MONTANA INSTRUMENTS

MANUAL ADDENDUM FOR THE CRYOSTATION™ OPTIONS

User Manual - Options
April, 2015

Contents

SAFETY 

Safe Operation of the Cryostation Options

- The thermal connections to the sample space on the extended version of the CRYOSTATION™ can be damaged by extreme motion of the sample space. Be careful to not allow any significant motion of the sample space with respect to the cryostat itself.
- DO NOT bend or force motion of the sample space as this could damage the system. If motion is required, move the entire cryostat as one unit.
- If the Cryostation support plate cannot be bolted to the optical table then ensure that it is tabbed down to the optical table to achieve the best performance.
- Be careful of the fragile components when working inside the sample space or removing the radiation shield. Take care to not drop parts or screws into the system.
- Do not remove the base radiation shield or spacer housing with the RF and fiber feedthroughs prior to contacting support@montanainstruments.com. Due to the fragile nature of the positioners, flex link, and wiring it is not recommended that any of these components be removed without prior instruction.
- Do not over-tighten any bolt or screw within the system. This could result in stripping or damaging internal components within the system.

Introducing the Extended Sample Space Option

The extended sample space option is an optional variation of the Cryostation which enables greater access to the sample chamber. This allows users to more easily integrate auxiliary equipment to the Cryostation platform. The option, shown in Figure 1, extends the sample space by 120mm from the main body of the cryostat.

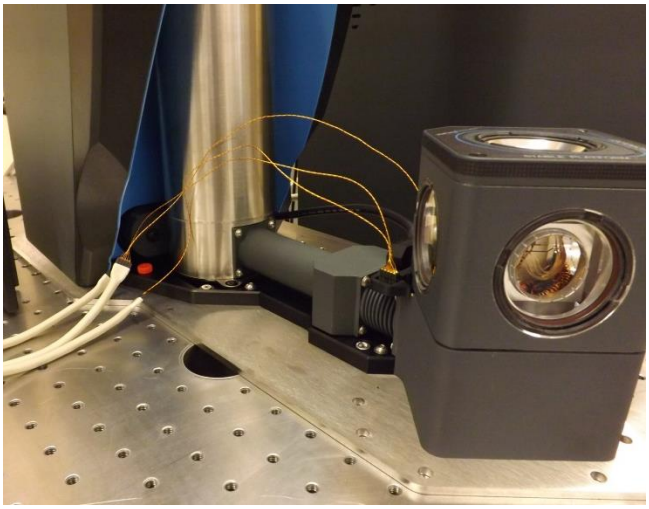

Figure 1: The Extended Sample Space Option for the Cryostation™

Using the Extended Sample Space Option

The extended sample space option includes a permanent support plate beneath the system to allow for the proper hole spacing to the optical table. This plate also serves as a support structure for the sample space. It is not recommended that the plate be removed, as this could expose the sample chamber to possible motion, which could result in damage to the delicate thermal connections within the system. Use the holes in the plate to mount the system to the optical table. If the system cannot be lined up with the holes in the table at 45 degrees, tab down the plate to the optical table to minimize vibrations. With the plate underneath the cryostat, the system will operate in the same manner as the basic Cryostation.

Piezo Flex Link Option Care

- Be sure to apply N-grease to all metal surfaces that will contact another metal surface to insure good thermal contact.
- Do not over tighten screws at risk of stripping.
- Do not remove the positioners unless necessary, if necessary please contact support@montanainstruments.com

Piezo Wiring and Connections

The control cables from the Attocube controller have a 2x1 socket connector on them. The red dot is pin 1. Be sure to be consistent on use of this pin 1. Inconsistent use could result in damage of the positioners.

Figure 2 shows the wiring from the Z and rotation positioner going into the User Bridge connectors on the PCB. The harnesses in the cold space are installed, routed through the hooks, under the PCB, through the thermal clamps, and then into the sample space and attached to the Attocube stages. The Z stage is inserted into the Z2 user bridge and the rotation stage is plugged into the T2 user bridge connectors. The white dot on the PCB indicates pin 1. The red wire on the wiring harness indicates pin 1. Stay consistent with the use of pin 1.

