Centaur

Scanning Probe Optical Microspectrometer

Basic Datasheet

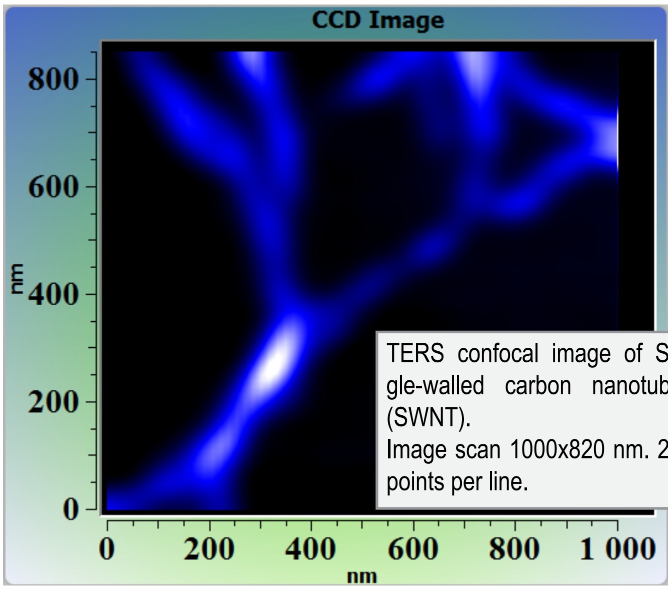
Nano Scan Technology Ltd.
Russia, 141700, Dolgoprudny,
Zavodskaya St, 7
Phone: +7 (495) 642-40-68
+7 (495) 642-40-67
Skype: NanoScanTech
E-mail: info@nanoscantech.ru
web: www.nanoscantech.com

Centaur and Centaur HR combine:

- ► Scanning Probe Microscope;
- ► Inverted or Upright Optical Microscope;
- ► Laser Confocal Microscope;
- ► Raman Confocal Microscope;
- ► Fluorescence Confocal Microscope.

Applications:

- ► Scanning Probe Microscopy;
- ► Raman Confocal Microscopy;
- ► Fluorescence Confocal Microscopy;
- ► Near-Field Scanning Microscopy;
- ► Tip-Enhanced Raman Spectroscopy (TERS);
- ► Tip-Enhanced Fluorescent Spectroscopy (TEFS).



TERS confocal image of Single-walled carbon nanotubes (SWNT).
Image scan 1000x820 nm. 200 points per line.

