Low Vibration
Cryogenic Equipment

atto CRYO

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Low Vibration Cryogenic Equipment

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attoDRY1000 | Low Vibration. Cryogen-Free.

Helium-free cryostats with optional superconducting magnets

The attoDRY1000 is a cryogen-free cooling system setting new performance benchmarks and making possible what was considered impossible only a few years ago. The attoDRY1000 was specifically designed to provide an ultra-low vibration measurement platform for cryogenic scanning probe experiments without the need for liquid Helium.

The standard closed-cycle system enables vibration-sensitive experiments in a temperature range from 4 K to 300 K. The optionally available microscope inserts are cooled by a controlled exchange gas atmosphere. Superconducting magnets up to 9 T are available as an option. Due to a proprietary design, mechanical vibrations created by the pulse-tube cold-head are decoupled from the measurement platform, creating a peak-to-peak vibration amplitude of less than 4.2 nm[1] at the sample location.

Despite the mechanical decoupling between coldhead and sample platform, the cooling performance of the attoDRY1000 is simply outstanding. Temperatures as low as 3.5 K[2] and probe cooldown times as fast as 1 hour[3] make cryogenic scanning probe experiments a delight.
For the attoDRY1000, a wide variety of scanning probe microscopy inserts ranging from confocal (CFM) to magnetic force microscopy (MFM), as well as probe station inserts (CPS) are available.

[1] measured in vertical direction using an attoAFMI at a bandwidth of 200 Hz
[2] measured at the 2nd stage platform/magnet
[3] measured using a standard confocal microscope insert

MAIN ADVANTAGES

+ no liquid Helium needed
+ long measurement cycles
+ low vibrations
+ ‚set-and-forget' type of operation
+ large bore size and sample space
+ magnetic fields up to 9 T
+ compact instrumental design

PRODUCT KEY FEATURES

> cryogen-free, low vibration cryostat platform
> very fast cooldown and turn-around times
> temperature control range: 4 K to 300 K
> optional superconducting magnets up to 9 T

BENEFITS

> scanning probe microscopy experiments in a cryogen-free, low vibration environment
> fast exchange of samples and/or scanning probe tips
> measurements at a broad range of temperature and magnetic field (optional) with highest stability

APPLICATION EXAMPLES

> solid state physics and quantum dot optics
> materials science research on ceramics, polymers, additives, alloys, ..
> semiconductor device characterization

COMPATIBLE MICROSCOPE SYSTEMS

> attoCFM I,attoCFM II, attoCFM III, attoRAMAN, attoAFM I, attoMFM I, attoSHPM, attoCPS I / II

Temperature Range	
standard edition	4 .. 300 K
General Specifications	
technology	low vibration pulse-tube based closed-cycle cryostat designed for scanning probe microscopy applications
material of body	Stainless Steel and Aluminum
top loading system	quick and easy sample exchange, 2"diameter probe bore fitting all attocube inserts
Performance Data	
temperature range	4 .. 300 K
cool down time to 4 K (no magnet)	< 5 h
cool down time to < 5 K (with CFM insert)	1 h
temperature stability	< +/- 5 mK (4 K..100 K)
Pulse Tube Based Pre-Cooler	
nominal cooling power (4.2 K)	> 1000 mW
power consumption	6 kW
cooling	water cooling
Dimensions	
cryostat (width x depth x height)	640 x 640 x 1200 mm³
System Connections	
vacuum pump	flange and valve included
thermometry	standard feedthrough included
Options	
superconducting magnet	3 .. 9 T
Available Inserts	
confocal microscopes	attoCFM I, attoCFM II, attoCFM III
confocal Raman microscopes	attoRAMAN
atomic/magnetic force microcopes	attoAFM I, attoMFM I, attoAFM III (on request)
scannning Hall probe microscopes	attoSHPM
cryogenic probe station transport measurements	attoCPS I, attoCPS II atto3DR double rotator module

NEW

attoDRY1100 | Fully automated. Turnkey operation.

