



MPMS Service Note 1014-305

Removing and Installing the Sample Tube

The MPMS sample-tube assembly contains all the MPMS thermometry and the sample-space heaters. Hence, you will need to replace the sample tube in the event a thermometer or heater fails. Additionally, some MPMS options, such as the Enhanced Temperature Control (ETC) option, require the installation of a sample tube that has specialized components.

In preparation for removing and reinstalling the MPMS sample tube, you will remove or disconnect various related components, such as the sample, sample transport, top plate, and head-cover assembly. However, you will leave the probe in the dewar.

The preparatory procedures are described in Section I. Section II has the instructions for reinstalling the components and the sample tube, and Section III has instructions for restoring the system and its software.

We strongly recommend that you gather your tools and review all the instructions before you begin so that you can prepare for the different steps. Your preparation is especially important for removing and working around parts with fragile components and for performing the replacement quickly.

Important: You must complete these procedures as quickly as possible (no more than 20 min) to minimize the chance that an ice plug will form in the impedance.

Tools and Supplies

Allen wrench, sizes 1/16, 3/16, 3/32, 5/64, 7/64

vacuum grease (Apiezon M)

I. Removing the Sample Tube

I.A Remove the Sample

1. Set the system to room temperature (298 K) and the field to zero ($H=0$ Oe). Wait for the system temperature to stabilize.
2. Remove the sample.
3. Exit from MultiVu (or MPMSR2).
4. Disconnect the gas lines from the probe. Leave the lines leaning against the connectors.

I.B Remove the Sample Transport

Figure 1 shows the sample transport and the screws that attach it to the probe.

1. Loosen and remove the two 1/4-20 x 3/8 cap screws from the front of the sample-transport base.
2. Loosen and remove the two 4-40 x 1/4 cap screws from the back of the sample-transport base.

I.C Remove the Black Airlock Handle from the Airlock-Valve Assembly

1. Loosen and remove the 7/64 hex nut that is inside the black airlock handle (J, Figure 2).
2. Pull out on the airlock handle until you can remove it from the airlock-valve assembly. Put it to the side.

I.D Remove the Head-Cover Assembly

1. Loosen and remove the eight 4-40 button head screws (C, Figure 2) that hold the head-cover assembly (D, Figure 2) in place.
2. Gently pull the head-cover assembly away from the components, working carefully so that you do not damage the wires (K, Figure 2) leading to the J1, J2, and J3 electrical connectors (A, Figure 2) mounted on the inside.
3. Disconnect the wires to the J1, J2, and J3 electrical connectors mounted inside the head-cover assembly. Put the head-cover assembly to the side.

I.E Remove the Top Plate

Important: In this phase, you will be removing the four screws (E, Figure 2) that fasten all the probe head assemblies together. Be careful not to shift the assembly components before it is time to remove them in Section I.F below.

1. Loosen and remove the four 1/4-20 cap screws (E, Figure 2) from the top of the top plate (F, Figure 2).
2. Loosen and remove the two 6-32 button head screws (G, Figure 2) from the back of the top plate.
3. Remove the top plate from the assemblies and put it to the side.

I.F Remove the Sample-Tube Assembly

Important: When you remove the sample-tube assembly, take extra care with the wiring that runs down the outside of the sample tube—this wiring is fragile and easy to break. Also, you must keep the sample tube straight (it bends easily).

1. Detach the cable assembly (O, Figure 2) from the electrical connector (N, Figure 2) on the sample-tube assembly (M, Figure 2). Note that the brown wire connects to pin number 1 and is aligned with the arrow on the connector socket of the sample-tube assembly.
2. Move the airlock-valve assembly (I, Figure 2) out of the way just enough so that you will be able to remove the sample-tube assembly.
3. Locate two O-rings: one (L, Figure 2) is located where the airlock-valve assembly mates with the block of the sample-tube assembly (M, Figure 2), and the other (P, Figure 2) is located where the sample-tube assembly block mates with the vacuum-sleeve assembly (Q, Figure 2). Put the O-rings to the side for use with the new sample-tube assembly.