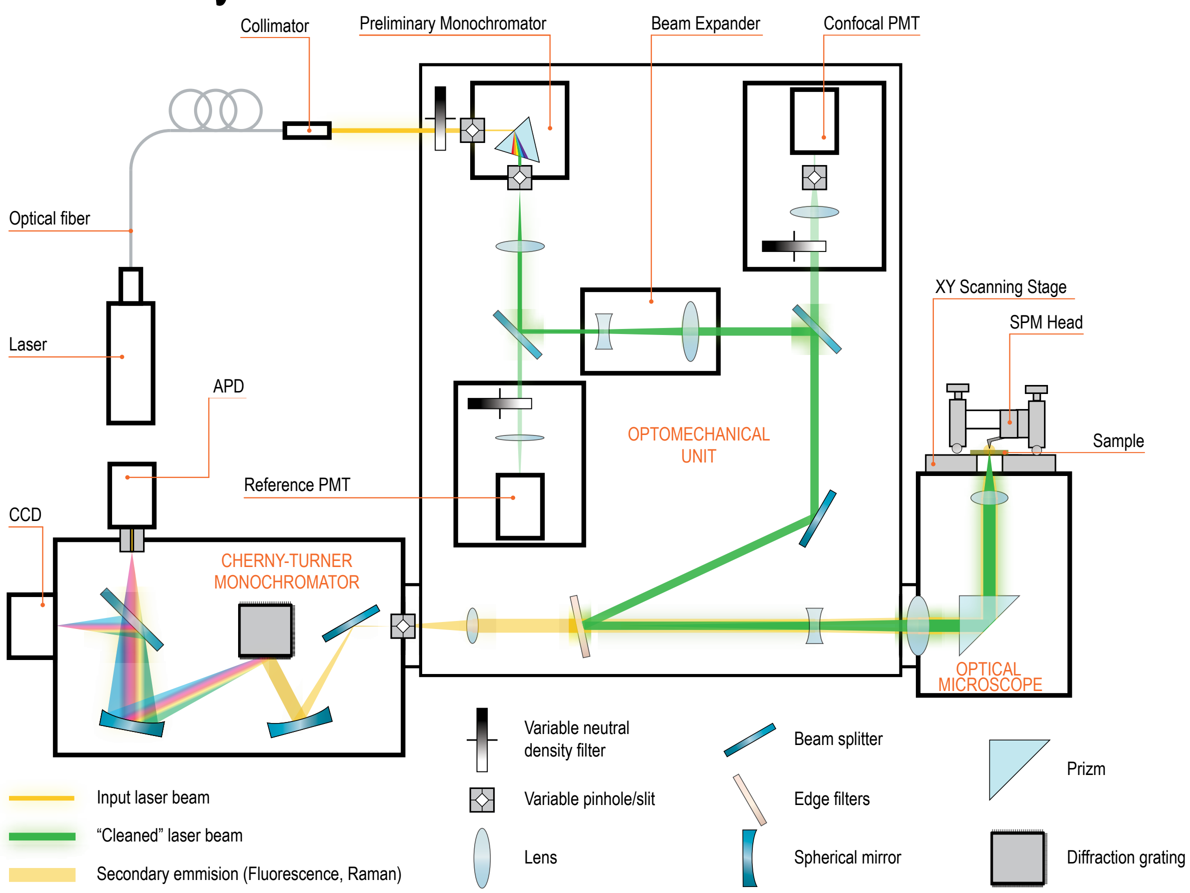
Where to use:

► Chemistry. Combination of methods of scanning probe microscopy and Raman spectroscopy allows the analysis of the composition and structure of organic and inorganic substances, traditional and composite materials;
► Physics. Investigation of physical characteristics of surface and subsurface layers of substances and materials;
► Biology. Study of tissues, cells and their structures, biological molecules and the interactions between them;
► Interdisciplinary research. Research in the field of nanotechnology, pharmaceuticals, materials science, mineralogy, geology, forensic, analysis of art and many others.

Advantages of Centaur:

► Dual independent scanners (in head and base);
► Multiple simultaneous signal recording (confocal, spectra, topography, phase etc.);
► Full spectra recording in each scan point;
► Integration with virtually unmodified upright or inverted optical microscopes to work with transparent and none transparent samples;
► Modern cross-platform software (for all the Centaur units).

Centaur - layout:



