2317 Birdie Dr.
Bozeman, MT 59715
USA

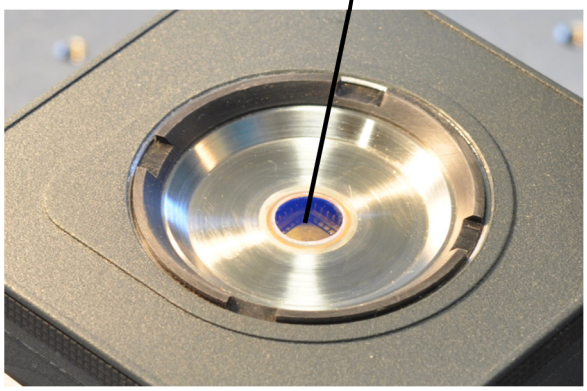
TOLL FREE: 877-333-0959
TEL: 406-551-2796
FAX: 406-551-2797
EMAIL: info@montanainstruments.com
WEB: www.montanainstruments.com

MONTANA INSTRUMENTS

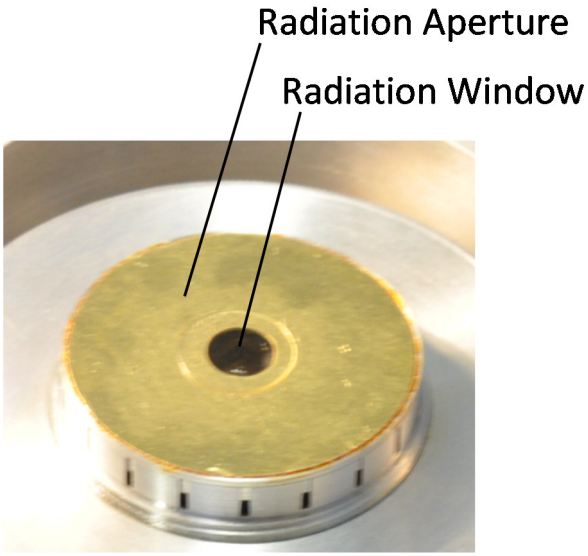
1mm Low Working Distance Module	Doc-117

The Low Working Distance Module is an optional tool for the CRYOSTATION™ which allows samples to be positioned for low temperature experiments at a distance less than 1mm from regular room temperature optical components. The main components are the outer vacuum window and the radiation aperture and the radiation window shown below.

Low Working Distance Module mounted installed in the CRYOSTATION™ Sample Space



Radiation aperture and radiation window for the Low Working Distance Module



The outer vacuum window is intended to seal the sample space, and allow a high vacuum to be pulled within the system. The outer window is comprised of a stainless steel support which holds a smaller thin window. The support creates a large thin area which allows room temperature optics to be positioned directly above the window itself. The radiation aperture is used in a similar way to the support a thin radiation window, while allowing samples much larger than the window to be positioned directly beneath the radiation window. The radiation window is held only by thermal grease, minimizing the thickness of the overall window assembly.

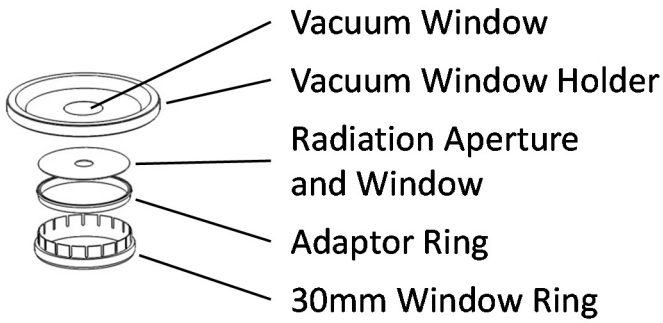
For certain applications, the radiation window can be removed, leaving a 6mm aperture. An additional heat load and higher sample temperatures will result due to the added radiation from room temperature on the sample. The exact heat load and resulting temperatures will vary depending on the sample and system setup. When possible, it is recommended to use the radiation window to block radiation from room temperature to the sample.