Touchscreen control of field & temperature

The attoDRY1100 features all the benefits of the attoDRY1000, yet it also adds a fully automated gas handling system and turnkey operation of temperature and magnetic field control. Measurements in a low vibration environment at low temperatures and high magnetic fields have never been that easy! The integrated touchscreen allows for setting your desired field (B) and temperature (T) without even using a PC. At the same time, more elaborate measurement schemes such as programmable sweeps of T and B are easily possible via a USB/Ethernet connection and a LabVIEW interface.

MAIN ADVANTAGES

+ no liquid Helium required
+ NEW: integrated 4.3" touchscreen
+ full automation of field and temperature control
+ USB/Ethernet interface, LabVIEW control
+ designed for vibration sensitive measurements
+ NEW: *in-situ* double rotator for full field (9 T) in 3D

BENEFITS

+ scanning probe microscopy experiments in a cryogen-free, low vibration environment
+ fast exchange of samples and/or scanning probe tips
+ measurements at a broad range of temperature and magnetic field (optional) with highest stability

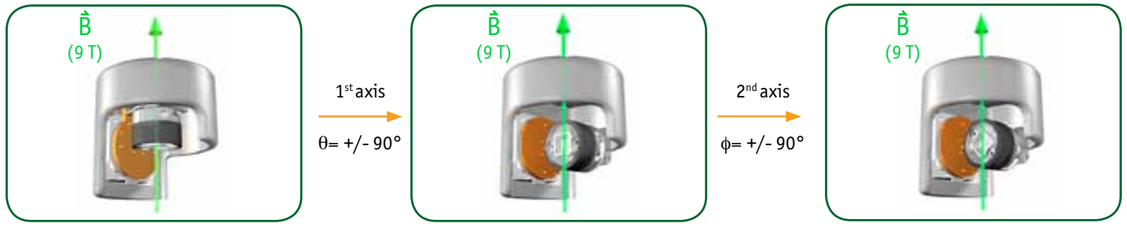
NEW

Accessories

atto3DR: double rotator for *in-situ* operation

The atto3DR, attocube's 3-dimensional rotator module, provides access to the full magnetic field (e.g. 9 T) in all directions relative to the sample surface, a feature which is unheard of even with significantly more expensive 2D/3D vector magnet setups, simply because split coil configuration do not achieve such high field values. The module comes fully wired and equipped with a convenient leadless ceramic chip carrier (LCCC) socket with 20 contacts, which makes sample exchange a quick and easy task. Of course all parts are non-magnetic, and it is compatible with all attoCRYO setups with a 2" sample space and exchange gas cooling, whether it is a dry or a liquid setup.

The atto3DR allows for a rotation around a horizontally fixed axis, which controls the tilt angle between the sample surface and the external magnetic field, by +/- 90°, and an additional rotation around an in-plane axis by another +/-90° -, thus allowing access to any relative orientation between sample and field.



out of plane configuration | *in plane configuration* | *in plane rotation*

PRODUCT KEY FEATURES

> *in-situ* double rotation
> full field (e.g. 9 T) in 3D
> integrated chip carrier socket
> eucentric rotation
> plug & play module
> resistive encoder for closed loop operation
> software control (GUI & LabVIEW)

Specifications	
module outer diameter	49 mm
max. sample size	4.9 mm x 4.9 mm x 1.2 mm
chip carrier: number of contacts	20
travel range (step mode)	+/- 90° for both rotators (reserve: +/-10°)
typical minimum step size	1 m°@300 K, 0.5 m° @ 4K
max. speed (@300 K)	approx. 30°/s
readout mechanism	resistive sensor
encoded travel range	315° (both rotators)
sensor resolution	approx. 6 m°
repeatibility	approx. 50 m°
linearity	approx. 1 %

attoDRY1000 / 1100

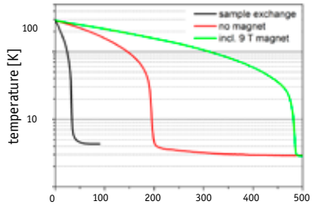
Helium-free cryostats with optional superconducting magnets

attocube has devoted all of its cryogenic experience and years of development time into a cryogen-free system which is dedicated for scanning probe microscopy or other vibration sensitive experiments. At attocube, we believe that the performance of every instrument can only be judged by the measurements it is capable to deliver and not by the specs which come with it.

