



# Microscopy Cryostat System

**RC102-CFM Microscopy Cryostat offers fast cooldown, high efficiency, lowest thermal drift, excellent temperature stability and ultra low vibration**

**O**ptical cryostat for use in microscopy, spectroscopy, wafer probing, IC testing and more.

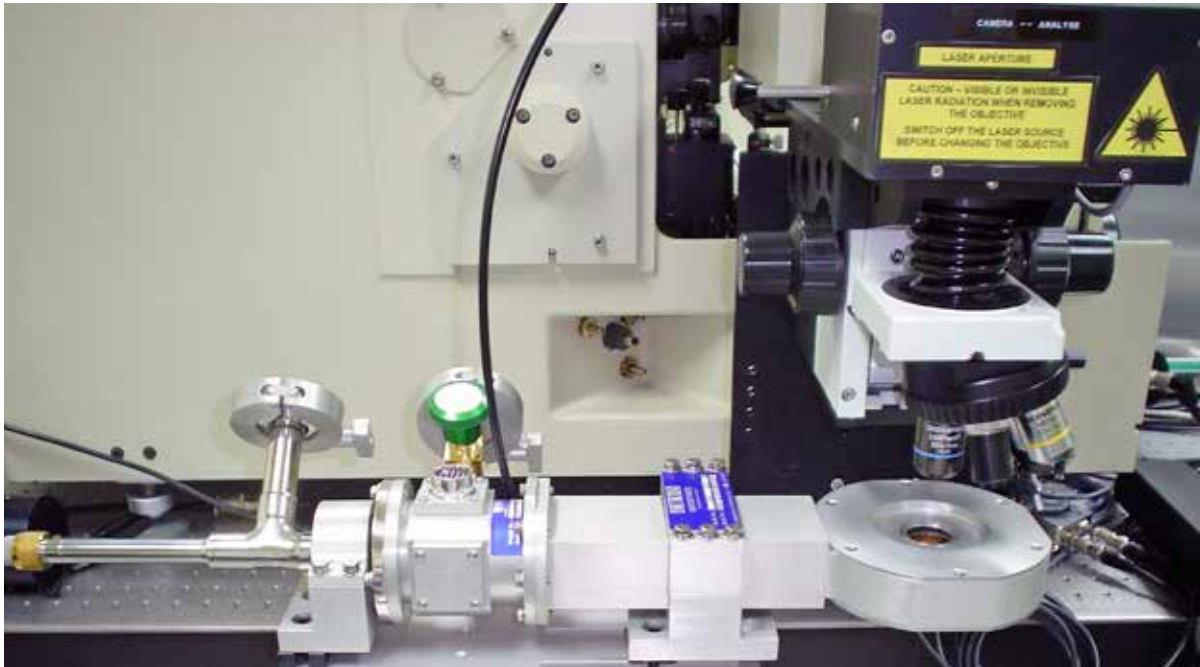
**E**asy to operate and 'Performance by Design'. Open the flow valve; insert the transfer line into a storage dewar and cooling commences. Operates with liquid helium or nitrogen.

**I**nterchangeable sample holders provide height adjustment and optimize the cryostat for varying samples and different experimental configurations. The sample can be set to be very close to the window.

**H**ighly efficient detachable stainless steel flexible transfer line connects the microscopy WORKSTATION to a storage (transport) dewar. Incorporated in the system is our XE insulating technology for the highest in efficiency.

**A**dd a magnetic field now or later. Versatile design allows magnet and microscopy cryostat to be used together or independently. Select a 2 Tesla or 5 Tesla superconducting magnet field!

- Large clear view windows  
Reflection and transmission  
Extra thin windows available  
0.5 mm (0.020")  
1.5 mm (0.06") is standard
- Short working distance  
Sample height adjustment up to the window
- Ultra low nanometer drift and sample vibration
- Sturdy strong stable sample support
- 'HiRes-NOMOVE' design results in near zero movement due to thermal contraction
- Operating temperature range - <4 to 325K
- Efficient with 'Push' (pressurized storage dewar) or 'Pull' (small vacuum pump operation)
- Use either liquid helium or nitrogen
- Go THIN - 30 mm thick  
'THIN' fits more microscopes
- Compact, lightweight and portable, easily integrated into microscopes and spectrometers
- Efficient economical operation - lower cryogen consumption using our break-through XE insulating system
- Versatility - expansion kits include 2 inch wafer probing, DIP IC testing, magnetic fields .....



- √ Compact - lightweight and portable, easily integrated into microscopes and spectrometers
- √ Efficient - lower cryogen consumption, economical operation and fast cooldown
- √ Flexible - operates in any orientation
- √ Optimized - adjustable close working distance to sample allows proper positioning of high power lens
- √ Reliable - no diaphragm pump required - based on our popular and proven RC102 Cryogenic Workstation
- √ Variable temperature - <math><4\text{K}</math> to 325K (500K optional)
- √ Versatile - Use either liquid helium or nitrogen - 'push-or-pull' operation

## The MICROSCOPY WORKSTATION

The RC102-CFM is a 'sample in vacuum' cryostat. The sample holder is located in vacuum. The sample can be adjusted away from or very close to the window using vari-height thread in sample holders. For high rigidity, the sample is supported by opposing tension supports.

Liquid cryogen is delivered to the sample mount through the vacuum insulated transfer line. An adjustable needle valve provides flow rate control. Connect the heater on the sample mount to the temperature controller for automatic variable temperature operation.

The WORKSTATION can be operated in any orientation. The standard system includes a six (6) foot (8 foot optional) flexible transfer line with a 52 inch long (60 inch optional) storage dewar leg.

