# Power Meter Design Notes

## Command line API

* Reset – clear accumulated current
* Sample n – samples per second
* Report n – data reported to host per second
* Start
* Stop

## Report data format

JSON:

{ “I” : n; “V” : n }

## User interface

Display of mAh used, updated continuously

Display of remaining battery capacity (mAh)

Need a way to enter initial battery capacity

## Calculations

We want to display power used in mAh. To do this we need to add up the current from each sample interval and divide by the number of intervals per hour. We will need 32-bit arithmetic for this, but need to choose scale/resolution so that we don’t overflow 2^31-1.

The resolution of the INA219 breakout (0.1-ohm shunt resistor) is 100uA. Therefore, the calculations should be done in units of 100uA. With 32 bits and a 100mS sample rate we can accumulate current up to 5.965Ah.

The AtMega32u4 probably has enough bandwidth to sample every millisecond.

We need to average the 1ms samples into 100mS averages and accumulate those. At full scale (16000 units) we can go for 3.728 hours. At 100mA we can go for 59.65 hours.

## Managing the INA219

With a 16MHz clock and a prescale of 256 we can get an exact 1mS time tick. For this the timer should bet set to generate an interrupt at 250 counts.

### Power Monitor

State machine, clocked by 1ms timer. Timer interrupt sets flag and increments counter, state machine waits for flag and adds to accumulator when count reaches 100.

### INA219 interface

Configure(busVoltageRange, shuntGain, shuntVoltageRes, busVoltageRes, mode)

SetRegisterPtr()

ReadRegister() – at current pointer

## Hardware

Sparkfun AtMega8u2 breakoutj, 16MHz clock

Adafruit INA219 Current Sensor Breakout