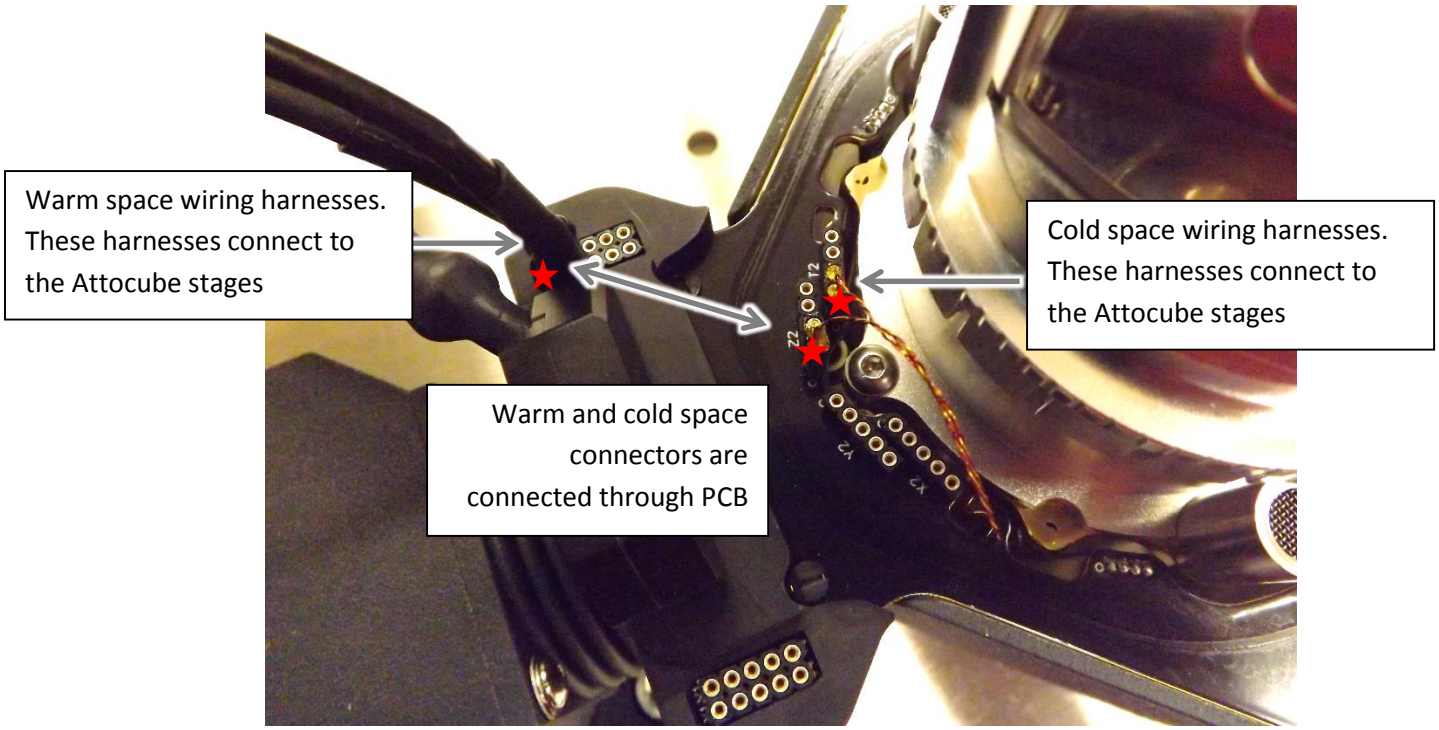

Figure 2: Positioner wiring in cold space. Red stars indicate pin 1

The wiring harness from the warm space to the Attocube sockets is plugged into the vertical connectors outside the sample space. The connections in the sample space and the warm space are connected through the circuit board. Pin 1 is the top pin and the wiring harness has a label for pin 1. Pin 1 goes to the red dot on the cable that runs to the Attocube controller.

Sample Space Heater Integration

The heater is built into the pedestal post. The user thermometer reads the temperature of the heater and is mounted to the side of the heater, as shown in Figure 3. The bottom of the heater should have a thin layer of N-grease applied. The heater is attached to the top of the rotator stage using two M2x8 socket head screws and Belleville washers. These screws can strip out in the platform, but should be pretty tight. The screw in the middle of the heater should not be removed.