With measured vibration levels of less than 0.6 nm RMS at the sample location, the combination of attocube's ultra-stable SPM modules and the attoDRY1000's proprietary low vibration design proves to be the perfect platform for scanning probe microscope applications (see application examples on the following page).

The attoDRY1000 is currently the only proven low vibration pulse tube cooler available on the market - come and harness its power.

COOLDOWN TIMES



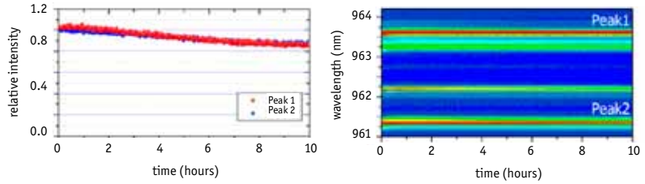
CUSTOMER FEEDBACK

Dr. Benito Alén Millán:
In contrast to many other such complex pieces of equipment, we were able to perform our first regular measurements already after 2 weeks, and since then, have been very pleased with the performance of the attoDRY1000.

(Molecular Beam Epitaxy group at the Instituto de Microelectrónica de Madrid, Spain)

Scanning Probe Microscopy gone dry.

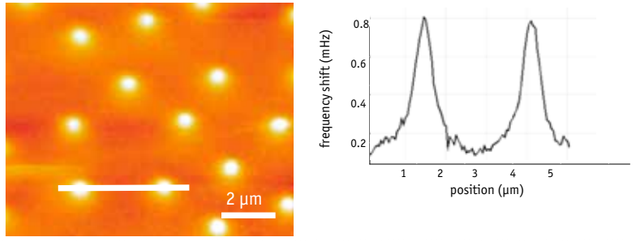
Selected applications with the attoDRY1000/1100



Cryogen-free confocal measurements on a single quantum dot.

The data to the left show photon anti-bunching experiments performed on a single quantum dot. Without any special effort the customer observed that the dot luminescence intensity remains constant within 14 % over 10 hours.

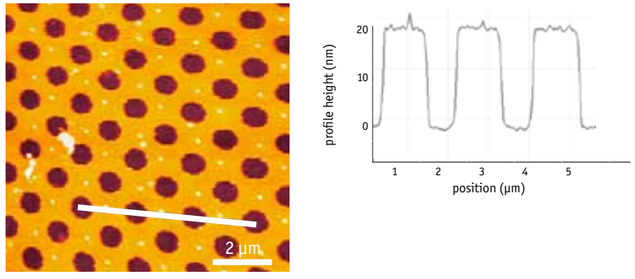
The data was generously provided by Benito Alén Millán, Molecular Beam Epitaxy group at the Instituto de Microelectrónica de Madrid, Spain.



Magnetic Force Measurements on Bi-2212 at 4K.

In this measurement, attocube's attoMFM Ixs within the attoDRY1000 was used to image the hexagonal vortex lattice of optimum doped $Bi_2Sr_2CaCu_2O_{8+\delta}$ (Bi-2212) at a temperature of 4.1 K and a magnetic field of 10 Gauss. The signal-to-noise is approx. 20:1.

attocube application labs, 2009; sample courtesy of A. Erb, Walther Meissner Institute, Germany.



Atomic Force Measurements at 4K.

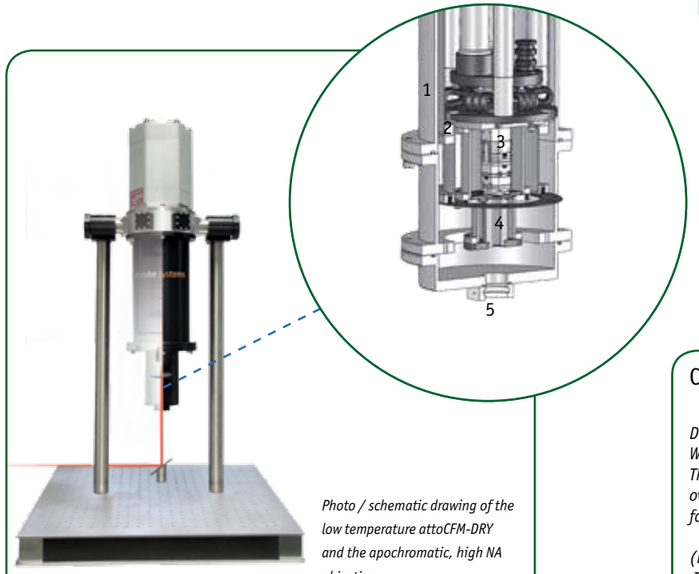
The outstanding performance of the ultra-low vibration level of the pulse-tube cooler in combination with the high stability of the AFM module allows for ultra high resolution imaging of nm-features over a wide temperature range (< 4 K .. 300 K) without the need for liquid Helium. The result on the left shows an AFM contact mode image of a Si-substrate/SiO2-layer. Height: 20 ± 2 nm recorded at 4 K.