web: www.nanoscantech.com
e-mail: info@nanoscantech.ru

1	Main parameters	
1.1	SPM resolution (XY lateral)	<1 nm
1.2	SPM resolution (Z vertical)	<0.1 nm
1.3	Field of view of SPM (scanning range) when scanning with probe	100x100 μm
1.4	Field of view of SPM (scanning range) when scanning with sample	100x100 μm
1.5	Z range	15 μm
1.6	Residual nonlinearity of the scanner	<0.3%
1.7	Optical resolution in the a confocal microscope mode	~2/3 λ
1.8	Field of view (scanning range) in confocal mode	100x100 μm
1.9	Spectral resolution:	
	Grating 200 lines/mm	1.45 nm
	Grating 600 lines/mm	0.45 nm
	Grating 1200 lines/mm	0.22 nm
1.10	Spectral range:	
	Grating 200 lines/mm	330 - 1300 nm
	Grating 600 lines/mm	400 - 1200 nm
	Grating 1200 lines/mm	400 - 870 nm
1.11	Optical transmission within the spectral range	≥ 60%
1.12	Signal-to-noise ratio at the peak of the luminescence spectra *(for the luminescence signal of the dye with a quantum yield of not less than 50% at a concentration of 10^{-5} mol/liter and the shift of the maximum of the luminescence line relative to the maximum excitation lines not less than 5 nm).*	≥100
1.13	Signal-to-noise ratio at the peak of the Raman spectra *(for the Raman signal from the oscillator strength of the benzene molecule at a frequency of 607 cm^{-1} and the frequency shift of not less than 200 cm^{-1})*	≥100000
2	Scanning Probe Microscope unit	
2.1	SPM head	
2.1.1	Built-in flat XYZ scanner	
2.1.1.1	Scanning/positioning XYZ range	100x100x15 μm
2.1.1.2	XY stage resonant frequency	1 кHz
2.1.1.3	Z rezonant frequency	7 кHz
2.1.1.4	Residual nonlinearity	<0.3%
2.1.1.5	SPM resolution (XY lateral)	<1 nm
2.1.1.6	SPM resolution (Z vertical)	<0.1 nm
2.1.2	Displacement sensors	
2.1.2.1	Sensors type	Capacitance
2.1.2.2	Measuring principle	Time-to-digital convertion
2.1.3	Scanning head approach system	
2.1.3.1	Minimal step	1 μm
2.1.3.2	Coarse approach implementation	Stepper motors
2.1.3.3	Number of stepper motors	3
2.2	Scanning stage	
2.2.1	Built-in flat XY scanner (XY stage)	
2.2.1.1	Dynamic range scanning / positioning XY	100x100 μm
2.2.1.2	Resonant frequencies of XY	1 kHz
2.2.1.3	Residual nonlinearity	≤0.3%.
2.2.2	Sensors	
2.2.2.1	Sensors type	Capacitance sensor

3	Optical unit	
3.1	Pre-monochromator to filter spurious modes of laser source	
3.1.1	Spectral range	400..800 nm
3.1.2	Spectral resolution	< 1 nm
3.1.3	Variable pinhole diameter range	0..1 mm
3.2	Motorized ND filter to adjust the power of the input laser	
3.2.1	ND filter range	0..4
3.2.2	Number of gradations	256
3.3	Expander / collimator beam unit	
3.3.1	Diameter of the input beam	1 mm
3.3.2	Output beam diameter	3..15 mm
3.4	Signal PMT unit	
3.4.1	Positioning	Three coordinate motorized objective
3.4.2	Focal plane	At the intersection of the slit
3.4.3	Resolution of laser confocal images	~2/3 λ
3.4.4	PMT control	Software
3.5	Reference photomultiplier unit	
3.5.1	Input laser intensity calibration	PMT and software
3.6	Confocal laser line selection unit	
3.6.1	Filter type	Edge filters
3.6.2	Half-width of the recession curve of the transmission filters	3 nm
3.6.3	Angle of incidence on the filters	5-16°
3.6.4	Ability to measure the line of the secondary spectrum	to 80 cm^{-1} from the line excitation
3.7	Objective	Three-axis motorized focusing objective
3.8	Monochromator unit	
3.8.1	Focal length	F=260 mm
3.8.2	Spectral range	200-1000 nm
3.8.3	Grating 1	1:1 (mirror)
3.8.4	Grating 2	200 lines/mm (blaze 500 nm)
3.8.5	Grating 3	600 lines/mm (blaze 600 nm)
3.8.6	Grating 4	1200 lines/mm (blaze 600 nm)
3.8.7	Crossed entrance slit range	1x1 mm
3.8.8	Entrance slit accuracy	1 μm
3.8.9	Output slit range	1 mm
3.8.10	Accuracy of the output slit	1 μm
3.8.11	Slits, mirrors, shutters and gratings mechanic	All-around automation
3.8.12	Interface	USB 2.0
3.9	Periscope unit	
3.9.1	Integration with upright or inverted microscope	Implemented
3.10	CCD (basic)	
3.10.1	Cooling	Buid-in Peltier element
3.10.2	Minimum temperature cooling	-30°C
3.10.3	Dark current	1 count/sec per pixel
3.10.4	Quantum yield	95% over the entire spectral range
3.10.5	Spectral range	400-1000 nm
3.10.6	Number of pixels	1024x256
3.10.7	Interface	USB 2.0
3.11	Excitation laser source (basic)	
3.11.1	Wavelength	473 nm
3.11.2	Output power	25, 50 mW