4. Grip the sample-tube assembly by the brass block, then remove it from the probe. You might need to turn the sample-tube assembly slightly as you raise it out of the tube. Keep the sample tube straight and take care not to bend or break the fragile wiring along its sides.

II. Installing the Sample Tube

II.A Insert the Replacement Sample-Tube Assembly

Important: When you insert the replacement sample-tube assembly, take extreme care with the wiring that runs down the outside of the sample tube—the wiring is fragile and easy to break. Also, you must keep the sample tube straight (it bends easily).

1. Examine the O-rings that are referred to in Step I.F (L and P, Figure 2) to determine if they are clean and well coated with Apiezon M grease. Clean and grease them if necessary, then put them back in place.
2. Grip the new sample-tube assembly by the brass block and slowly insert it into the vacuum-sleeve assembly (Q, Figure 2). You might need to turn the tube slightly as you lower it so that it will fit. Keep the sample tube straight, and take care with the fragile wiring along the outside of the sample tube.
3. The block of the sample-tube assembly should now be seated on the vacuum-sleeve assembly.
4. Reattach the cable assembly (O, Figure 2) to the connector (N, Figure 2) on the sample-tube assembly (M, Figure 2). Note that the brown wire connects to pin number 1 and is aligned with the arrow on the connector socket of the sample-tube assembly.
5. Move back the airlock-valve assembly (I, Figure 2) until it is properly seated on the sample-tube assembly.

II.B Reinstall the Top Plate

1. Seat the top plate (F, Figure 2) onto the airlock-valve assembly, aligning the screw holes.
2. Insert the four 1/4-20 cap screws (E, Figure 2) into the holes in the top of the top plate, but do not tighten them yet.
3. Insert the two 6-32 button head screws (G, Figure 2) into the holes in the back of the top plate, but do not tighten them yet.

II.C Reinstall the Head-Cover Assembly

1. Reattach the leads (K, Figure 2) to the J1, J2, and J3 electrical connectors (A, Figure 2) inside the head-cover assembly (D, Figure 2).
 - mixed-color wires connect to J1
 - brown wires connect to J2
 - black wires connect to J3
2. Fit the head-cover assembly around the airlock-valve assembly, the sample-tube assembly, and the vacuum-sleeve assembly, matching the thru holes on the head-cover assembly with those on the top plate (H, Figure 2) and under the vacuum-sleeve assembly (R, Figure 2).
3. Insert the eight 4-40 screws (C, Figure 2) into the thru holes in the head-cover assembly, but do not tighten them yet.
4. Simultaneously tighten the screws located at C, E, and G (Figure 2) on the head-cover assembly and the top-plate.

II.D Reinstall the Black Airlock Handle

1. Push the black airlock handle (J, Figure 2) back onto the airlock-valve assembly (I, Figure 2).
2. Insert the 7/64 hex nut into the airlock handle and tighten it.

II.E Reinstall the Sample Transport

1. Seat the sample transport (Figure 1) onto the top plate (F, Figure 2), aligning the screw holes.
2. Verify that the blue plug is in place on the sample transport, as shown in Figure 1.
3. Insert and tighten the two 4-40 x 1/4 cap screws into the holes at the back of the sample transport base, as shown in Figure 1.
4. Insert and tighten the two 1/4-20 x 3/8 cap screws into the holes at the front of the sample-transport base, as shown in Figure 1.
5. Reconnect the small gas line to the probe head.
6. Purge the airlock by pressing the **Purge Airlock** button (B, Figure 2).

III. Restore the MPMS System

Each sample tube has a unique set of .ipl files that contain the thermometry calibration data. After you restart the software and set up the system, you will copy the .ipl files for the new sample tube to your system.