attocube application labs, 2011.

attoDRY700 | Table-top ready. Cryogen-free.

Cryogen-free table top cryostats with optical access and included cryogenic objective

The attoCFM-DRY is a low temperature compatible confocal microscope dedicated to perform cryogenic optical experiments on any optical table. The main concept of this development is to offer an ultra-high numerical aperture, apochromatic confocal table-top microscope dedicated for cryogen-free low temperature operation. To achieve this task, attocube has implemented a new apochromatic objective, providing an enhanced level of chromatic aberration correction with a numerical aperture (NA) of up to 0.95. As a result, ultra-high resolution images and spectra can be recorded with high collection efficiency, making this objective series ideal for experiments on e.g. quantum dots, photonic crystals or NV color centers in diamond.
The attoCFM-DRY is compatible with any optical bench, thus allowing for easy integration into existing optical setups for fast, highly accurate, and stable confocal measurements. The dual-stage pulse tube cooler integrates a novel anti-vibration system, facilitating highly sensitive measurements in a cryogen-free environment. Further features such as easy sample exchange, fast cool-down and turn-around times, and simple operation guarantee customer satisfaction and successful experiments.



01 vacuum tube
02 65 K radiation shield
03 xyz positioner and scanner
04 high NA objective
05 optical vacuum window

Photo / schematic drawing of the low temperature attoCFM-DRY and the apochromatic, high NA objective.

BENEFITS

+ cryogen-free
+ large coarse positioning range at low temperature
+ compact table-top system suitable for any optical table
+ minimized drifts
+ compatible with room temperature optical equipment

CUSTOMER FEEDBACK

Dr. Bernhard Urbaszek:
We are pleased with the performance of the attoDRY700. The good mechanical and thermal stability ensures that overnight the selected quantum dot remains within the focus of the objective.

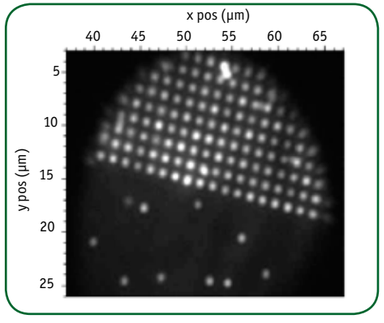
(Laboratoire de physique et chimie de nano-objets, INSA Genie Physique, Toulouse)

PRODUCT KEY FEATURES

> highest flexibility combined with lowest vibrations
> lowest base temperature: 2.8 K, controllable up to 300 K
> temperature stability (2.8 K .. 70 K): < 0.025 K without temperature controller
> compatible with any optical table
> very fast cool down times: < 2 h typically to 4 K (no load)
> cooling power: 250 mW at 4 K
> low mechanical vibration level due to integrated anti-vibration system
> various objectives available with an NA of up to 0.95

APPLICATION EXAMPLES

> solid state physics and quantum dot optics
> fluorescence observation
> biological and medical research on tissue samples in cytological and neurological applications



Temperature Range	
standard edition	4 K (with standard wiring)
with sample heater (optional)	4 K .. approx. 300 K
with temperature controller (optional)	4 K .. approx. 300 K, temperature controlled

General Specifications	
material of body	Aluminum
temperature isolation	vacuum isolation, radiation shielded
bottom loading system	quick and easy sample exchange
damping	internal anti-vibration damping system

Performance Data	
cool-down time	< 2 h typically to 4 K (without load)
lowest temperature	2.8 K (without load)
temperature stability (2.8 .. 70 K)	< 0.025 K without temperature controller
cooling power	10 W at 65 K, 250 mW at 4.2 K