3.11.3	Spectral linewidth	<1 MHz (<0.01 pm)
3.11.4	Spatial mode	TEM00 M^2 <1.1
3.11.5	Beam diameter at aperture	700 µm
3.11.6	Beam divergence (full angle)	<1.2 mrad
3.11.7	Noise, 20 Hz -20 MHz (pk-pk)	<2%, typical <1.5%
3.11.8	Noise, 20 Hz -20 MHz (rms)	<0.25%, typical <0.15%
3.11.9	Long-term stability (8 hr)	<2% (±3°C)
3.11.10	Beam pointing stability (over 10-40 °C)	<10 µrad/°C, typical 5 µrad/°C
3.11.11	Polarization ratio	>100:1 linear
3.11.12	Total system power consumption	<25 W, typical <15 W
3.11.13	Operating temperature	10-40°C
3.12	Vibration protection	
3.12.1	Type of vibration protection	Passive
3.12.2	Implementation of the system of vibration protection	Optical plate
3.12.3	Dimensions of the optical plate, WxDxH	900x1800x200 mm
3.12.4	Thread diameter	M6
3.12.5	Cells step	25 mm
4	Optical microscope	
4.1	Type, manufacturer and specifications of the microscope	Optionally, in accordance with the terms of the specification either upright or inverted microscope
4.2	Inverted microscope (for trasperent samles)	
4.2.1	Brand of microscope	Olympus IX71
4.2.2	Type of microscope	Inverted
4.2.3	Transmitted light illuminator	
4.2.3.1	Illuminator	The illuminator of the transmitted light
4.2.3.2	Lamp	Halogen, 12 V, 100 W
4.2.3.3	Power	
4.2.4	Focus	
4.2.4.1	Stroke	9 mm
4.2.4.2	Minimum fine focus graduation	1 µm
4.2.5	Condenser	
4.2.5.1	Type	Universal
4.2.5.2	N.A.	0.55
4.2.5.3	W.D.	23.3 mm
4.2.6	Built-in magnification changer	1x / 1,6x
4.2.7	Light path selection	2-step
4.3	Upright microscope (for opaque samples)	
4.3.1	Brand of microscope	Nikon Eclipse FN1
4.3.2	Type of microscope	Upright
4.3.3	Light illuminator	
4.3.3.1	Illuminator	Lamp unit FN-LH with pre-centering
4.3.3.2	Lamp	Halogen, 12 V, 100 W
4.3.4	Focus	
4.3.4.1	Stroke	9 mm
4.3.4.2	Minimum fine focus graduation	1 µm
4.3.5	High eyepoint	10x, F.N.: 22, 25
4.2.6	Condenser	
4.2.6.1	Type	Universal, revolving type
4.2.6.2	N.A.	0.78
4.2.6.3	W.D.	13 mm

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.