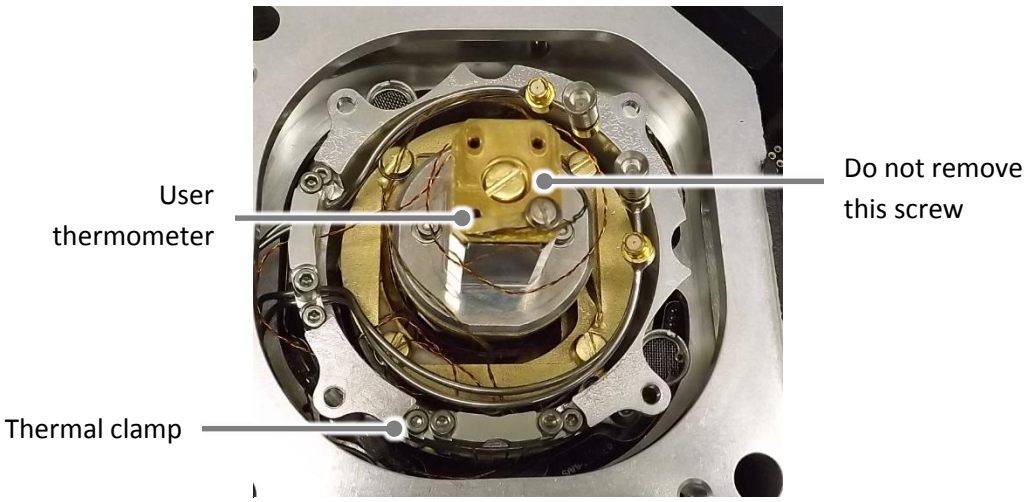

Figure 3: Heater mounted in sample space

The user thermometer is attached with a clamp at the side of heater. The wire is then lagged with GE Varnish to prevent ohmic heating through the wire. The heater wire is attached to the USERHTR port and the user thermometer is attached to the USERTHERM port. It is difficult to access these ports with the lower radiation shield and vacuum housing installed, but they can be accessed with tweezers in the case that they need to be removed. The user thermometer is plugged in at a 90 degree angle to fit below the radiation shield. The thermometer is symmetric and can be plugged in either orientation. The heater connector is plugged into the middle two connectors of the USERHTR connector. The wires are routed under the thermal clamp. When routed under the thermal clamp be sure the wires do not overlap, as this could break the wires. Generally the wires are plugged into the connectors on the PCB and then the thermal clamp is added, this aides with wire management.

If the orientation of the sample mount needs to change the thermometer can be removed by taking off the clamp, and using acetone or isopropyl alcohol to remove the GE Varnish that lags the thermometer wire down. To remount the thermometer, clean the surface of both the thermometer and the mounting surface with acetone. Apply a very thin layer of N-grease below the thermometer and then clamp the thermometer in place. Keep light pressure on the thermometer with the clamp, if the clamp is too tight then the thermometer will not have even contact over the metal surface it is up against. Lag the thermometer wire with GE Varnish, making sure that the wire comes into contact with the metal and does not contact the surface through the GE Varnish. Wait at least 2 hours for the GE Varnish to set before beginning a cool down.

The L bracket sample mount is mounted to the top of the post. Again, apply a very thin layer of N-grease to the base of the mount before mounting onto the post. Use two M2x4 socket head screws and Belleville washers to hold the sample mount in place.

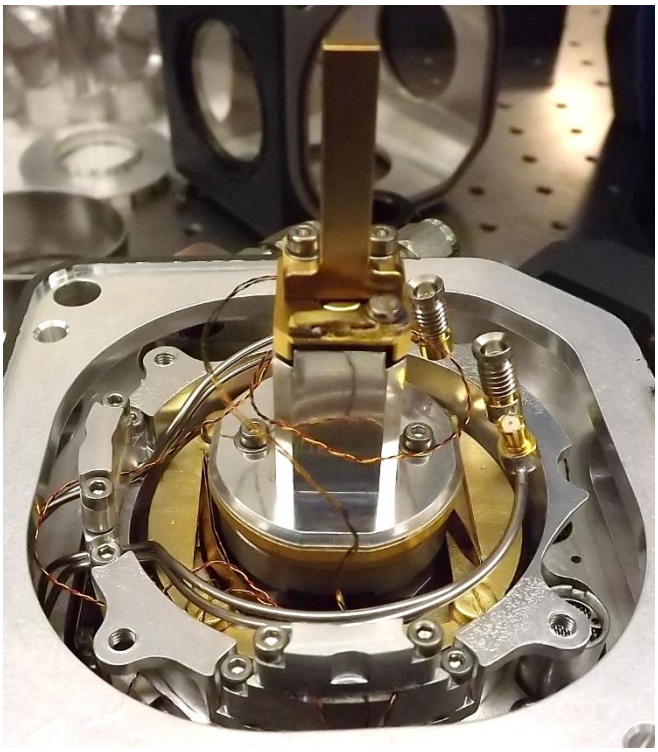

Figure 4: L bracket sample mount mounted to heater post

Once the wires are secured under the thermal clamps, the middle radiation shield can be added with four M3x6mm screws and Belleville washers. It is important to make sure that the wires from the heater, thermometer, and RF coax do not touch the walls of the radiation shield as this will add a heat load onto the 4K sample space. Also, move the Z and rotator stages to ensure that there is enough wire to allow full rotation of the stage at room temperature.

NOTE: The rotator is shipped set in its zero position. The rotator should not be moved more than 180 degrees one direction and 180 degrees in the other direction for a full 360 degrees due to the nature of the flex links that allow thermal conduction through the rotator stage. They can bind from continual rotation.

