



The Nanonics CryoView 2000™
Shedding **light** on the unseen



NANONICS IMAGING LTD.

The Nanonics **CryoView 2000™**

As SPM technology continues to establish its place as a crucial tool in the microscopist's laboratory, Nanonics Imaging has focused on developing innovative SPM systems to meet the increasing demands placed on such instrumentation.

Since its incorporation in 1997, and the introduction of its first systems to the market, Nanonics Imaging has aimed to provide SPM systems that can be integrated onto standard optical microscopes. Such integration provides customers with a powerful combination of both standard far-field microscope techniques together with the ultra-high resolution techniques associated with SPM technology.

The Nanonics CryoView 2000™ introduces the world of integrated microscopy to low temperature research. With simultaneous NSOM, AFM and Confocal imaging, complementary techniques can be used to analyze samples at low temperatures and high vacuums.

Our in-house team of experts works with each customer on a one-to-one basis to provide customized solutions that suit the particular requirements of the research to be undertaken. Nanonics Imaging's continuous, high-quality consultation and support of its customers facilitates successful research – which is after all, the ultimate goal.

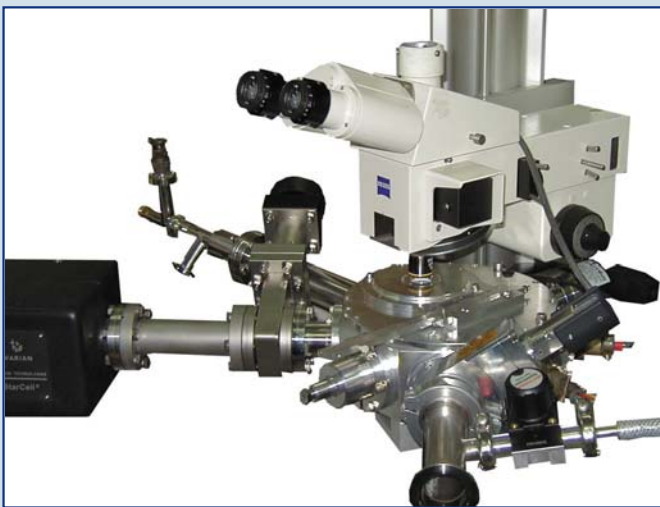


Integration onto Standard Optical Microscopes

The unique Nanonics system architecture is designed for integrated microscopy. The CryoView 2000™ X-Y-Z scan stage, the 3D FlatScan™ and the use of cantilevered optical fiber probes all leave the optical axis completely free. Therefore the sample can be viewed with standard upright, inverted or dual optical microscopes. These advances in system architecture allow lenses with high numerical apertures and magnifications to be used when the CryoView 2000™ is placed beneath an upright microscope.

High Vacuum Chamber

The CryoView 2000™ is designed around a central 5×10^{-8} Torr vacuum chamber. Each side of the octagonal chamber is equipped with a port to add flexibility to the system. When used for low temperature work, a vacuum pump station is connected to the chamber and evacuates the cryostat for operation at an interim temperature of < 25 K. The chamber can be connected to a high vacuum pump station and a transfer line from a dewar that contains the cryogen for low-temperature operation at temperatures down to 10K.



CryoView 2000™ system under a Zeiss Axiotech Vario microscope.



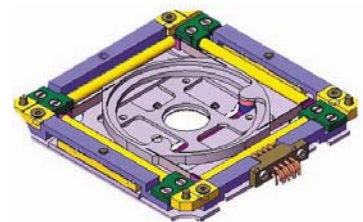
Changing the probe in the CryoView 2000™ system.

Localized Low Temperature Operation

The cryogen is transferred through the transfer tube to cool the cold finger. The sample is cooled by copper braids connecting the cold finger to the sample. The stepper motors and the piezoelectric elements of the 3D FlatScan™ are not maintained at low temperature. Therefore the positioning of the sample and the scanning range of the tip scanner are not altered by working at low temperature.

Motorized Sample Positioning

The CryoView 2000™ X-Y-Z motorized stage controls rough motion in the x, y and z directions with three independently operated stepper motors. This allows for rough motion of the sample in the x and y axis, for easy sample positioning. The motion in the z axis allows manual coarse approach and automatic fine approach of the probe to the surface. The unique design of the stage keeps the sample stage far from heat sources within the chamber and leaves the optical axis completely free.



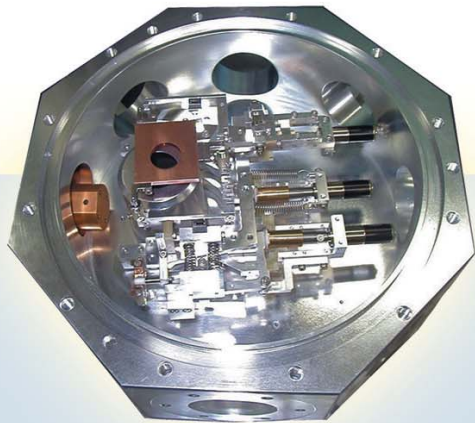
Schematic view of the flat scanner used in the CryoView 2000™ system.