The restoration procedures vary according to the software that is being used. Section III.A has instructions for systems that use MPMSR2, Section III.B has instructions for systems that use MultiVu.

III.A MPMSR2 (DOS-based) Systems

Prepare the System

1. Start the software:
 - a. Type MPMSR2
 - b. Press the **<Ret>** key or the **<Enter>** key
2. Access the **Diagnostic Gas Controls** menu:
 - a. Press the **F7** key to open the **Diagnostic Menus**
 - b. Move the cursor to the **Gas Control** entry field
 - c. Press the **<Ret>** or **<Enter>** key to open the **Diagnostic Gas Controls** menu
3. Enable the valves:
 - a. Move the cursor to the **Valve Operation** entry field and press the **<Ret>** or **<Enter>** key
 - b. Move the cursor to **Enable** and press the **<Ret>** or **<Enter>** key
4. Reconnect the large gas line and wait for the flow to reach 500 cc/min.
5. Purge the system several times by pressing the **Purge Air Lock** button (B, Figure 2).

Copy the .ipl Files

1. Copy the .ipl files for the new sample tube into the MPMSR2 directory:

- a. Insert the floppy with the new .ipl files into the drive (P/N 1014-009)
 - b. Open (go to) the C:\MPMSR2 directory
 - c. Type `copy a:*.ipl`
2. The system is now ready for you to set it up for measurements.

III.A MPMS MultiVu Systems

Important: Do not perform the steps in this section if you are installing the ETC option. Instead, return to *Service Note 1014-309*, Section II.B (MultiVu systems).

Prepare the System

1. Double-click on the MultiVu icon on the computer desktop to start the application.

2. When the MultiVu window appears, use the **Chamber/Gas Control Diagnostics** dialog box (Figure 1) to open the **Cooling** valve:

- a. On the MPMS MultiVu main toolbar, select **Utilities >> Diagnostics >> Chamber**.
- b. In the **Chamber/Gas Control Diagnostics** dialog, locate the **Valves** subsection.
- c. Select **Open** in the options menu next to the **Cooling** valve.
- d. Click on the **Set** button.

Important: You must click on the **Set** button or the **Cooling** valve will not be opened.

- e. Click on the **Close** button to close the **Chamber/Gas Control Diagnostics** dialog.

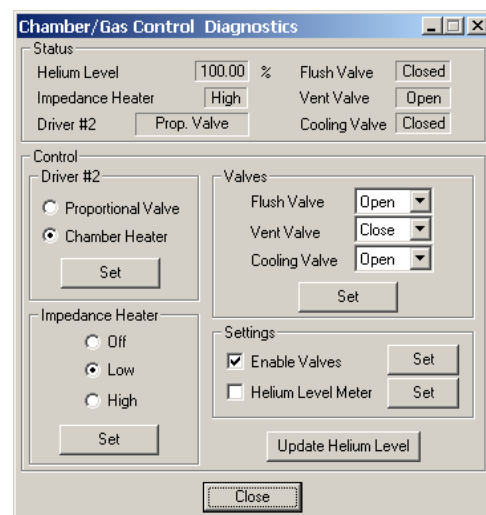


Figure 1. MPMS MultiVu Chamber/Gas Control Diagnostics dialog

3. Reconnect the large gas line and wait for the flow to reach 500 cc/min.
4. Purge the system several times by pressing the **Purge Air Lock** button (B, Figure 2).

Copy the .ipl Files

1. Copy the .ipl files for the new sample tube into the MultiVu directory:
 - a. Insert the floppy with the .ipl files into the drive.
 - b. Open (go to) the C:\QdMpmS\MultiVu directory.
 - c. Access the files on the floppy (e.g., double-click on the My Computer icon, then double-click on the icon for the (A:) drive).
 - d. Select all the files on the floppy, copy them, and paste them into C:\QdMpmS\MultiVu.
2. The system is now ready for you to set it up for measurements.