CAUTION: At room temperature the stages should be run at about 1000Hz and no more than 40V. Prolonged high voltage at room temperature can damage the stages. At cold temperatures the Z stage can go up to 50-60V and 1000Hz, and the rotator works best at 60V and 900Hz.

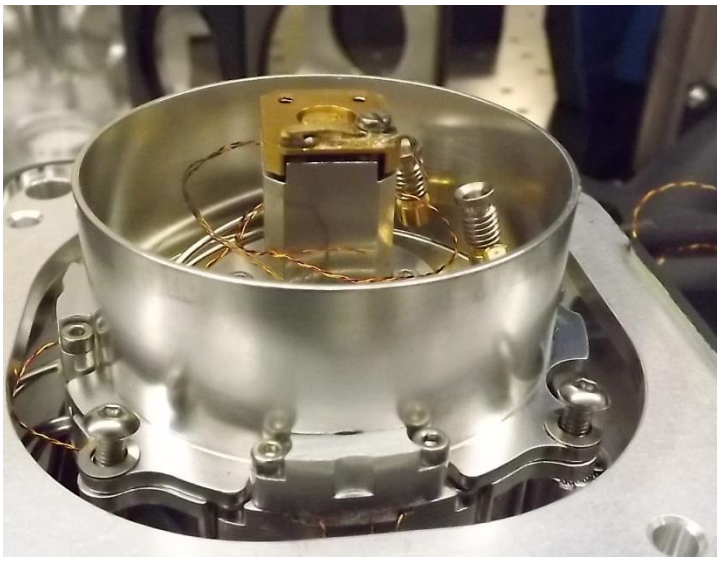

Figure 5: Middle radiation shield attached

Operation of the Heater

The module for operation of the heater is activated in the software along with the magnet module. The module is labeled User Heater and the temperature can be set up to 400K. The User Thermometer Installed box should be checked.

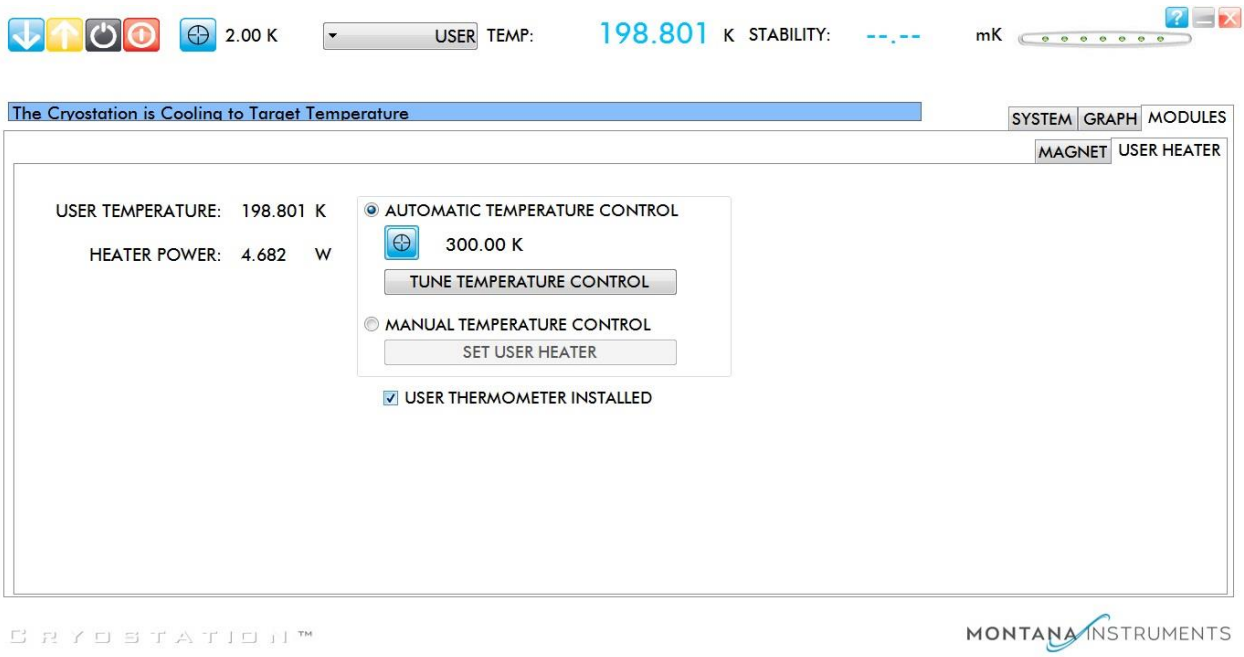

Figure 6: Interface for Heater Control

The stage can be operated in Automatic Temperature Control mode, where the user simply enters the set point and the heater power is applied to achieve that temperature.