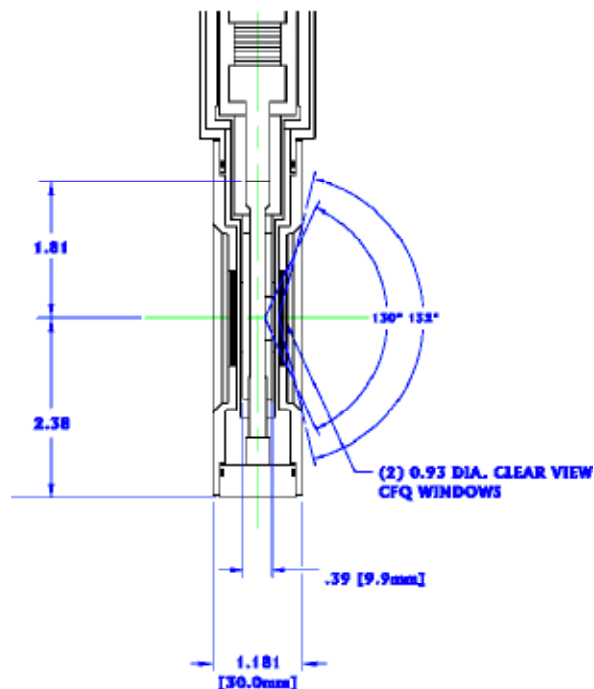
The typical setup consists of the RC102-CFM cryostat, a liquid helium (or nitrogen) storage dewar, helium gas cylinder with pressure regulator and a vacuum pump. A stainless steel flexible transfer line is supplied with the system.

The transfer line leg inserts into the liquid cryogen. A small pressure is used to transfer the liquid out of the storage dewar, through the transfer line and directly to the sample mount. Alternately, a small vacuum pump can be used to 'pull' the liquid helium from the storage dewar. A flow control valve regulates the cryogen flow. Pressure inside the storage dewar can be adjusted using a helium gas cylinder. An activated charcoal cryopump built into the transfer leg will automatically pump when inserted into liquid helium or low pressure nitrogen dewar, maintaining excellent vacuum during extended periods of operation. The transfer line quick disconnects to and from the microscopy WORKSTATION.

Electrical connections to the sample are made through the O-ring sealed ports located on the instrumentation housing. A spare port is provided for future requirements. For safety, the shroud and transfer line are protected against overpressure by pressure reliefs.

Windows at 0 and 180 degrees provide optical access. For reflection, the total angle of acceptance is 130 - 152 degrees, depending on sample position. For transmittance, the angle used quartz, 1.5 mm thick (0.5 mm thick option is available); suprasil, ZnSe and other window materials can be selected. The standard clear view aperture is 24 mm diameter (13 mm for 0.5 mm thick windows). The adjustable holder allows the sample to be moved right up to the window. Samples can be mounted through the radiation shield opening or half the radiation shield is removable to allow full access.

Variable temperature is automated using an electronic temperature controller. Heaters are attached to the sample holder and cold finger. Set the temperature into the controller and obtain the desired temperature. Operation below 4K is achieved by reducing the flow pressure by pumping on the helium vent.



Temperature range	3.2 K to 325 K up to 500K optional
Cool down time	20 minutes typical
Temperature stability	Better than +/- 50 mK
Weight	3.2 kg
Vibrational amplitude	20 nm
Drift (over 1 hour)	+/- 150 nm
LiHe usage	~0.7 l/hr at 5K, less at higher temperatures



## PUSH OR PULL?

CRYO Industries flow cryostats can be operated in 'push' or 'pull' operating modes. Liquid cryogen helium or nitrogen can be drawn from the main reservoir into the sample region by either:

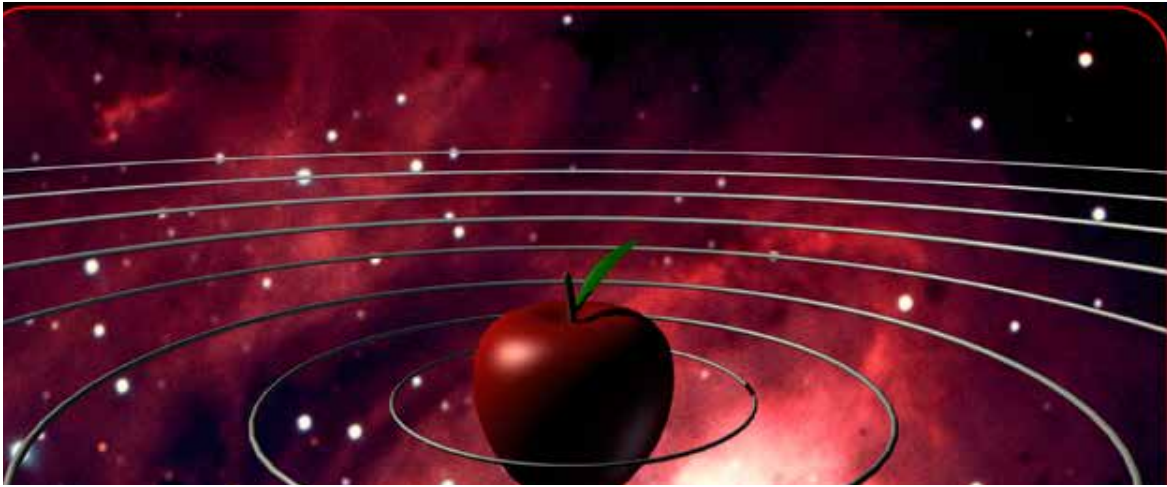
**"Pushing"** - A small pressure in the storage dewar 'pushes' the cryogen from the storage dewar into the transfer line to the sample mount.