Confocal Objectives	Configuration A	Configuration B	Configuration C	Configuration D
type	aspheric	aspheric	achromat	plan apochromat
numerical aperture	0.68	0.55	0.82	0.95
working distance	1.61 mm	2.68 mm	0.4 mm	0.35 mm
spectral range (depending on AR-coating)	400 .. 1600 nm (*)	400 .. 1600 m (*)	300 .. 1600 nm (> 80 % trans.)	400 .. 700 nm
temperature @ sample	4 K	4 K	4 K	< 6 K

Sample Positioning	
positioners and scanners	coarse positioners ANPxyz101 with piezo scanner ANSxy100
step size	0.05 .. 3 µm @ 300 K, 10 .. 500 nm @ 4 K
coarse range	5 x 5 x 5 mm³

*depending on AR coating: coating A: 400-600nm | coating B: 600-1050nm | coating C: 1050-1600nm | uncoated

The figure to the left shows a large-scale PL image of single InAs quantum dots that were grown at predefined locations on a prepatterned substrate. This particular attocube setup allows for using a commercially available high-NA objective that is placed in the isolation vacuum of the cryostat and anchored at room temperature, guaranteeing highest optical imaging properties. It allows for fast optical characterization of the quantum dots with fast turnaround times.

The measurement was kindly provided by C. Strelow, T. Kipp, and A. Mews, University of Hamburg, Germany. Sample courtesy of A. Schramm, Tampere University of Technology, Finland.

attoDRY2000

Cryogen-free cryostats with customizable superconducting (vector) magnets

The attoDRY2000 is based on the same design as the attoDRY1000 but is equipped with a more powerful pulse tube cooler, enabling the integration of large solenoids and 2D/3D vector magnets. Upon customer's request, the attoDRY2000 can be equipped with solenoids with up to 15 T field, 2D magnets with up to 7/2 T, or 3D magnets with up to 5/1/1 T. Depending on the magnet chosen, the attoDRY2000 features either a 2" or a 1" clear bore diameter. The attoDRY2000 excels with the same ultra low vibration level as the attoDRY1000 and is therefore perfectly suited for scanning probe applications.

PRODUCT KEY FEATURES

> cryogen-free, low vibration cryostat platform
> specifically designed for large solenoids or vector magnets (solenoids with up to 15 T and vector magnets with up to 7/2 T and 5/1/1 T)
> very fast cooldown and turn-around times
> temperature control range: 4 K to 300 K

COMPATIBLE MICROSCOPE SYSTEMS

> attoCFM I / II / III, attoRAMAN, attoAFM I, attoMFM I, attoSHPM, attoCPS I / II

Temperature Range	
standard edition	4 .. 300 K
General Specifications	
technology	low vibration, pulse-tube based closed-cycle cryostat, designed for scanning probe microscopy applications in high magnetic fields
material of body	Stainless Steel and Aluminum
top loading system	quick and easy sample exchange, 2"diameter probe bore fitting all attocube inserts
Performance Data	
temperature range	4 .. 300 K
cool down time to 4 K (full assembly)	depending on magnet
cool down time to < 5 K (CFM insert)	depending on magnet
temperature stability	< 0.1 K
Pulse Tube Based Pre-Cooler	
nominal cooling power (4.2 K)	> 1500 mW
power consumption	11 kW
cooling	water cooling
Dimensions	
cryostat (width x depth x height)	640 x 640 x 1200 mm
Options	
superconducting magnet	up to 15 T, 7/2 T, 5/1/1 T

Optional Configuration

mK and table top cryogen-free cryostats

CRYOGEN-FREE mK SYSTEMS

attoDRY4000
The attoDRY4000 is a cryogen-free adiabatic demagnetization refrigerator system which operates at a temperature of 100 mK. The cryostat uses a double stage ADR salt pill with a hold time of up to 48 h at base temperature. The attoDRY4000 provides a low level of vibration and is therefore perfectly suited for scanning probe measurements.

attoDRY5000
The attoDRY5000 is a cryogen-free dilution refrigerator unit with a base temperature of < 12 mK. With a cooling power of up to 400 µW at 100 mK, the attoDRY5000 is capable of handling even large experiments with high specific heat or large heat loads.