Easy Access to Sample and Probe

The Cryoview 2000™ scanner port can be opened for easy access to both the sample and the probe without needing to open the entire vacuum chamber.

Probes are supplied premounted on a probe holder which includes the tuning fork used for the feedback. Using this probe holder the probe can be easily replaced, accurately and repeatedly.

The sample sits directly beneath the scanner port which is located for quick access.



Open Vacuum chamber of the CryoView 2000™, showing the motorized X-Y-Z stage



CryoView 2000™ vacuum chamber. The probe scanner is shown in the center of the open lid.

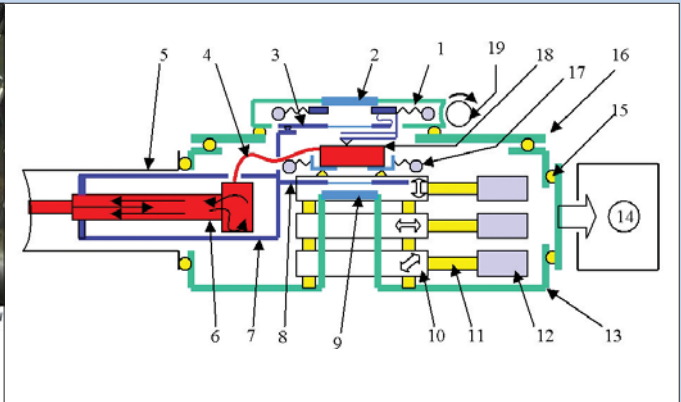
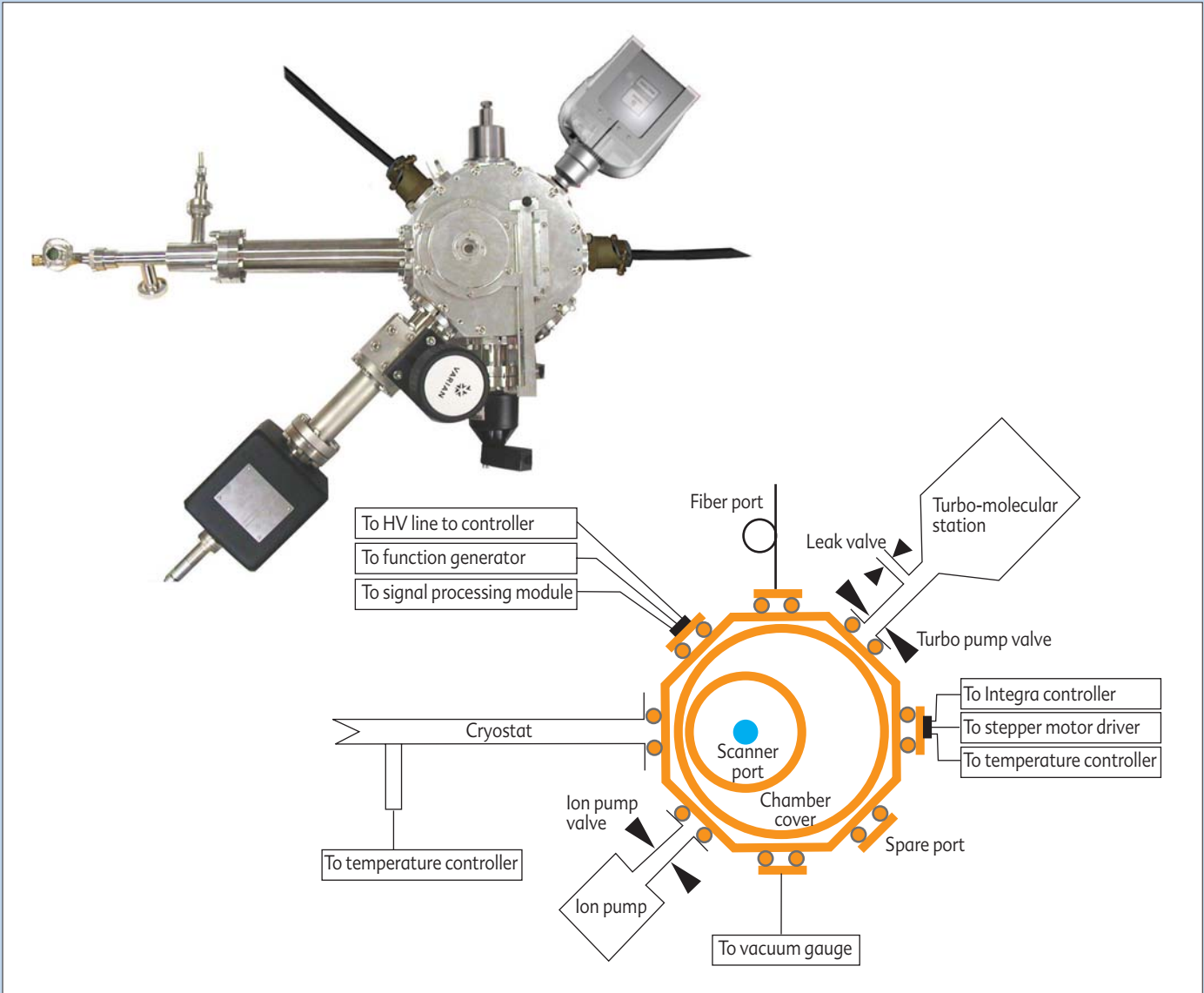
Large XYZ Scan Range