Or,

**"Pulling"** - Sucking liquid from the main storage dewar to the cold finger by using a small pump. The liquid helium is drawn from the main reservoir of the storage dewar into the sample mount using a small diaphragm (gas flow) pump, while maintaining the storage dewar near one atmosphere.

- 3.2 K to 325 K operating temperature range
- Operates with either LHe or LN<sub>2</sub>
- Operates in Push or Pull modes
  - Push - storage dewar overpressure = 'push'
  - Pull - diaphragm pump = 'pull'
- (2) 0.93 inch [23.6 mm] diameter x 0.062 inch [1.59 mm] thick optical suprasil windows
  - 0.020 inch [0.5 mm] thick window option
- Windows top and bottom
- Adjustable sample holder
  - Can be adjusted right up to the window
- 50 ohm heater installed on sample mount
- 19-pin hermetic electrical feedthrough
- Spare blank feedthrough port
- NW25 vapor pumping port & vacuum valve with safety pressure relief
- Flexible stainless steel transfer line with flow control valve
- Silicon diode temperature sensors installed on cold finger and next to sample
- 30 mm thin





## NO-MOVE

What is a NOMOVE?

**The sample holder is supported radially with equal and opposing support forces and is rigidly anchored directly to the outer vacuum jacket.**

There is no physical support to the sample holder through the cold finger and radiation shield, which move as the temperature changes. The sample is physically decoupled from the internal moving cold components.

Thermal contraction is toward the center of the sample, resulting in the lowest movement design. The supports are designed to operate in the elastic region. Supports are rigid and under tension.

Movement toward or away from the window is virtually zero because there is no support component in this z-direction.

Lowest Vibration

High Resolution

NOMOVE

**Easy Mounting  
with adjustable position support**

Adjust close to the microscope for more rigidity or move to fit your needs.

More universal compact design (30 mm thick) and still with fast cooldown, high efficiency, excellent temperature stability and ultra low vibration levels.

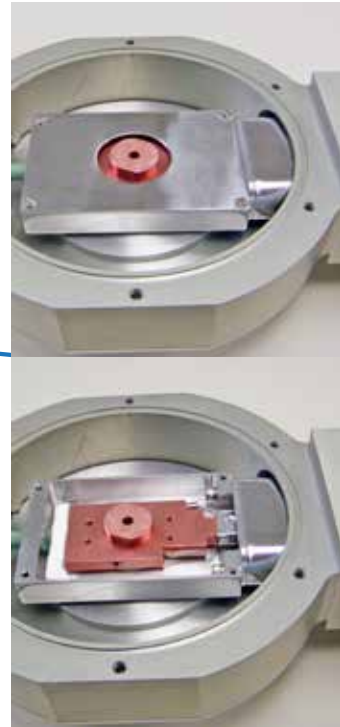
A flow of liquid helium or nitrogen cools the sample, which can be adjusted away from or very close to the window. For high rigidity, the sample is supported on both sides. Sample distances are customer selectable.



Interchangeable single thread sample holders allow for quick sample change, adjustable distances and selectable diameters and apertures.



Full sample access  
Remove the full size cover. The sample can be quickly accessed through the radiation shield. Plus, the radiation shield splits in half to allow fast full access to the sample mount.