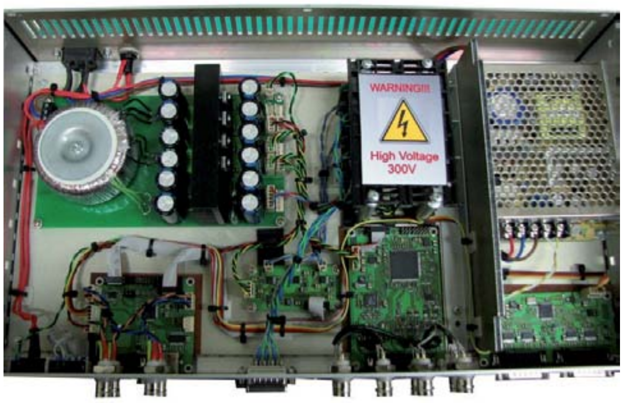
►One of the most important parts of the EG-3000 controller is closed loop feedback system realized by means of 20-bit TDC (Time-to-Digital Convertion) to measure displacement capacitance sensors. Controller is capable to operate 6 channels with feedback simultaneously, which allows to independently scan 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.

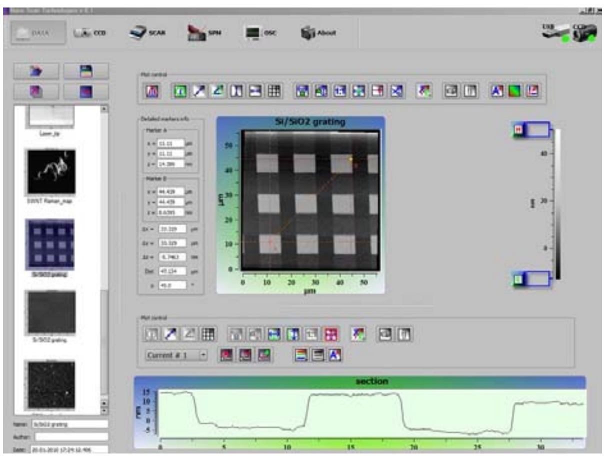
►EG-3000 has multy channel (up to 12) control for stepper motor with micro step option, for example, for adjustment of scanning head (stage).

►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; RISC
1.1.2	PC Interface	USB 2.0
1.1.3	Other interfaces	RS 232, RS485, SYNC I/O
1.2	High-voltage outputs	
1.2.1	Voltage	-10..150 V
1.2.2	Noise	< 5 ppm.
1.2.3	Number of channels	3 or 6
1.2.4	Resolution (digital-analog converters)	18 bit
1.3	Stepper motors control unit	
1.3.1	Number of channels	4/8/12
1.3.2	Power supply	24V, 3A
1.3.3	Microstepping mode support	1/1, ½, ¼, 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	
1.4.9.1	Number of input channels	2
1.4.9.2	Voltage Range	±10 V
1.4.9.3	ADC resolution	16 bit
1.4.9.4	Number of output channels	2
1.4.9.5	Voltage range	±10 V
1.4.9.6	DAC resolution	16 bit
2	Minimal PC configuration	
2.1	CPU	Min 2 GHz
2.2	RAM	512 GB
2.3	HDD	200 GB
2.4	Monitors	2 monitors 20``

1	Accessories	
1.1	Lateral calibration of SPM scanners; Detection of lateral and vertical scanner nonlinearity; Detection of angular distortions.	
1.1.1	Grating for 2-D (XY) tip characterization	1 pcs
1.2	Detection of lateral non-linearity, hysteresis, creep, and cross-coupling effects; Determination of the tip aspect ratio; Detection of lateral and vertical scanner nonlinearity; Detection of angular distortions.	
1.2.1	Grating for 3-D (XYZ) tip characterization	1 pcs
1.3	Cantilevers and probes	
1.3.1	Contact mode	20 pcs
1.3.2	Tapping mode	20 pcs
1.4	Other accessories	Optional

NanoScanTechnology
reasoned innovations

Contact:

Russia
141700, Dolgoprudny, Zavodskaya St, 7

Phone: +7-495-642-4068
+7-495-642-4067

Skype: NanoScanTech

E-mail: info@nanoscantech.ru
web: www.nanoscantech.com

Nano Scan Technology Ltd.