

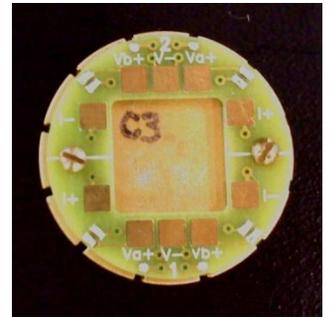
## Physical Property Measurement System (PPMS) – AC Transport (ACT)

All users must receive specific training for the AC Transport option regardless of training on other options. Reserve all necessary time in Coral and enable and disable when starting and finishing your experiment. Fill out a log sheet for each use.

The AC transport option can be used for making several different measurements with AC excitation: resistivity, I-V curves, Hall Effect, and critical current. Resistance measurements can also be made using the Resistivity option. Which option is more appropriate depends on several factors, including whether an AC signal is desirable/acceptable, the resistance of the device(s) to be tested, and the number of devices to be tested. Consult the system documentation and/or facility staff to help determine which option is appropriate. The three “transport...” PDF documents on the PPMS computer desktop are a particularly useful resource for making electronic transport measurements.

### Sample Preparation

The AC Transport option performs measurements using 4 or 5 contact points on up to 2 channels at a time. The standard ACT puck (see right) includes pre-mapped pads I+, I-, V<sub>A</sub>+, V<sub>B</sub>+, and V- on both Channels 1 & 2. The recessed area measures 10.8 mm square (with rounded corners), so samples that fit within this area will work best. The base is conducting, so an insulating layer such as Kapton tape will be necessary for samples with conductive back sides. Electrical contact between the sample and the desired channel input pads can be made via wire bonding, soldered or silver-painted wires, spring-loaded press contacts (consult staff on use of these), or other methods. Alternatively, samples can be mounted on the user puck, which has a blank face and no pre-configured channel set-up. This can be useful for larger samples or if no ACT pucks are available. The pin-to-channel correspondence for the user puck is posted on the bulletin board. The ACT or user puck can be used in combination with the User Bridge (the blue face plate corresponds to the ACT option channels) to test sample-to-puck connections in advance of insertion into the PPMS using a hand-held ohm meter or other device.



### 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. Click `Utilities - Activate Option...` and open the ACT connection diagram and connect all cables accordingly. Note that if the ACMS option has been used more recently than the AC Transport 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.
3. Select and activate the AC Transport option. `ActStatus.log` will pop up to indicate the activation status.
4. If not immediately inserting a sample, insert the baffle/flange rod and clamp it in place, then purge and seal the system (note – this is not necessary if switching from the Resistivity option). Or, go to step 3 under Measurement Procedure to install a sample.

### Measurement Procedure

Refer to Chapter 5 of the AC Transport manual for information on performing measurements. Once the option is activated, the tabbed AC Transport Control Center contains most commands needed to set up and perform a measurement. To insert a sample:

1. On the Install tab, click the `Vent` button and follow the on-screen instructions.
2. When the system is vented, remove the baffle/flange rod.

3. Visually verify that there is not a puck in the system, and if there is, remove it.
4. To place the puck in the puck insertion tool:
  - a. Flip the switch on the handle up to open the collar.
  - b. Put the puck into the bottom of the tool, sample side first.
  - c. Hold the puck in place while flipping the switch down to lock the puck in place.
5. Using the tool, slowly lower the puck into the probe. When it reaches the bottom, rotate it until the key aligns with the key slot (this happens with the key facing forward), then press down to engage the pins.
6. Flip the switch on the tool up and withdraw the tool.
7. Replace the baffle/flange rod and finish the install procedure in the software to purge and seal the system.
8. Place the puck insertion tool back on the wire shelving unit.
9. On the Data File tab, click `Browse` and set up a file location and name. Then, you will be prompted to enter sample info on the Sample 1 and Sample 2 tabs; click `Next >>` and `Finish` after each one, respectively.

All measurements made using AC Transport fall under one of four modes corresponding to the four buttons which are always visible at the bottom of the AC Transport Control Center (regardless of which tab is open): `Hall Coefficient`, `Resistivity`, `IV Curve`, or `Critical Current`. Clicking one of these buttons will open a new window which serves as the interface for that measurement. Since each interface and measurement procedure is unique, users should refer to the relevant sub-section of section 5.3 of the AC Transport manual for specific information on a measurement type. In general:

- Immediate measurements can be made by clicking the `Measure` button at the bottom of the measurement window. Results are displayed and can be saved to the specified file (see above) by clicking `Save`.
- Within the AC Transport Control Center, the Waveforms tab displays the expected and actual data waveforms for every measurement. This can be useful for seeing noise levels and determining if the input parameters and measurement range are appropriate.
- For information on setting up and running sequences, refer to the PPMS general instructions. ACT measurement commands are listed under “AC Transport” (click the + to expand the list of choices). When a measurement command is selected, the measurement interface includes tabs for Sample 1 and Sample 2; the measurement can be made on either or both samples (each with their own separate parameters) by clicking the respective `Measure` check-boxes, whereas one or the other is selected in an immediate measurement. The PPMS Data tab allows the user to select what parameters and results (from both the measurement and the system hardware) will be saved to the 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 (with slight differences for puck removal). When finished, the AC Transport 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. Click `Utilities - Activate Option...` and select and de-activate the AC Transport option.
3. Remove the AC Transport 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.