### Add a Magnetic Field with Narrow Gap Kit or Superconducting Magnet

#### **Narrow Gap Kit for use with electromagnets**

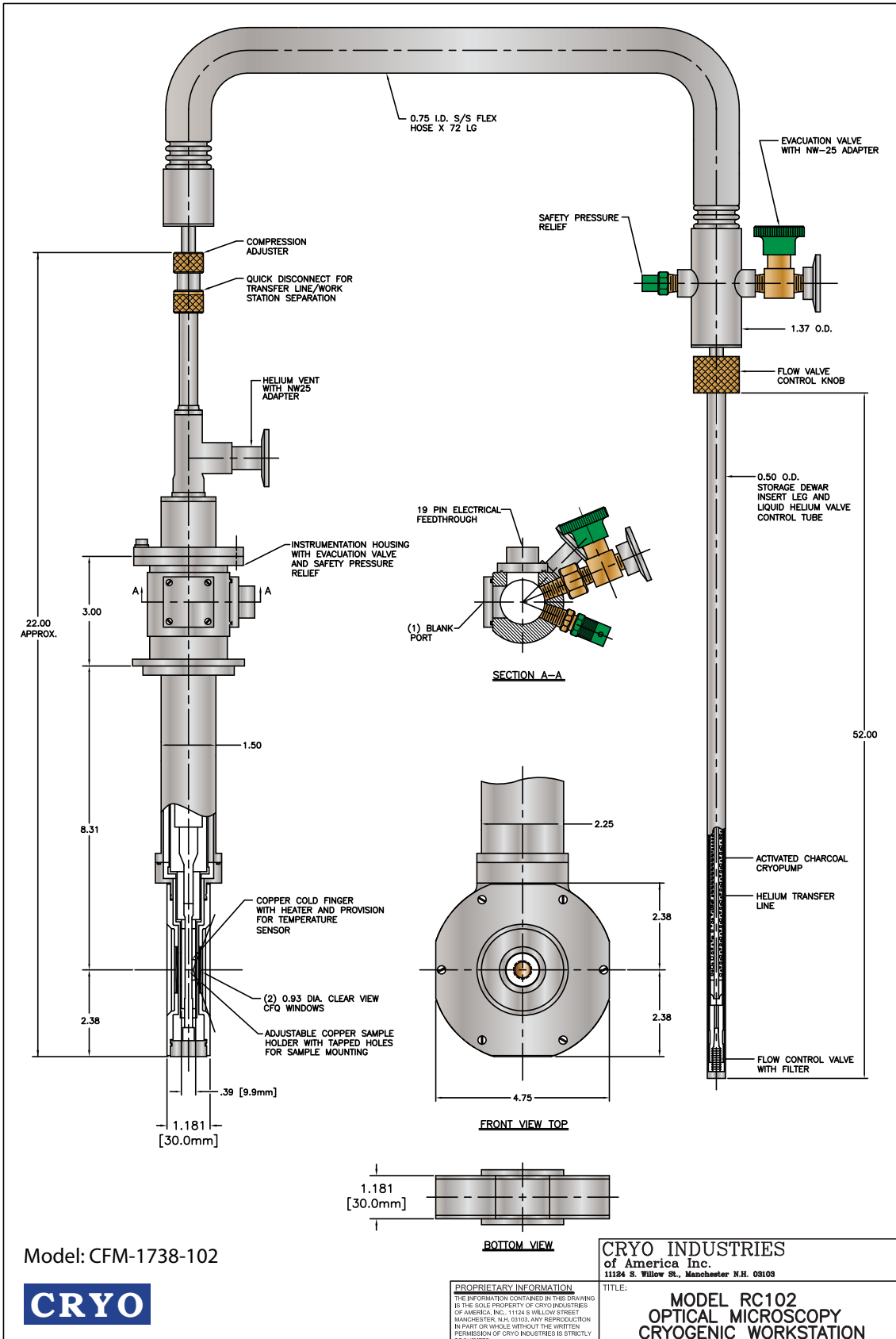
- Fits narrow 1.0 inch gap
- Strain free window mounting (top window)

or

#### **High Temperature Superconducting Magnet**

- Mates to top of cryostat - no modifications needed
- High field - select 2 Tesla or 5 Tesla





Model: CFM-1738-102



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TITLE:  
**MODEL RC102  
 OPTICAL MICROSCOPY  
 CRYOGENIC WORKSTATION**



MicroMag (LHe)

# MicroMag

## 2 or 5 Tesla

### Superconducting Magnet System



**Micromag-LHe** provides a 2 or 5 Tesla magnetic field in a Room Temperature Bore (RTB). A compact table top design that mates to the microscopy cryostat and offers high efficiency, easy of operation, ultra low vibration and is also available in a cryogen free design.

The **Micromag** can be separated from the microscopy cryostat providing independent operation and a high magnetic field in a 1.875" [47.6 mm] for use with many other different experiments. An EZ install 'sample extender kit' is available to position the sample in the center of the magnetic field.

**E**asy to operate and 'Performance by Design'. Open the flow valve; insert the transfer line into a storage dewar and cooling commences. Efficient detachable stainless steel flexible transfer line connects the microscopy WORKSTATION to a storage (transport) dewar. Incorporated in the system is our XE insulating technology for the highest in efficiency.

The magnetic bore can be orientated horizontally or vertically.

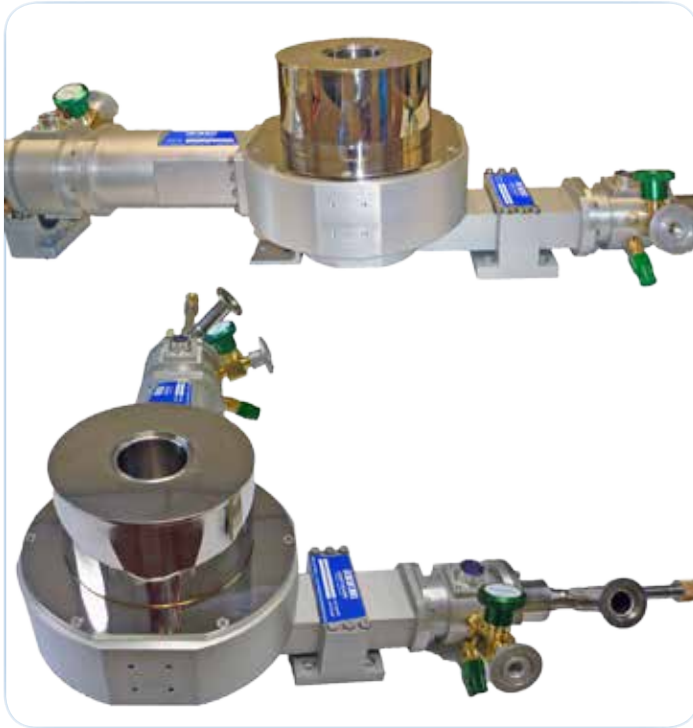
**A** versatile design allows magnet and microscopy cryostat to be used together or independently. The magnetic field can be added to the microscopy cryostat now or later. Select a 2 Tesla or 5 Tesla superconducting magnet field!