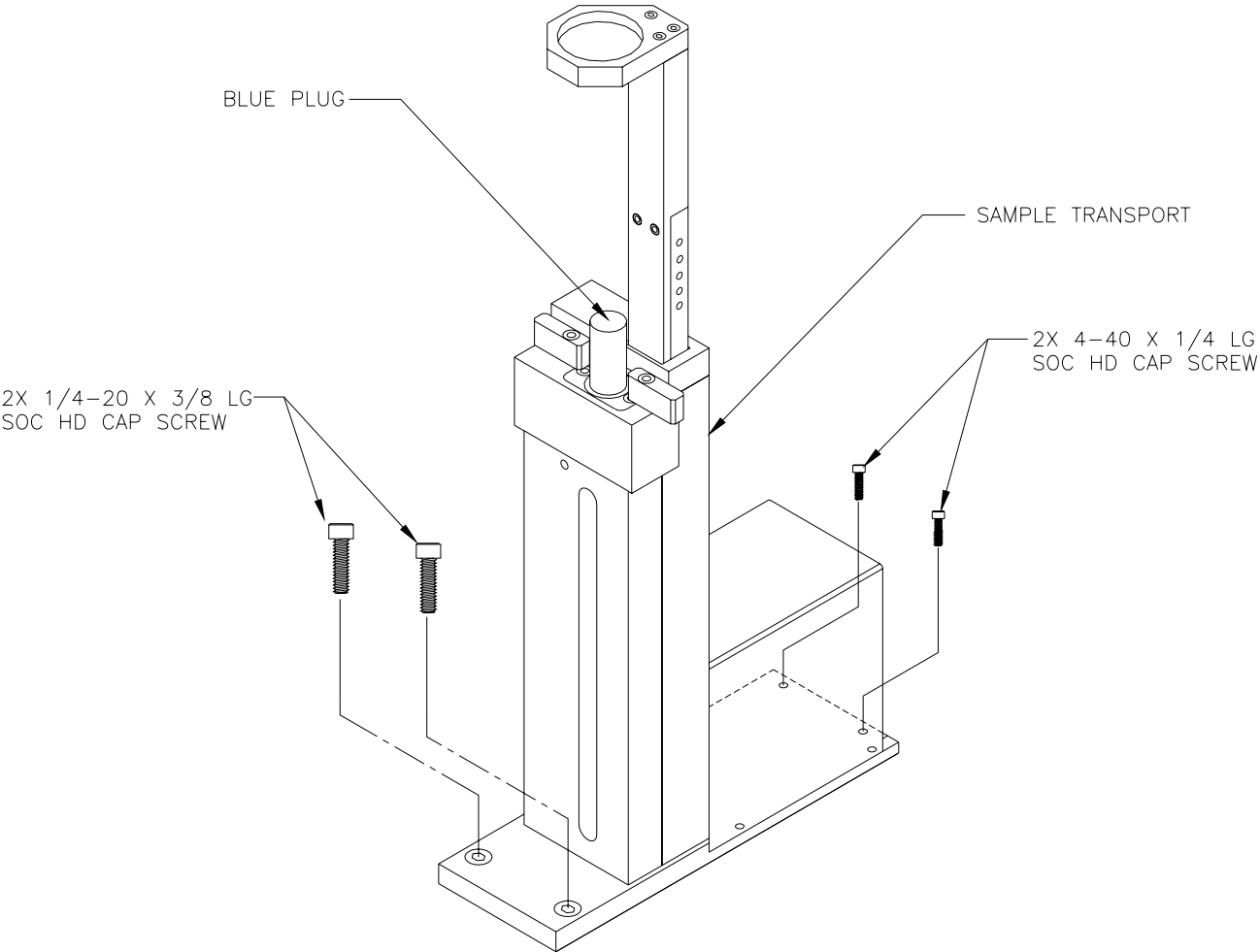


Figure 1. Sample transport

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