TABLE TOP BASED CRYOGEN-FREE SYSTEM

MONTANA INSTRUMENTS
attocube pioneers of precision

attoDRY500

The attoDRY500 is a new low temperature platform, enabling both optical and scanning probe microscope measurements in an ultra-stable, highly automated environment.
The attoDRY500 comes equipped with several positioner options, allowing the user to conduct a wide range of optical measurements. For ultimate ease of use, all control features including positioning capabilities are seamlessly included in one software package.

Available positioning options:

/xy	attoDRY500 equipped with ANPxy101 positioners
/xyz	attoDRY500 equipped with ANPxyz101 positioners
/Theta	attoDRY500 equipped with ANR101 rotzator

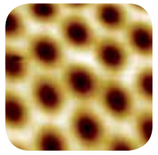
attoLIQUID1000

Liquid Helium based superconducting magnet systems

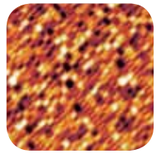
attocube's attoLIQUID1000 cryogenic system is based on highly efficient liquid Helium bath cryostats with 50 l cryogenic liquid reservoir. As with the whole attoLIQUID family, the attoLIQUID1000 has been optimized for highest stability, enabling experiments such as ultra high resolution imaging and/or spectroscopy using scanning tunneling microscopy (STM) or long-term optical investigations of single quantum dots over several weeks.

The attoLIQUID1000 facilitates a base temperature of 4.2 K which can be furthermore reduced down to 1.8 K by pumping on the Helium reservoir. All of attocube's available scanning probe microscopy inserts are compatible with the attoLIQUID1000 and are cooled by a controlled exchange gas atmosphere in thermal equilibrium with the surrounding liquid Helium. Both superconducting solenoids (up to 15 T) and vector magnets are available as upgrade options.

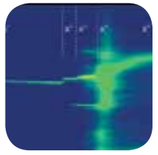
Vortex imaging



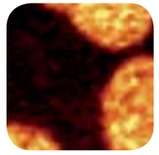
Harddisc imaging



Quantum dot spectroscopy



Raman imaging



Piezo response force microscopy

Scanning gate microscopy

PRODUCT KEY FEATURES

> ultra high stability
> highest flexibility
> base temperature 4.2 K (1.8 K when pumping on the reservoir)
> compatible with superconducting magnets up to 15 T
> attoDAMP™ system for shielding against acoustic noise and mechanical floor vibrations

BENEFITS

> perform experiments with highest demands on thermal and mechanical stability
> optimize sample throughput due to minimized turn-around time

APPLICATION EXAMPLES

> ultra high resolution imaging with STM or AFM/MFM on high-T_c superconductors, semiconductor structures, ..
> solid state physics and quantum dot optics (CFM)
> materials science research on ceramics, polymers, additives, alloys, ..
> quantitative surface characterization in the sub-micron range

COMPATIBLE MICROSCOPE SYSTEMS

> attoCFM I, attoCFM II, attoCFM III, attoRAMAN, attoAFM I / III, attoMFM I, attoSHPM, attoSNOM III, attoSTM, attoCPS I / II

Temperature Range	
standard edition	1.8 .. 4 K
with sample heater (optional)	1.8 .. approx. 70 K
General Specifications	
liquid Helium reservoir capacity	50 l
temperature isolation	vacuum isolation, vapor shielded (N2 shielded on request)
material of body	Aluminum
top loading system	quick and easy sample exchange, 2"diameter probe bore fitting all attocube inserts
attoDAMP™	vibration and acoustic noise damping system
Performance Data	
estimated liquid Helium static loss rate (standard edition, without insert)	0.25 l/hr
temperature stability	< 0.05 K
Dimensions	
cryostat (width x depth x height)	900 x 750 x 1500 mm³ (including attoDAMP)
electronic rack (width x depth x height)	640 x 640 x 1350 mm³ (including rack)
required ceiling height	approx. 3 m
Options	
superconducting magnet	solenoids: 6 .. 12 T, 15 T on request field vector magnets: e.g.: 8/2 T, 9/3 T, 9/1/1 T, ...
Helium transfer line	different sizes on request
Helium level meter	for Helium level detection
Available Inserts	
confocal microscopes	attoCFM I, attoCFM II, attoCFM III
confocal Raman microscopes	attoRAMAN
atomic force microscopes	attoAFM I, attoAFM III
magnetic force microscopes	attoMFM I
scanning Hall probe microscopes	attoSHPM
scanning near-field optical microscopes	attoSNOM III
scanning tunneling microscopes	attoSTM
cryogenic probe station	attoCPS I, attoCPS II