- Large Magnetic Field  
Select 5 Tesla or 2 Tesla
- Large Room Temperature Bore (1.87" [47.6 mm])
- Integrates directly to standard microscopy cryostat
- Demounts from the sample microscopy cryostat and is capable of independent operation
- Magnet cryostat does not need to be physically coupled to sample cryostat.
- The magnetic field and magnet bore can be orientated horizontally or vertically, relative to the floor.
- Full sample cryostat operating temperature range 3.2 K to 325 K

Sample Temperature Range	3.2 K to 325 K up to 500K optional
Cool down time	~ 4 hours
Helium Consumption for MircoMag (LHe)	1.0 l/hr vertical 1.3 l/h horizontal 1.0 l/h horizontal with gas flow pump
Weight	10 kg

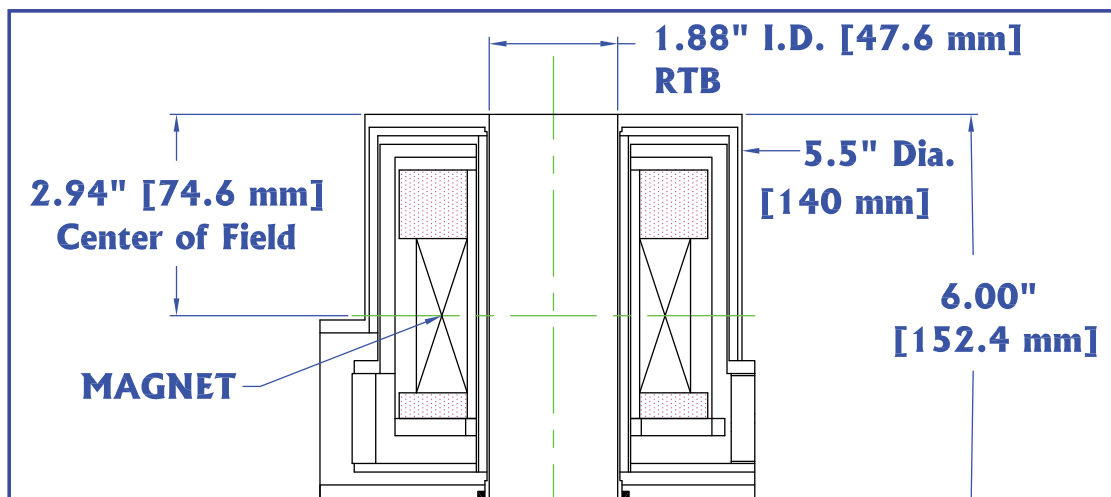


Below: Room Temperature Bore Microscopy Style together with Microscopy Cryostat with Sample Extension in different configurations.



Above: Operates with bore in vertical or horizontal operation. Room Temperature Bore fits over microscopy cryostat with sample extender kit installed

Right: Extender kit for standard microscopy cryostat- for positioning sample in the center of the magnetic field.





# MicroMag-101

## Cryogen Free 5 Tesla Superconducting Magnet System

**Micromag-101** is a compact, Cryogen-Free Room Temperature Bore superconducting magnet system that mates to the microscopy cryostat. You select the magnetic field - 2 or 5 Tesla.

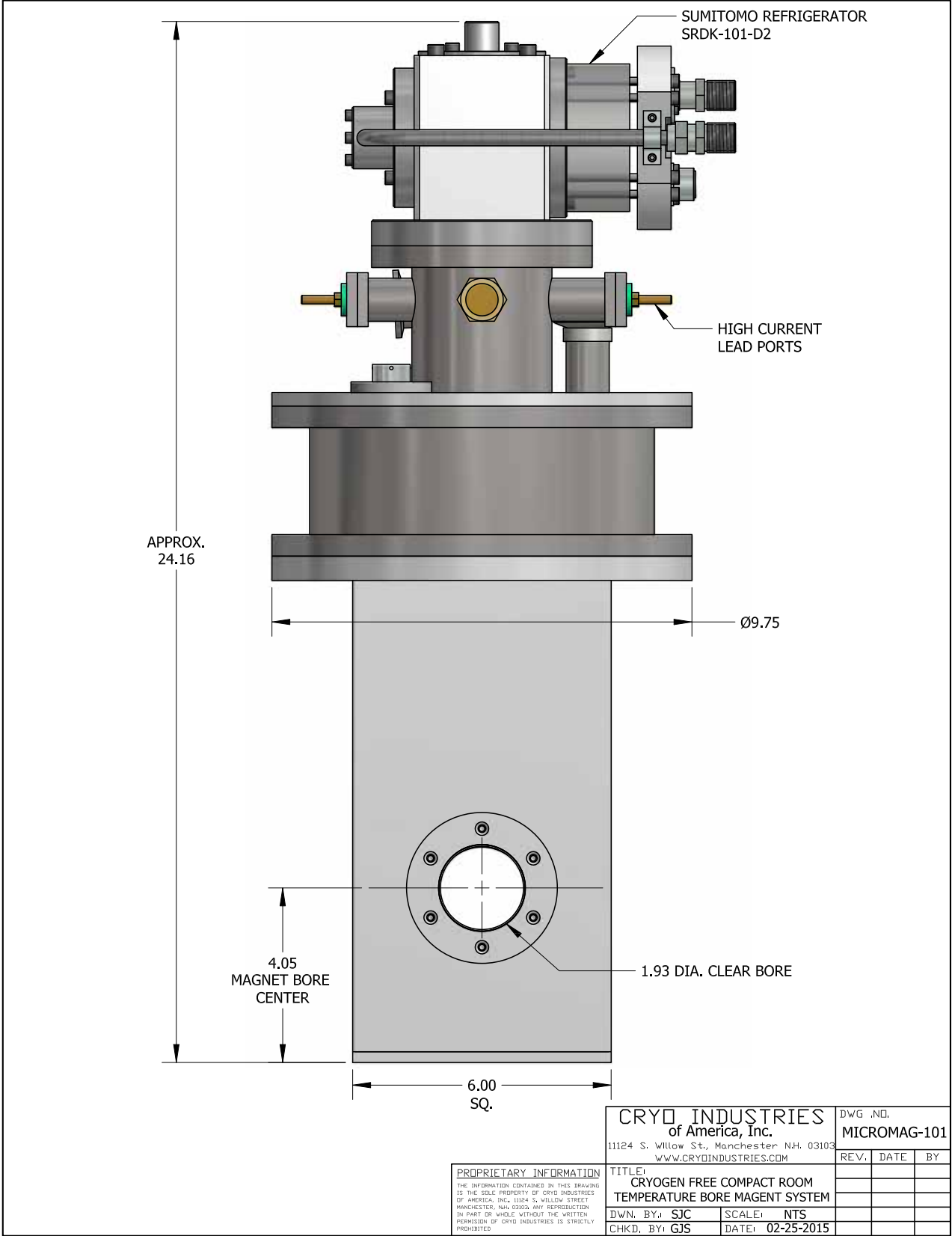
**T**he **Micromag** utilizes a single-phase, low energy consumption (3.0kW), air-cooled helium compressor.

