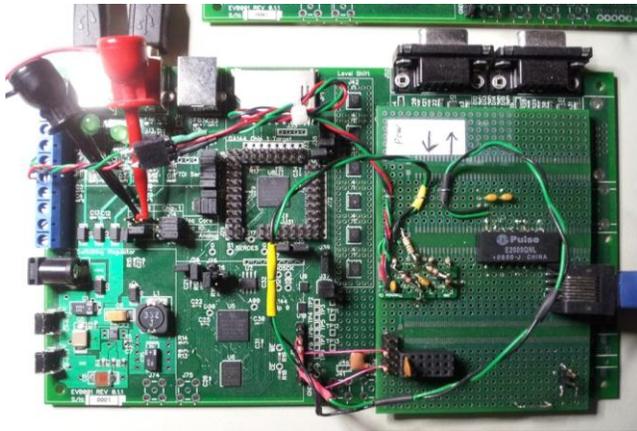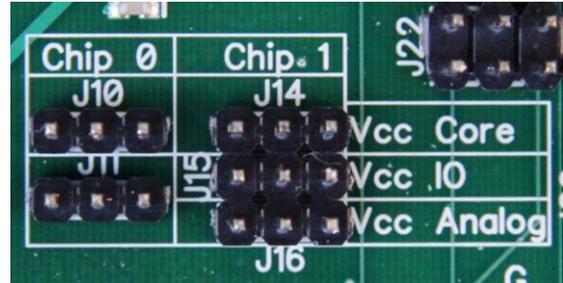# Measuring Currents
used on the EVB001 Evaluation Board

The power configuration jumpers on the EVB001 board serve two purposes. The first is independent selection of power sources for five buses: J10 and 11 select Host chip core and IO/Analog buses; J14, 15 and 16 select Target chip core, IO and Analog, respectively. Each jumper has three stakes. The center stake leads to the chip bus, and may be connected to the right (default) for use of the onboard 1.8V supply, or to the left for selection of an external supply using barrier strip J1. See DB003 for more information about these options.

The second purpose is to allow insertion of current measuring apparatus in series with one or more of these buses. For example, at GreenArrays we have used a Keithley model 2100 6.5-digit multimeter for this purpose. The photo at left shows the connections used to monitor Host Core power in this example; clipleads place the multimeter between the center and right hand pins of J10, monitoring current drawn from the onboard power supply by the Host Core bus. The photo below shows a reading made while polyFORTH is running on the board with Ethernet and TCP/IP code running both on the chip and in the virtual machine. Although more than 50 of the chip's nodes are involved in this particular case, most duty cycles are low so the total consumption of 28.6 mA represents less than 500 microamps mean per node.

Considerations: Test leads should be kept as short as is possible, and we twist the leads together to improve their transmission line characteristics. The choice of meter and mode of its use is extremely important, and is one of the reasons for our selection of the meter shown here. Most ammeters are of the shunt type, inserting a resistor in series with the current path to be measured and then measuring the voltage drop across this resistance. When using a three or four digit meter, it is necessary to employ a resistor with relatively high value to measure relatively small currents, but this leads to significant voltage drops as the current increases.

Since it is usually impractical to change the resistor's value without cutting power to the circuit under test, this means that a low enough valued resistor must be selected so that the circuit will survive all phases of the experiment including those phases that consume relatively high power and would cause an unacceptable voltage drop. When this is done with a low-resolution meter, the result may be the inability to obtain useful current resolution during the low-power, *interesting* part of the experiment.

Therefore we have selected a 6.5-digit meter (the display above is filtered and omits the 10 µA digit) and prefer to use it in its 3 Ampere scale. This meter uses an 0.1Ω shunt resistor on that scale, so that even when the circuit is using 1 amp the voltage drop is only 100 mV, within our spec, yet the meter has a resolution of 10 µA.. Conversely, on the 100 mA scale a 5.1Ω resistor is used, and in this case if the circuit is consuming only 100 mA the voltage drop is 510 mV, well outside our spec.

Thus, if you wish to use the on-board power supply, you should also use a meter whose resolution is high enough, and shunt resistance low enough, that you can see everything you need to without dropping the supply voltage too far. If you must use a low resolution meter then you will probably need to use an external, adjustable power supply to keep the operating voltage of the circuit within spec. For more information see http://www.greenarraychips.com