Quantum Design

Application Note 1076-303

Using the PPMS Resistivity Option in Voltage Mode

The Quantum Design PPMS Resistivity Option (model P400) can be used as a sensitive voltmeter to perform experiments like reading sample voltages as function of temperature and applied magnetic field. Instead of reporting a resistance (in ohms), the bridge channel will now report a voltage (in millivolts). While in voltage mode, each bridge channel can also output a current up to 5 mA.

To enable this mode of operation you will need to use the following command either in a sequence or through *Mon6000*.

$BR_VCNF **Ch# Range Avg Current;**

Where in the above command:

Ch# is an integer ranging from 0 to 3 which selects the Bridge Channel to be used in the voltage mode measurement; a "0" indicates bridge channel 1, etc.

Range takes a value of 1 or 2 which selects the type of ranging during the measurement (it is required to use auto-ranging). Here, 1 = standard auto ranging and 2 = sticky auto ranging;

Avg is an integer which specifies the number of averages per measurement

Current is a number from 0.00 to 5000 µA (5 mA)

In addition, the voltage measurements can be made in a relative mode to eliminate any offsets that might be present in the voltage measurements. These voltmeter offsets can be significant (typ. 0.1 mV). To use the card in relative mode use the command:

$BR_VREL **Ch# Mode;**

Where:

Ch# is an integer ranging from 0 to 3 which selects the Bridge Channel (1-4) to be used in the voltage mode measurement;

Mode where 0 = absolute, and 1 = relative.

In relative mode, voltages are reported relative to the voltage at the time the $BR_VREL **Ch# Mode** command was sent.

If doing this in MultiVu using the *Execute Command* sequence command, one must use the:

portcmd " "

syntax where the bridge command is placed within the quotes. The figure below depicts a typical MultiVu sequence which can be used to employ the Resistivity Option in Voltage mode.
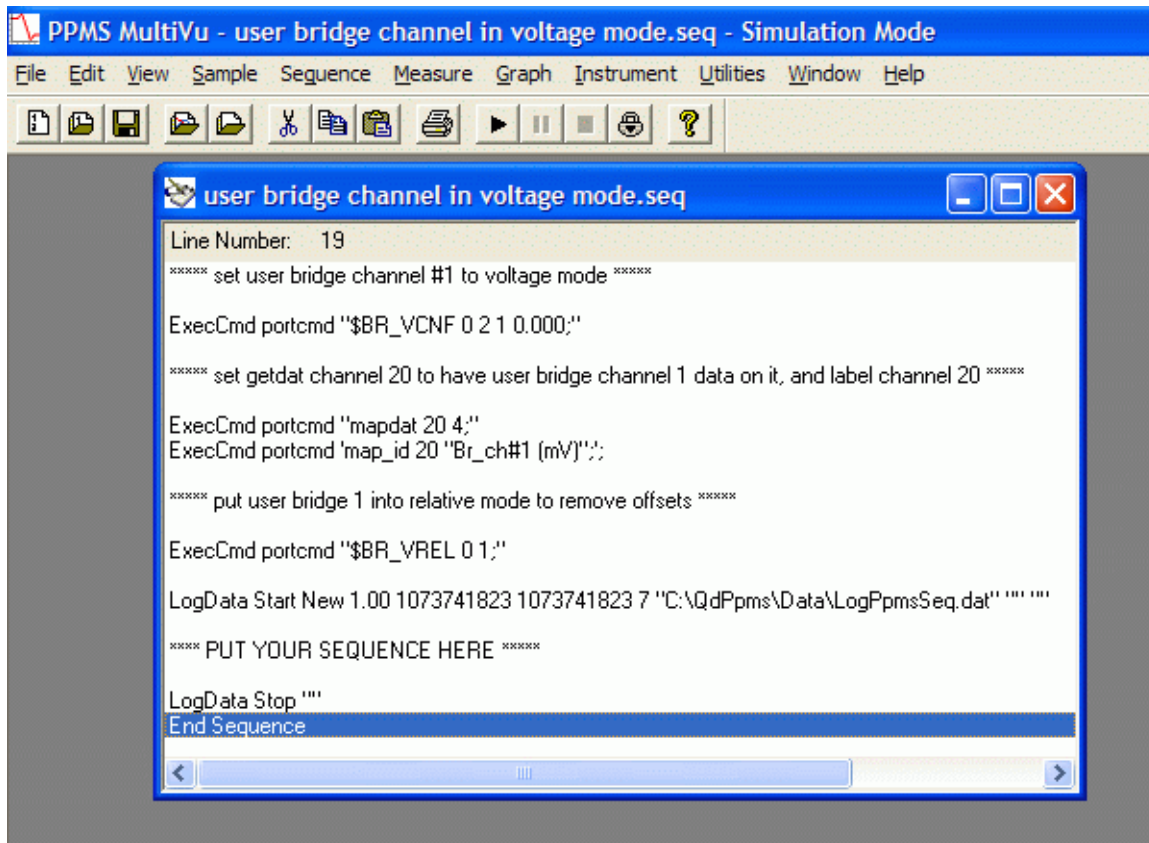
Figure 1: User bridge channel in voltage mode sequence.

Note on experimental wiring for voltage measurements: your experiment always needs to be referenced to the analog ground of the User Bridge in order to avoid saturation of the amplifiers. Since the voltmeter in the bridge card does not have a ground reference, you will need to provide this. In the usual 4-wire resistance measurements, this ground is supplied from the current source. If the measurement does not involve the current source, you can alternately connect one side of the voltage pair for each active channel (say, V+) to the pin 13 (shield) of the User Bridge connector, see p. 2-2 of the *Resistivity Option User's Manual 1076-100A*. In order to isolate the channels, use a 100 kΩ resistor to make the connection between V+ and pin 13. The connections are easily made by using a jumper box like shown here: http://www.cwc-group.com/db25jumper.html

Keep in mind that the User Bridge multiplexes one current source and voltmeter to the 3 channels on the puck: when one channel is active, the others are open.