The CryoView 2000™ uses the 3D FlatScan™ technology developed by Nanonics. A novel planar, folded-piezo, flexure scan design allows simultaneous lateral and axial sample scanning.

The ultra thin package and open optical axis permits the scanner to be incorporated into systems where conventional scan stages are too bulky and geometrically awkward. The CryoView 2000™ uses two 3D FlatScan™ scanners to provide 1nm resolution in the tip scanner and 0.02nm resolution in the sample scanner in the x, y and z directions.

The minimal stage height of 7 mm allow for easy access with high powered microscope objectives from either above or below the scanning stage. The large vertical (axial) displacement of up to 70 microns simplifies approaching a sample and allows tracking of structures with very large topographical features.

Top view of CryoView 2000™ system



Cross-section of the vacuum chamber including cooling mechanism and AFM scan head

- | | | | |
|---|----------------------------|----------------------|------------------------------|
| 1. Cryogenic tip scanner | 5. Cryostat | 10. XYZ positioner | 15. Vacuum seal |
| 2. Upper sapphire window | 6. Cold finger | 11. Transmission | 16. Removable chamber cover |
| 3. Upper radiation screen | 7. Radiation shield | 12. Stepper motor | 17. Cryogenic sample scanner |
| 4. Copper wire braids
(heat changer) | 8. Bottom radiation screen | 13. UHV chamber | 18. Cold sample mount |
| | 9. Bottom sapphire window | 14. UHV pump station | 19. Scanner hinge |

Technical Specification CryoView 2000™

Modes of Operation

NFOM	Transmission, reflection, collection, fluorescence
AFM	Contact, non-contact, intermittent-contact
Feedback Mechanism	Tuning Fork Feedback
Confocal Microscopy	Transmission, reflection, fluorescence

Scanning/Sample

Scanner	2 Piezoelectric flat scanners are available: 1. Scan range: 25 micron Z-range, 50 micron XY-range 2. Scan range: 5 micron Z-range, 10 micron XY-range
Step Size	< 1 nm for 50 micron scanner; < 0.02 nm for 10 micron scanner
Sample Positioning	XYZ stepper motors
Maximum Sample Size	16 mm diameter

Probes

NSOM Probes	Cantilevered tapered optical fiber probes
AFM Probes	Cantilevered tapered glass probes
Specialized Probes	Cantilevered probes for electrical or thermal measurements Custom probes available on request

Optics

Viewing/Detection Optics	Free optical access to the sample from top and bottom for optical observation of the sample (all conventional far-field modes of operation are available) Detection of the NSOM signals with any optical microscope (upright, inverted, dual) or other optics
Detectors	Photomultiplier Tube (PMT), Avalanche Photodiode Detector (APD), InGaAs Detector for IR, CCD
Lasers	A large variety of laser systems can be used (UV, VIS, IR)
Spectroscopy	Full range of capabilities including software for correlating probe position with CCD spectrum acquisition. Online fluorescence and Raman capabilities
Video System	Optional CCD camera.

Optical Resolution

Confocal Microscopy	Diffraction limited
Near-field Microscopy	From 50 nm upwards, depending on the aperture size of the NSOM probe used

Controller and Software

Controller	Nanonics Integra controller
Software	Quartz Software for Integra controller (Windows XP). Real time image display, image acquisition (up to 8 channels) and analysis, 3D rendering

Low Temperature

Temperature Range	Room temperature to <10K
Ports	Extra port for additional feedthroughs
High Vacuum	5x10 ⁻⁸ Torr

Options

Electrical Measurements	Options for resistance, thermal measurements
Nanochemical/Gas Delivery	Deliver a chemical via the nanopipette-AFM tip to your sample surface
Raman Microscopy	Fully integrated with Renishaw inVia Series microscope



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