**T**he Room temperature bore cryostat is separate from the microscopy cryostat providing independent operation and a high magnetic field in a 1.93" [49.2 mm] bore for use with many other different experiments. An EZ install 'sample extender kit' is available to position the sample in the center of the magnetic field.

**T**he magnetic bore can be orientated horizontally or vertically.

**A** versatile design allows magnet and microscopy cryostat to be used together or independently. The magnetic field can be added to the microscopy cryostat now or later. Select a 2 Tesla or 5 Tesla superconducting magnet field!

- 5 Tesla Superconducting Magnet
- Ultra-Compact, Tabletop Design (<175mm RTB length)
- Single phase, low energy consumption (3.0kW)
- Ramp Rate: 0.5 T/min
- 1.93 inch (49mm) Room Temperature Bore
- Horizontal or Vertical Mounting
- Cryogen Free
- Air-Cooled Compressor
- Mates to CIA Microscopy cryostat
- Simple, cost efficient operation



<b>CRYO INDUSTRIES</b> of America, Inc. 11124 S. Willow St., Manchester N.H. 03103 www.CRYOINDUSTRIES.COM		DWG. NO. <b>MICROMAG-101</b>	
REV.	DATE	BY	
TITLE: <b>CRYOGEN FREE COMPACT ROOM          TEMPERATURE BORE MAGNET SYSTEM</b>			
DWN. BY:	SJC	SCALE:	NTS
CHKD. BY:	GJS	DATE:	02-25-2015

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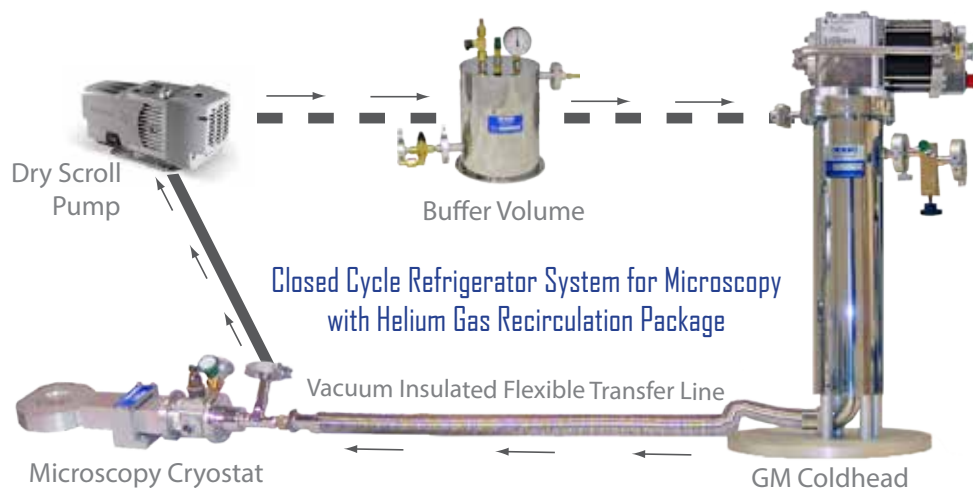
# Universal Cryocooler: Cryogen Free Microscopy System

**U**niversal Cryocooler provides closed Cycle Refrigerator System for Microscopy. The sample has no direct mount to the refrigerator making this system ideal for low vibration experiments. It employs a closed loop circulation of helium gas for sample cooling.

**T**he refrigerator cryostat (Universal Cryocooler) transfer line is interchangeable with CRYO's liquid helium XE transfer line. Hence, the microscopy cryostat can be used with either the Universal Cryocooler or the standard liquid helium transfer line.

**C**RYO's closed cycle 'CRYO COOLER' provides a continuous cold helium gas stream – without using liquid helium. The system incorporates a “closed cycle” cooler. Press the On/Off switch and the cooling begins. Warm gas enters the refrigerator cryostat where it is cooled to low temperatures. The cold gas flows through a transfer line (bellows section) to the microscopy cryostat's cold finger. The sample is attached to the cold finger, which is cooled by the cold gas stream.

**T**he refrigerator vibration is isolated because the microscopy cryostat is separate from the refrigerator cryostat. The system is ideal for low vibration sensitive experiments.