Figure 7: Set target temperature for Automatic Temperature Control

The PID parameters can be adjusted by selecting the Tune Temperature Control. For temperatures between base temperature and 70K the PID parameters should be as follows: P: 0.01, I: 0.1, D: 0.02. For temperatures between 71K and 400K the PID parameters should be as follows: P: 0.1, I: 0.01, D: 0.02.

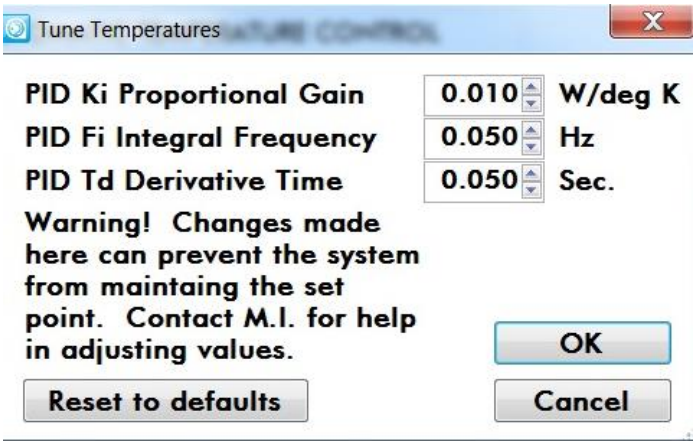

Figure 8: Tuning the PID Pop-Up

The user can also operate in Manual Temperature Control Mode by setting the User Heater power.

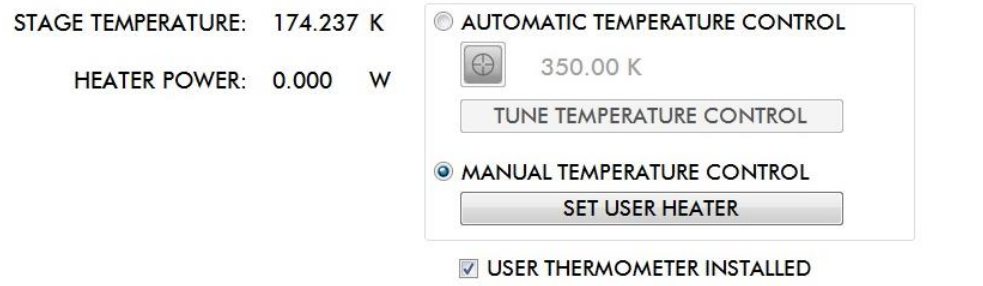

Figure 9: Operating Heater in Manual Temperature Control

RF Coax Interface Module Care

- Care must be taken to not allow RF cables to touch the radiation shield and ensure proper thermal lagging to achieve optimal low temperatures.
- When attaching or detaching flexible coax cables take care of the solder joints that hold the SMP connectors to the cable. These solder joints are the most fragile part of the assembly.

RF Coax Wiring

The RF Coax Interface module is an optional tool for the Cryostation which allows RF coax connections to feed into the vacuum environment of the sample chamber. The RF coax come in from the extension vacuum housing as shown in Figure 10.