attoLIQUID2000

Liquid Helium based cryostats for variable temperature operation

PRODUCT KEY FEATURES

> liquid ^{4}He bath cryostat with 50 l liquid Helium reservoir and variable temperature insert
> temperature range: 1.8 .. 300 K
> compatible with superconducting magnets up to 15 T

BENEFITS

> conduct scanning probe microscopy measurements at any temperature between 1.8 K and 300 K
> minimized Helium consumption compared to directly pumping the liquid Helium reservoir
> minimized mechanical vibrations

APPLICATION EXAMPLES

> investigation of temperature dependent phenomena such as superconducting and pseudogap behaviour in high-T_c cuprates or pnictides
> solid state physics and quantum dot optics
> materials science research on ceramics, polymers, additives, alloys, ..
> semiconductor device characterization

COMPATIBLE MICROSCOPE SYSTEMS

> attoCFM I, attoRAMAN, attoAFM I / III, attoMFM I, attoSHPM, attoSNOM III, attoCPS I / II

Temperature Range	
standard edition	1.8 .. 300 K, temperature controlled
General Specifications	
liquid Helium reservoir capacity	50 l
temperature isolation	vacuum isolation, vapor shielded (N2 shielded on request)
material of body	Aluminum
top loading system	quick and easy sample exchange,
	2" diameter probe bore fitting all attocube inserts
attoDAMP™	vibration and acoustic noise damping system
Performance Data	
estimated liquid Helium static loss rate (standard edition, without insert)	0.25 l/hr
temperature stability	< 0.05 K (for VTI / temperature controller)
Dimensions	
cryostat (width x depth x height)	900 x 750 x 1500 mm³ (including attoDAMP)
electronic rack (width x depth x height)	640 x 640 x 1350 mm³ (including rack)
required ceiling height	approx. 3.2 m
Options	
superconducting magnet	solenoids: 6 .. 12 T, 15 T on request field vector magnets: e.g.: 8/2 T, 9/3 T, 9/1/1 T, ...
Helium transfer line	different sizes on request
Helium level meter, temperature controller	included
Available Inserts	
confocal microscopes	attoCFM I, attoCFM II, attoCFM III
confocal Raman microscopes	attoRAMAN
atomic force microscopes	attoAFM I, attoAFM III
magnetic force microscopes	attoMFM I
scanning Hall probe microscopes	attoSHPM
scanning near-field optical microscopes	attoSNOM III
cryogenic probe station	attoCPS I, attoCPS II

Optional Configuration

mK and table top liquid Helium based cryostats

LIQUID HELIUM BASED mK SYSTEMS

attoLIQUID3000

This cryogenic system is based on highly efficient liquid Helium bath cryostats with 50l cryogenic liquid reservoir in combination with a ^{3}He insert. Reduction of the vapor pressure is achieved by an internal sorption pump (charcoal cooling) optimized for lowest vibrations.

attoLIQUID5000

Operating down to 20 mK, this state-of-the-art system features lowest base temperatures for combination with e.g. fiber based confocal microscopy, scanning tunneling microscopy or tuning fork based atomic force microscopy.

TABLE TOP BASED LIQUID HELIUM SYSTEM

attoLIQUID500

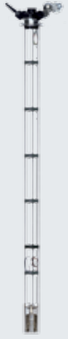
This model is a compact He-4 unit specifically designed for optical experiments on an optical table and is equipped with optical access through five windows.

