modern crossplatform compiler (GCC4) and interface part based on QT4 toolkit. Software is compatible with all modern versions OS Windows (XP, 2003, Vista, 7). Version for Linux, *BSD or MacOS X available by customer request.



NSpec features:

- Control of SPM head Certus parameters and functions;
- ► Control of scanning with SPM head or Stage;
- ▶ Full control of Centaur system, including spectrometer and CCD camera;
- ► Stepper motors control;

► Basic data processing. Please note that only basic data processing functions are implemented in NSpec Software. Specialized data processing (such as Gwyddion http://gwyddion.net) software is recommended for more detailed and powerful data processing. Special spectroscopy data processing software (e.g. GRAMS) is recommended for spectral data processing and filtering. NSpec Software has direct data export to ASCII, gwy (gwyddion), spc (GRAMS) formats.

1	Controller		
1.1	General characteristics		
1.1.1	CPU	32 bit float; RISC	
1.1.2	PC Interface	PCI interface /USB 2.0	
1.1.3	Other interfaces	RS 232, RS485, SYNC I/O	
1.2	High-voltage outputs		
1.2.1	Voltage	-10150 V	
1.2.2	Noise	< 5 ppm.	
1.2.3	Number of channels	6	
1.2.4	Resolution (digital-analog converters)	20 bit	
1.3	Stepper motors control unit	'	
1.3.1	Number of channels	4	
1.3.2	Power supply	24V, 3A	
1.3.3	Microstepping mode support	1/16 step	
1.4	Lock-in amplifier		
1.4.1	Number of channels	2	
1.4.2	Preamplifier gain	1-100	
1.4.3	Input voltage range	±10 V	
1.4.4	ADC resolution	16 bit	
1.4.4	Frequency range of input signals	0-1,2 MHz	
1.4.6	Frequency range of main oscillator	10 Hz – 3 MHz	
1.4.7	Output voltage amplitude	10 mV-10 V	
1.4.8	Frequency stability	< 5 ppm	
1.4.9	Additional channels ADC / DAC	Jitional channels ADC / DAC	
1.4.9.1	Number of input channels	8	
1.4.9.2	Voltage Range	±10 V	
1.4.9.3	ADC resolution	16 bit	
1.4.9.4	Number of output channels	4	
1.4.9.5	Voltage range	±10 V	
1.4.9.6	DAC resolution	20 bit	
2		Minimal PC configuration	
2.1	CPU	Min 2 GHz	
2.2	RAM	4096 MB	
2.3	HDD	500 GB	
2.4	Monitors	2 monitors 20`` (1st for pc, 2 for Video)	
2.5	NSpec SPM software with Win 7 Pro 64	Microsoft windows operating system with features like roughness measure- ment, grain size analysis, elasticity, adhesion, cross-sectional analysis, 3D analysis, Image and data export format, full control of system operation	
2.6	UPS	3 KVA online for 30 min. back-up	



1		Accessories
1.1	Lateral calibration of SPM scanners; Detection of lateral and vertical scanner non-linea Detection of angular distortions.	rity;
1.1.1	Grating for 2-D (XY) tip characterization	1 pcs
1.2	Detection of lateral non-linearity, hysteresis, creep Determination of the tip aspect ratio; Detection of lateral and vertical scanner non-linea Detection of angular distortions.	o, and cross-coupling effects; rity;
1.2.1	Grating for 3-D (XYZ) tip characterization	1 pcs
1.3	Cantilevers and probes	
1.3.1	Cantilever sets of different types	50 Nos
1.3.2	Essential Probes	50 Nos
1.4	Essential spare part	



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