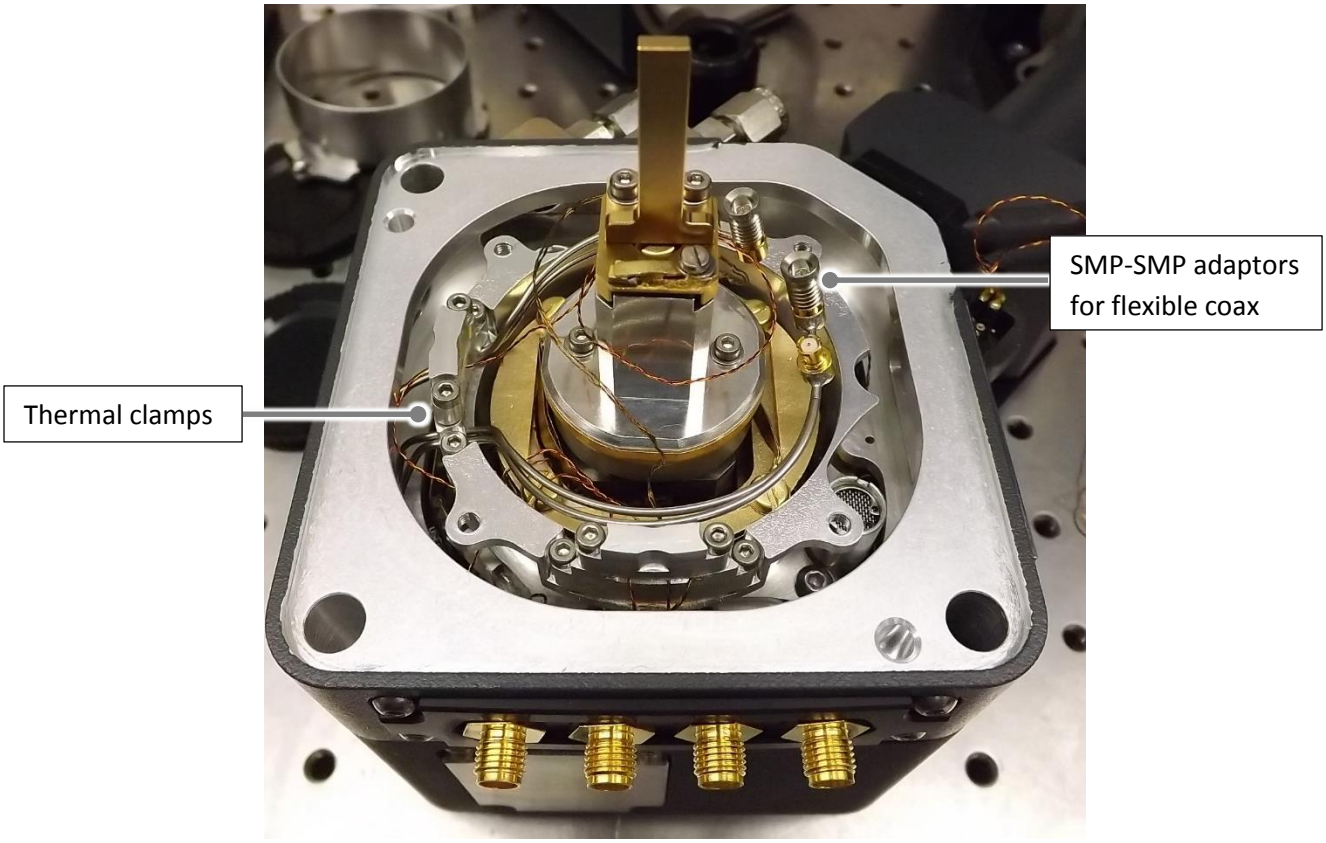

Figure 10: RF coax extension housing and in sample space

The RF cables are connected to the SMP connectors on the housing. Do not lift the vacuum housing up as the RF coax cables are clamped under the thermal clamps and will break if the vacuum housing is lifted off. The cables are then clamped under the thermal clamps to be thermally lagged, as shown in Figure 10. The RF cable should not touch the radiation shield or any part of the sample mount assembly. Any touch will add a thermal load and increase the base temperature of the sample space.

Figure 10 shows where the semi-rigid cables connect to the flexible coax cable with SMP to SMP adaptors. Extreme caution should be used when attaching or removing the flexible cable to the semi-rigid cable to avoid damaging the solder joint of the connector on the semi-rigid cable.

Figure 11 shows the designations for the RF coax SMA connectors to the inner SMP connectors.

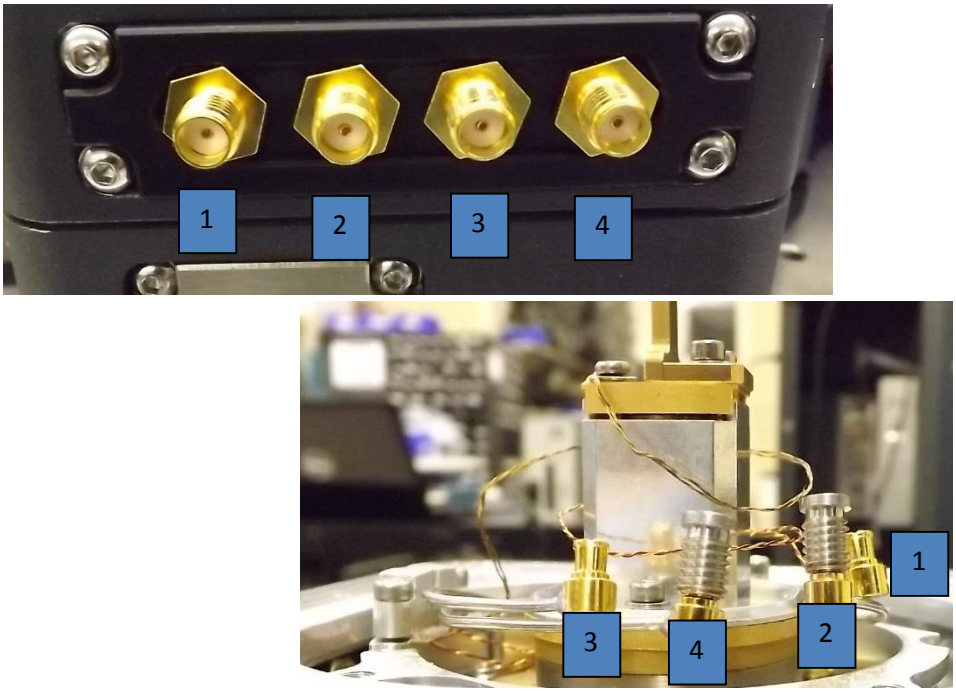

Figure 11: RF Coax Designations

Fiber Feedthrough

There are two fiber feedthrough ports opposite the RF coax panel. The covers can be unscrewed and the fiber added.