Choose your Type of Cryostat

Finding the appropriate cryogenic systems for your measurement task

	attoDRY									attoLIQUID				
	attoDRY1000	attoDRY1100	attoDRY2000	attoDRY3000	attoDRY4000	attoDRY5000	attoDRY700	attoDRY500		attoLIQUID1000	attoLIQUID2000	attoLIQUID3000	attoLIQUID5000	attoLIQUID500
temperature range	4 .. 300 K	4 .. 300 K	4 .. 300 K	300 mK .. 300 K	100 mK	10 mK .. 300 K	2.8 .. 300 K	3.5 .. 350 K		1.8 .. 70 K	1.8 .. 300 K	300 mK .. 100 K	< 25 mK	5 K .. 300 K
cryogen-free	■	■	■	■	■	■	■	■						
superconducting magnets	optional	optional	■	■		■				■	■	optional	optional	
superconducting vector magnets			■								optional	optional	optional	
superconducting split coil magnets	optional	optional	optional			optional					optional	optional	optional	
variable temperature	■	■	■	■		■	■	■		optional	■	■		■
top-loading (sample in exchange gas)	■	■	■							■	■			
vacuum loading (sample in vacuum)				■	■	■	■	■				■	■	■
optical access to sample	■	■	■				■	■		■	■			■
ultra low vibration	■	■	■					■		■	■	■		■
integrated positioners	optional	optional	optional	optional	optional	optional	■	■						optional
MIC compatibility														
CFM I	■	■	■				■	■		■	■		on request	■
CFM II / CFM III	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / on request	■ / on request	■ / -		■ / ■	■ / ■	■ / ■	■ / on request	■ / -
RAMAN	■	■	■				on request	on request		■	■			on request
AFM I / MFM I	■ / ■	■ / ■	■ / ■	on request	■ / -	on request / -		■ / ■		■ / ■	■ / ■	■ / ■	on request / -	■ / ■
AFM III /SNOM III	on request	on request	on request					on request		■ / ■	■ / ■	■ / ■	on request	
SHPM	■	■	■	■	on request	■		on request		■	■	■	■	on request
STM										■		■		
CPS I / CPS II	■ / ■	■ / ■	■ / ■	on request			on request			■ / ■	■ / ■	on request		
atto3DR	■	■	■							■	■			

Overview of available microscope and probing inserts

	Confocal Microscopes			Confocal Raman Microscopes	Scanning Near-Field Optical Microscopes	Magnetic Force Microscopes	Scanning Hall Probe Microscopes		Atomic Force Microscopes				Scanning Tunneling Microscope	Cryogenic Probe Stations	
	attoCFM I	attoCFM II	attoCFM III	attoRAMAN	attoSNOM III	attoMFM I	attoSHPM		attoAFM I	attoAFM III	attoAFM/STM	attoAFM/CFM	attoSTM I	attoCPS I	attoCPS II
attoDRY1000 attoDRY1100 attoDRY2000	■	■	■	■	on request	■	■		■	on request		on request		■	■
attoDRY3000		■	■			on request	■		on request					on request	on request
attoDRY4000		■	■				on request		■						
attoDRY5000		■	on request				■		on request						
attoDRY700	■	■	on request	on request										on request	on request
attoDRY500	■	■		on request	on request	■	on request		■	on request		on request			
attoLIQUID1000 attoLIQUID2000	■	■	■	■	■	■	■		■	■	■	■	■	■	■
attoLIQUID3000		■	■		■	■	■		■	■	■		■	on request	on request
attoLIQUID5000	on request	■	on request		on request		■		on request	on request	on request				
attloLIQUID500	■	■		on request		■	on request		■						
															
Description	low temperature confocal microscope, highly modular and flexible, free-beam optics	low temperature confocal microscope, highly stable and compact, fiber based	low temperature confocal microscope, optimized for transmission measurements, fiber based	low temperature confocal Raman microscope, developed for highest detection efficiency and stability	fiber based, low temperature scanning near-field optical microscope, tuning fork based	low temperature magnetic force microscope, cantilever based	low temperature scanning Hall probe microscope		low temperature atomic force microscope, cantilever based	low temperature atomic force microscope, tuning fork based	combined low temperature atomic force and scanning tunneling microscope, tuning fork based	combined low temperature atomic force and confocal microscope, tuning fork based	low temperature scanning tunneling microscope, highly compact and stable	cryogenic probe station with four ultra stable nano-manipulation stacks	highly flexible cryogenic probe station with four ultra stable nano-manipulation stacks