

## Physical Property Measurement System (PPMS) – AC Measurement System (ACMS)

All users must receive specific training for the ACMS option regardless of training on other options. Reserve all necessary time in Coral and enable and disable when starting and finishing your experiment. Keep in mind that the ACMS can take a long time to equilibrate temperature and plan accordingly when making reservations. Fill out a log sheet for each use.

### Sample Preparation

Refer to Chapter 3 of the ACMS manual for information on sample mounting and installation. Samples must be attached to the end of the sample rod; we have 3 rods, which should be kept in the long plastic tube on the wire shelf when not in use. There are two main

devices for mounting the sample to the rod – a plastic straw and the rod extensions with “bucket” style holders.

- When using a straw, securely place the sample roughly in the middle of the straw. Cut one end (~40% of the length) of the straw off and attach the other end to the black plastic straw adapter (these are kept in the ACMS Options case). Use the Pd reference sample (also kept in the case – put it back there when done!) to verify that the distance between the sample and the end of the rod is correct, and adjust if necessary. Attach the straw adapter to the end of the sample rod.
- The bucket can be particularly useful for liquid or powder samples, but can also be used for solid samples. There are two different bucket/rod extension assemblies with different labels on their storage tubes: the “sealed” assembly is better for liquids and is simply fully tightened to seal; the “short” assembly does not seal and can be tightened to a range of heights along the rod extension’s threading. In both cases, the sample must be rigidly in place relative to the rod during testing (particularly DC magnetization, where the sample moves), so packing tightly with cotton or some other means should be used to keep it from moving.

### Activation

1. In the MultiVu software, de-activate any other active option, and physically remove the cables/hardware as necessary according to the respective SOP.
2. Vent the system (if necessary), remove the baffle/flange rod, and place it in the cabinet.
3. Visually verify that there is not a puck in the system, and if there is, remove it (see the “Measurement Procedure” section of the Resistivity or AC Transport procedures).
4. Insert the ACMS coil set, making sure the key engages (this will occur with the white dot forward and slightly right of center). Remove the screw and keep it in a secure place.
5. Place the ACMS transfer head on top of the system and secure the flange seal by pushing the wings in.
6. Click `Utilities - Activate Option...` and open the ACMS connection diagram and connect all cables accordingly. Note that if the AC Transport option has been used more recently than the ACMS option (check the log book to determine this if necessary), two cables on the back of the Model 6000 controller will need to be changed.
7. Select and activate the ACMS option. The ACMS log should appear and should indicate that the option has been successfully activated. Note that the User temperature field on the Model 6000 will now be active and the temperature reading in the MultiVu software should indicate this temperature.



## **Measurement Procedure**

Refer to Chapter 4 of the ACMS manual for information on performing measurements. Once the option is activated, the ACMS Control Center window contains most commands needed to set up and perform a measurement. To insert a sample:

1. Use the `Sample` tab and click the `Change` button. This will vent the system and home the motor.
2. Remove the cap and insert the sample rod.
3. Replace the cap and click the `Finished` button to purge and seal.
4. Click the `Locate Sample` button to locate the sample using either DC or AC measurement with some appropriate applied field and scan parameters. When the locate operation is complete, the expected and actual waveforms will be displayed, as well as the sample location. If the location is more than 0.4 cm off center (positive distance means it is high, negative means it is low), it will need to be removed and adjusted.

When the sample is properly located, measurements can be made immediately or as part of a sequence:

- First, a data file must be selected using the `Datafile` tab. In the `Sample` tab, immediate measurements can be made by clicking the `AC Measure` or `DC Measure` button and specifying the desired parameters (range plus number of scans to average for DC, frequency and amplitude of oscillation and duration/count for AC). Results of an immediate measurement will be displayed when the measurement is complete and can be written to the specified data file.
- For information on setting up and running sequences, refer to the PPMS general instructions. ACMS measurement commands are listed under “ACMS” (click the + to expand the list of choices) and are similar to immediate measurements.
- For AC measurements, a series of multiple frequencies and/or amplitudes can be specified within one measurement command line.
- All measurement results (plus other data as specified in the PPMS `Data` tab) will be saved to the specified data file.

To change samples, set the system temperature to 300 K and the magnetic field to 0 Oe (persistent); this should be done at the end of each sequence, but can be done manually if necessary. Use the sample change sequence as described above. When finished, the ACMS option can be left active in the system.

## **De-activation and Removal**

1. Set the system temperature to 300 K and the magnetic field to 0 Oe (persistent).
2. Vent the system and remove the cap from the ACMS transport head. If there is a sample rod installed, it must be removed before de-activating the ACMS option. Use the sample changing procedure at the bottom of the previous page to remove the sample.
3. If a sample has been removed, the system will purge and seal at the end of this procedure, so it must be vented again.
4. Click `Utilities - Activate Option...` and select and de-activate the ACMS option.
5. Pull the flange seal wings out and lift the transport head off the top of the system. Leaving the cable attached, place the head securely in the holder on the shelf.
6. Remove the coil set by placing a screw in one of the tapped holes and lifting the coil set out. Leave the screw in and place the coil set in the cabinet.
7. Remove the ACMS amplifier/LEMO connector from the back of the probe and, if necessary, the connectors from the back of the Model 6000 controller. Hang the LEMO connector from one of the hooks on the wall.