Figure 12: Fiber feedthrough side panel

The Teflon ferrule is inserted into the cone shaped piece and then the fiber fed through the Teflon ferrule.

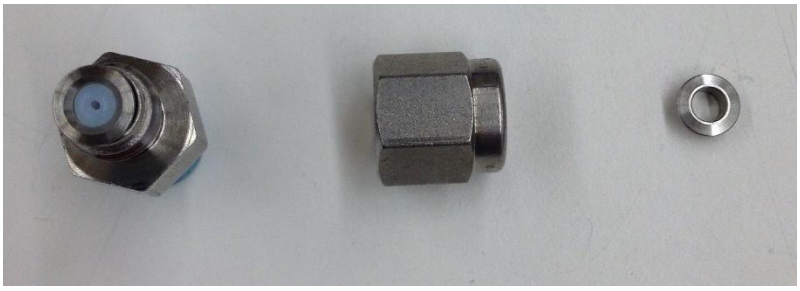

Figure 13: Fiber feedthrough components

The top ring is added and then the cap placed on. The cap should be tightened such that the fiber is clamped through the Teflon ferrule and the fiber can no longer be pulled through the Teflon ferrule.

Figure 14: Assembled feedthrough

Magnet Mounting

Since the magnet has an extension housing with the RF coax side panel and the fiber feedthroughs the magnet needs to be raised up with a spacer. The first piece to place is the thin spacer that can be used if the RF coax and fiber feedthroughs are not used for any reason. Neither of these spacers attaches to the table, they simply rests on the table.