MONTANA INSTRUMENTS

2317 Birdie Dr.
Bozeman, MT 59715
USA

TOLL FREE: 877-333-0959
TEL: 406-551-2796
FAX: 406-551-2797
EMAIL: info@montanainstruments.com
WEB: www.montanainstruments.com

The low working distance module is intended to be installed in the CRYOSTATION™ as a tool to allow working distances of less than 1mm. Before installing the components, ensure that the windows are clean, and free of any debris or residue. The vacuum window holder replaces an outer window on the system. When replacing this window, the o-ring should be inspected for debris and vacuum grease applied if needed.



Components of the Low Working Distance Module

The Radiation aperture is bonded to the adaptor ring using VGE varnish, supplied with the system. Care should be taken to maintain only a thin layer of varnish between the two components. The adaptor ring is then installed into the 30mm window ring using thermal grease. The 30mm Window ring can then replace the existing radiation window and window ring. Ensure a small amount of thermal grease is applied to the threads before installing the 30mm Window Ring.

The operation and use of the low working distance module is comprised of adjustment and alignment of the module components to obtain the required working distance. Care must be taken while aligning these components to ensure that they do not touch during operation. As the module is designed to allow working distances less than 1mm, it is important to consider the motion of the internal components within the CRYOSTATION™. This motion is due to the compression of o-rings within the system as well as the thermal contraction of internal components. When the module is installed on the top window in a system with 50mm windows, the o-rings compress a total distance of approximately 0.5mm. This compression occurs in two stages, first the o-rings compress by 0.3mm when the system in initially evacuated to around 2Torr and another 0.2mm as the system cools producing a vacuum less than 1mTorr. Both the radiation shield and sample post contract as the system cools from room temperature to its base temperature. The contraction of radiation shield results in approximately 0.2mm of downward motion of the radiation shield. The contraction of the

2317 Birdie Dr.
Bozeman, MT 59715
USA

TOLL FREE: 877-333-0959
TEL: 406-551-2796
FAX: 406-551-2797
EMAIL: info@montanainstruments.com
WEB: www.montanainstruments.com

sample post results in approximately .16mm of motion on the sample. See the Table 1 for a summary of typical motion within the system

Table 1: Downward Motion of System Components

	Downward Motion (mm)		
System Component	**Sample Space Evacuated to 2Torr**	**Thermal Contraction with Sample at 4K**	**Total**
Vacuum Lid	0.3	0.2	0.5
Radiation Window	0	0.2	0.2
Sample Post	0	0.16	0.16

The system motion can be easily compensated for in the initial system alignment. In order to align the system, first the sample and radiation window are adjusted to be close to the final position, leaving extra room between the components. The system is then evacuated to around 2Torr. The distance between the vacuum window and the radiation window can then be monitored, and the amount of required adjustment noted. Next the vacuum is released, and the radiation window is adjusted accordingly by turning radiation window holder out. This process is repeated until the required spacing is achieved. Next the spacing between the sample and the radiation window can be monitored and the amount of required adjustment noted. The radiation lid can be lifted off the radiation shield without turning the radiation window holder to allow adjustment of the sample position. In this way the entire system can be adjusted to less than 1mm working distance. The recommended system spacing can be seen in the Table 2.

Table 2: Recommended system spacing for low working distance experiments

	Recommended System Spacing (mm)	
System Component	**Sample Space Evacuated to 2Torr**	**System cold with Sample at 4K**
Vacuum Lid to Radiation Window	0.3	0.2
Radiation Window To Sample Post	0.1-0.2	0.2

Measuring the spacing between these components is often difficult; however, one simple technique for observing the spacing is to place a small mark on each window with a marker. Typical locations for marking the windows are to place a mark on the inside of the vacuum window and on each side of the radiation window. By simple visual comparison between the spacing between the dots one can quickly arrive at an overall all working distance of less than 1mm.