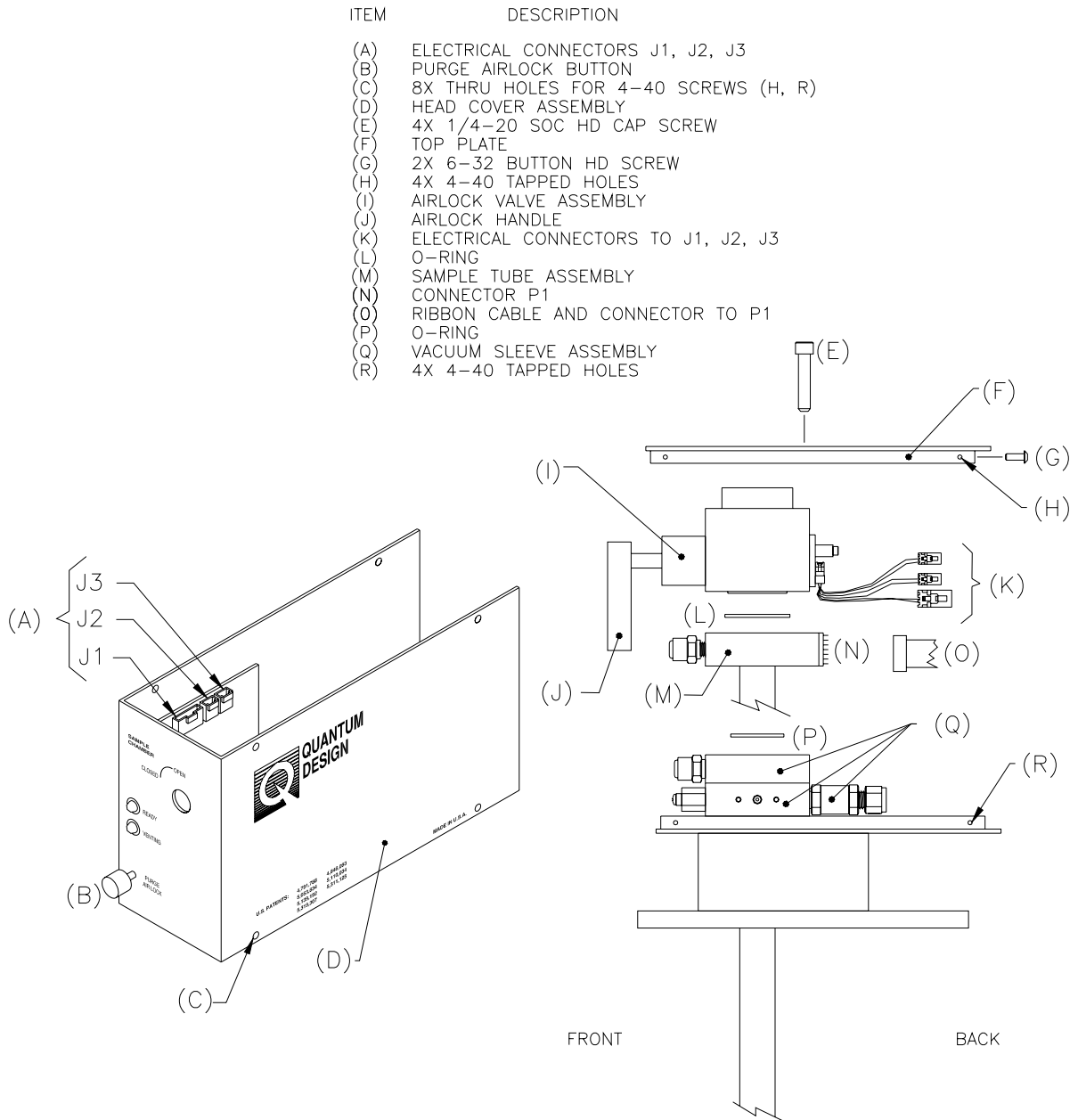


Figure 2. Components of probe head