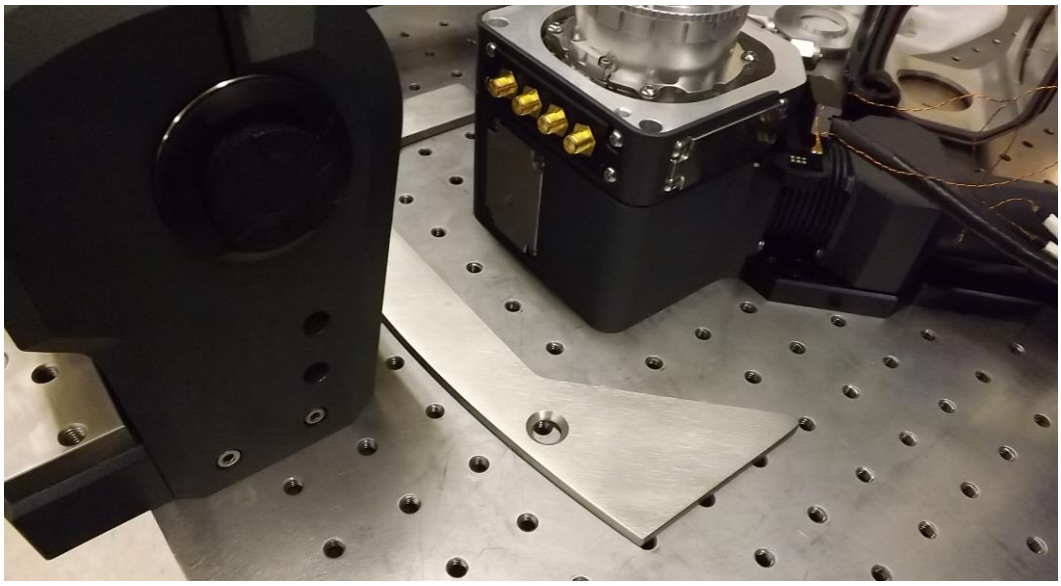

Figure 15: First spacer

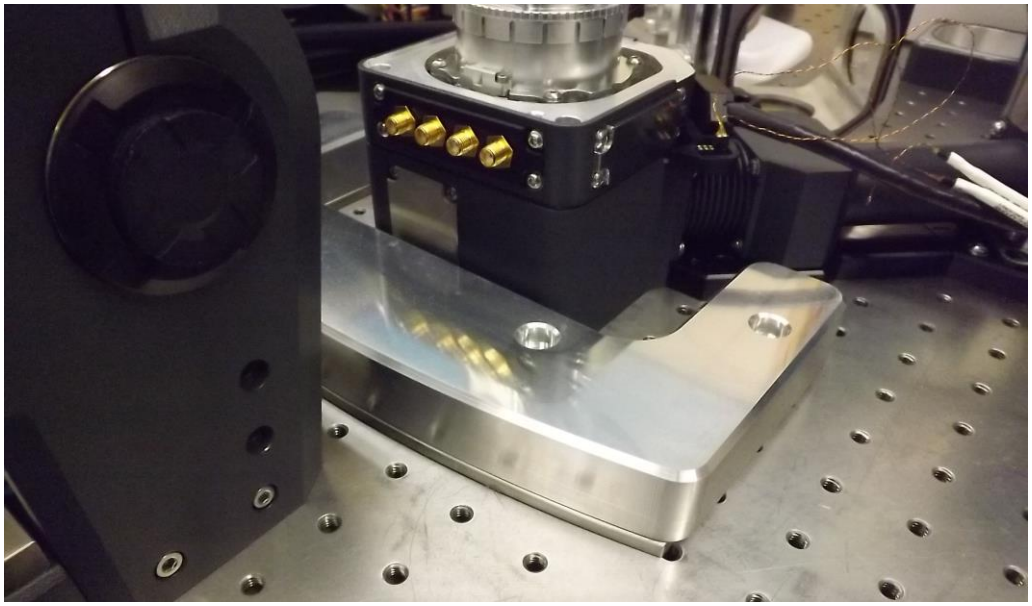

Figure 16: First and second spacer

The magnet with the spacers is shown in Figure 17.

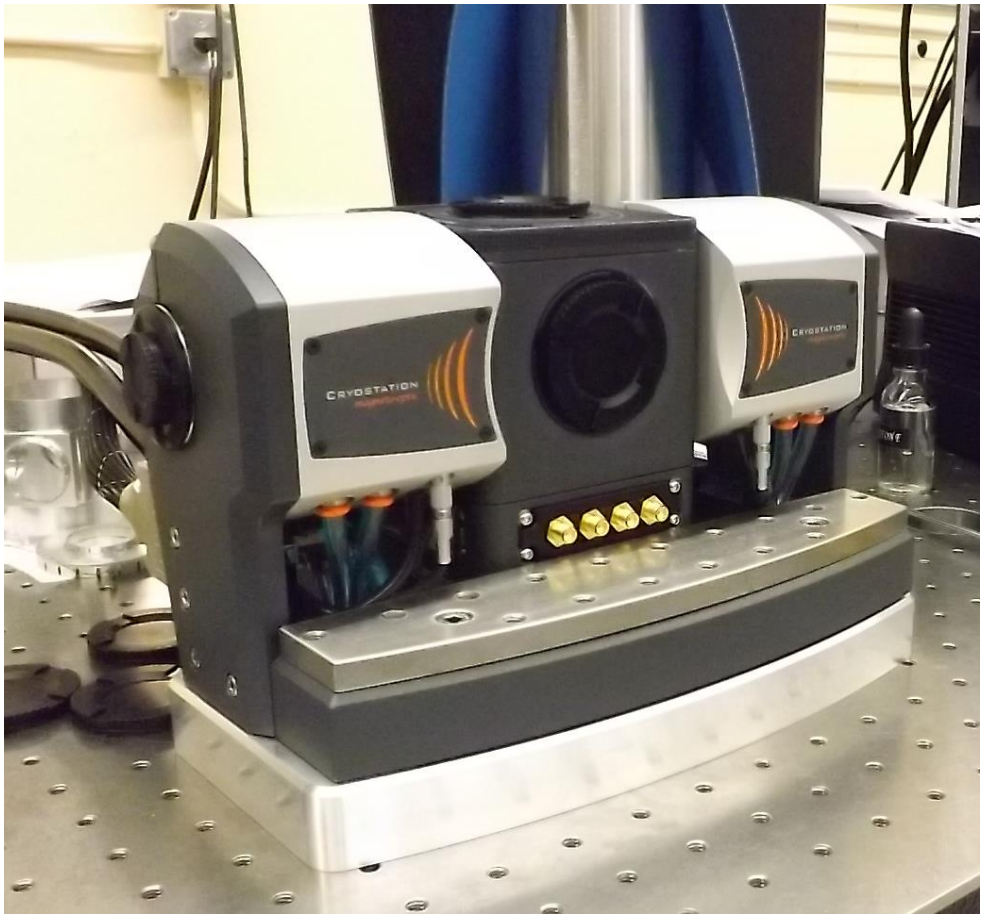

Figure 17: Magnet assembly

The rest of the magnet setup is the same as in the Magneto-Optic Option for the Cryostation Manual Addendum.

Please contact us at Montana Instruments if you have any further questions about custom options.