The power line related noise present with DC input signals is good to remove from the ADC. This mechanism is called Normal Mode Rejection (NMR). A multimeter achieves NMR by measuring the average DC input by integrating it over a fixed period.
By setting the integration time to a whole number of power line cycles, these error will average out to approximately to zero. When a multimeter is connected in series with test current to measure current, a measurement error, developed because of multimeter's series burden voltage is introduced. A voltage called burden is developed across the wiring resistance and current shunt resistance of multimeter.

Generally, following methods are used for current measurements, detailed discussed can be found in [1].

1) Shunt resistor, current measurement:

This is a common used for power measurement method in which voltage drop on the current shunt resistor is calculated. Figure 1 shows the mechanism for current measurement by using shunt resistor. Shunt resistor is place in series with current flow in a circuit and the resistor is chosen specifically to have high precision and low impedance. Shunt resistor is usually selected in the range of tens of hundreds $m\Omega$ with precision less than 1 percent.

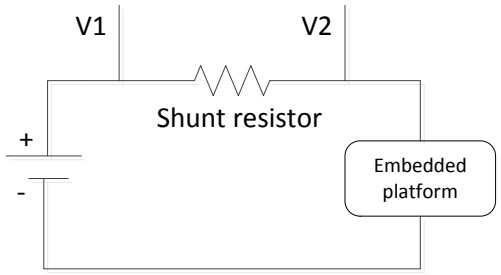

Figure 1. Shunt resistor current measurement

2) Current mirror method

Current mirror is assembled from four bipolar transistors. This combination duplicates the current consumed by the embedded platform e.g., FPGA or microcontroller as shown in Figure 2. The current is then measured by using shunt resistors. This method avoid the need to use shunt resistor from the direct supply line which reduces the influence to the measured system's voltage. Depending on the time resolution requirement, voltage drop across the shunt resistor can be measured by either Digital muiltimeter, oscilloscope or Digital acquisition units.

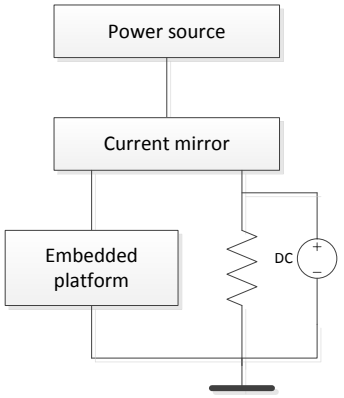

Figure 2. Current mirror method.

3) Charge transfer method

Two types of methods can be used

a. A known capacitor is charged from a power supply and then discharged by the consumed current of the embedded platform. Following this, the remaining voltage is measured.
b. A known capacitor is charged by the consumed current and then discharge time is measured.

Naehyuck *et al*. [2] presented in detail the measurement technique based on the charge transfer by using switched capacitors. An embedded platform is charged for a short period and measure the voltage V_a at the start of processing and then measure V_b at the end of processing. The consumed energy E for the measurement period can be calculated by using Eq.1

$$E = \frac{1}{2} C(V_a - V_b)^2 \quad (1)$$

References

[1] Ž. Nakutis, "Embedded Systems Power Consumption Measurement Methods Overview," *Matav. 2.44*, vol. 2, no. 2, pp. 29–35, 2009.

[2] Naehyuck Chang, Kwanho Kim, and Hyung Gyu Lee, "Cycle-accurate energy measurement and characterization with a case study of the ARM7TDMI [microprocessors]," *IEEE Trans. Very Large Scale Integr. Syst.*, vol. 10, no. 2, pp. 146–154, Apr. 2002.