## TWO MODELS ARE AVAILABLE:

<8 K\* to 325 K  
or  
20 K\* to 325 K

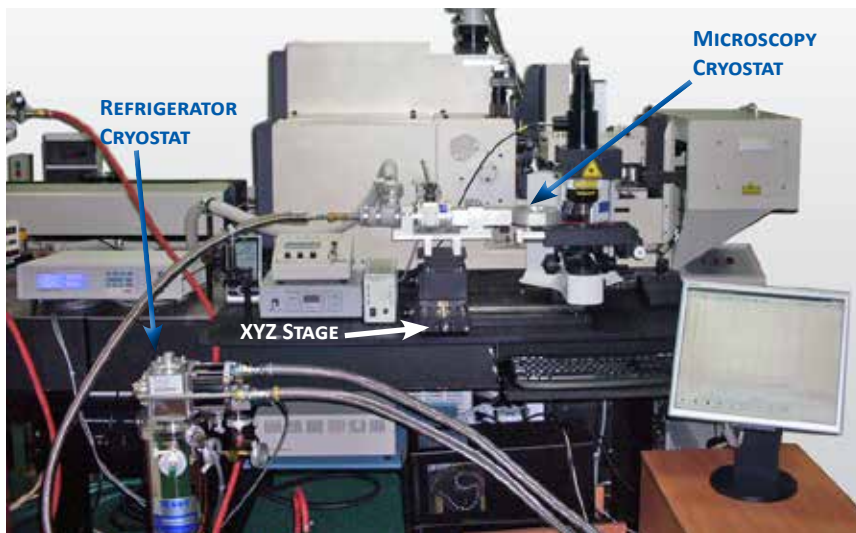
\*Base temperature at sample when cryostat mounted horizontally.  
Lower temperature of 5K is achievable with microscopy cryostat mounted vertically.



Cryocool-LT (Low Temperature)



Cryocool-G2 (20 K Base Temperature)



Interfacing the microscopy (sample) cryostat with your spectrometer/microscope and/or mounting it on an external XYZ stage is simple since the refrigerator cryostat (cooling source) is separate from Sample cryostat.

*Right: Closed cycle refrigerator system for microscopy installed in customer lab.*



# REF-CFM: Low Vibration Cryogen Free, Closed Cycle Refrigerator System for Microscopy Applications



**Optical cryostat for use in microscopy, spectroscopy, wafer probing, IC testing and more.**

Nano-meter level vibrations at the sample!

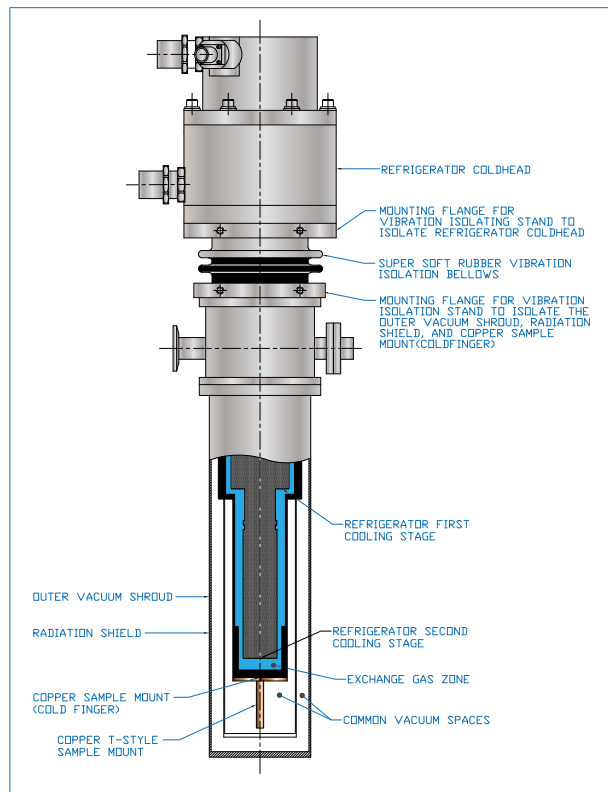
The REF-CFM is a 'sample in vacuum' cryostat with ultra-low vibrations.

## Principle of Operation

This innovative Cryo Industries cryostat places the sample in vacuum, isolated through a low vibration exchange gas design and flexible rubber bellows.

**The result is ultra low vibrations at the sample!**

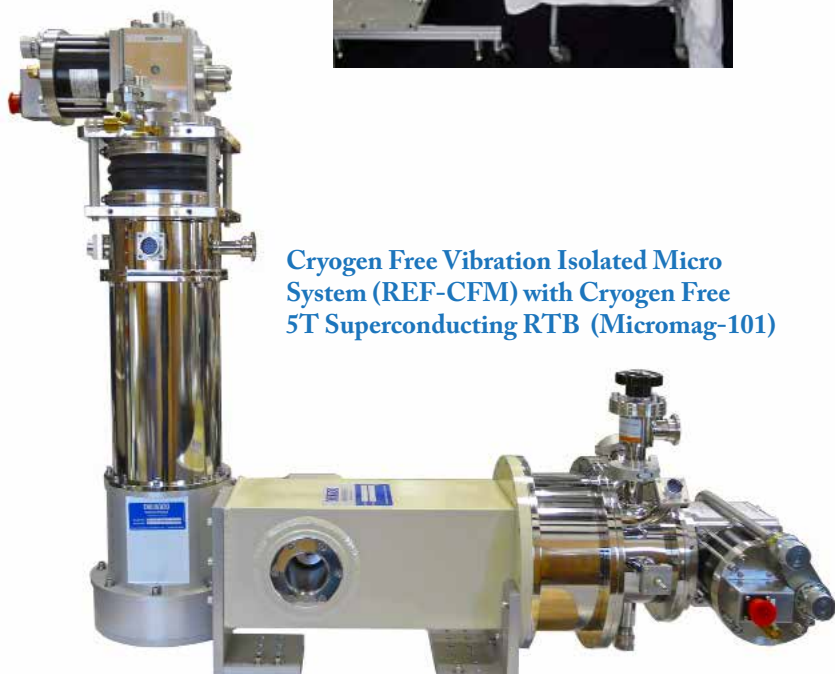
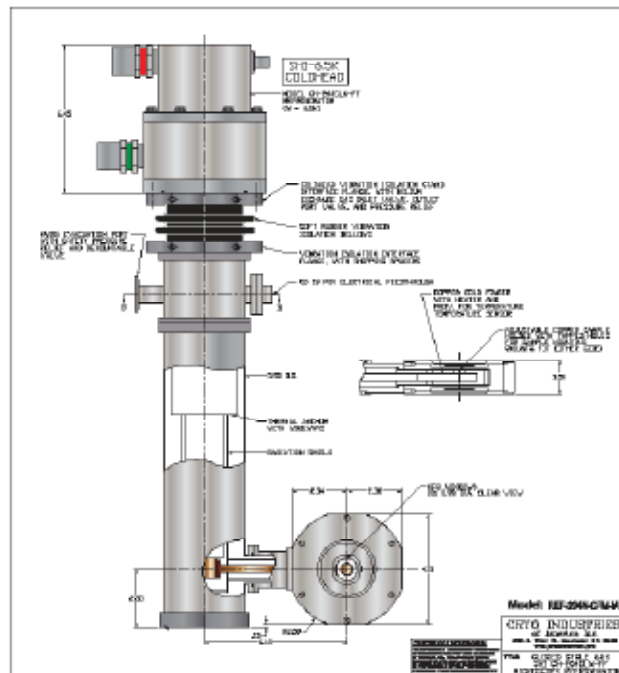
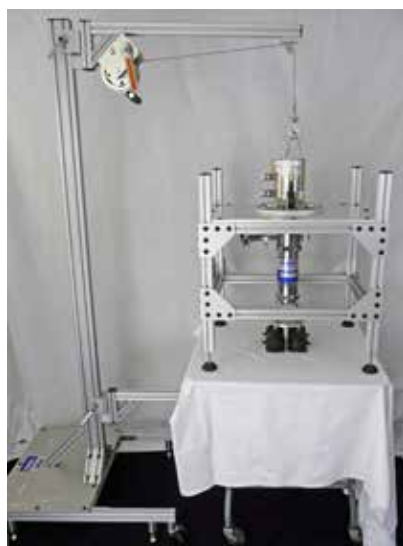
The cooling is provided by a Gifford-McMahn (GM) or pulse tube closed cycle refrigerator for long term cryogenic operation. No liquid cryogenes are needed!



Systems are available with 10 K, 6.5 K and 4 K cold heads with various cooling powers available.

The extended microscopy shroud comes with interchangeable, adjustable sample holders which allow for varying sample heights and positioning the sample close to the window.

These ultra low vibration systems are available with a four post stand and/or a mobile stand with adjustable cryostat support and hoist arms (see below).



**Cryogen Free Vibration Isolated Micro System (REF-CFM) with Cryogen Free 5T Superconducting RTB (Micromag-101)**

### System Features:

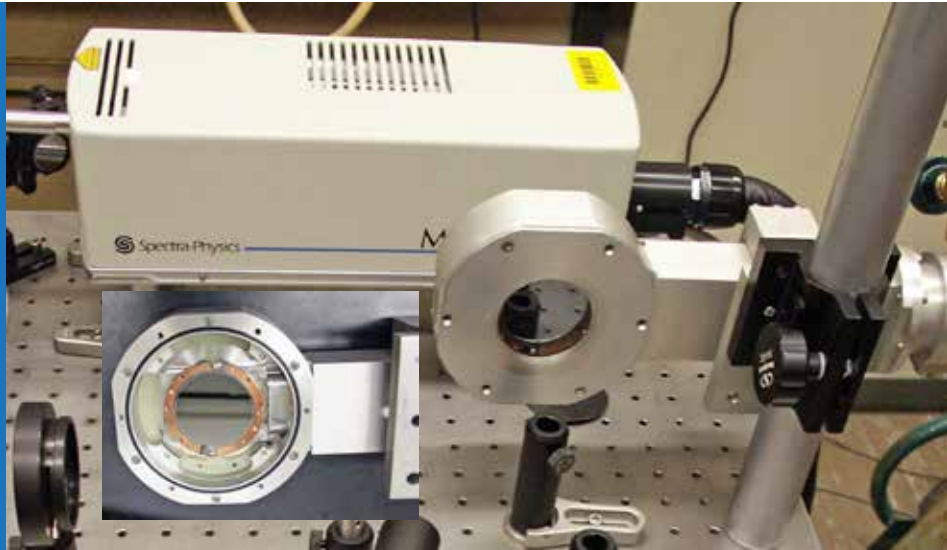
- Large clear view windows  
Reflection and transmission
- Short working distance  
Sample height adjustment up to the window
- Ultra low nanometer drift and sample vibration
- Sturdy strong stable sample support
- Versatility - expansion kits include 2 inch wafer probing, DIP IC testing
- Add a magnetic field! 2T or 5T options

**ACCESSORY**

**Wafer Probing Kit  
for 2 inch wafers**

**Dual or single wafer  
mounting.**

**Dual mounting  
allows probing one  
side, flip it over  
and probe the  
second wafer.**



**ACCESSORY - DIP IC TESTING**

