Exponential Moving Average

Exponential moving average means that the reading will reach 63% of its final value after the selected number of samples (triggers) has occurred. Thus, if 10 samples are selected, the reading will be at 63%, or one exponential constant along the exponential curve toward the final value of the measurement in 10 triggers (samples). Since this is a moving average, more recent samples are given more weight in the average than older samples. In a linear average, all samples are given equal weight, regardless of when they were taken. In exponential averaging, if the averaging were set for 10 samples and a steady state condition existed (after about 50 samples), and then one more sample were added, that sample would have an approximate effect on the result as if it were one sample at it's measured value weighted linearly with 9 samples at the previous average value (before the new sample was added). The start of an exponential curve is approximately linear, and one sample out of 10 is still on the linear part of the curve. Similarly, if 100 samples were selected and steady state existed (about 500 triggers), one more sample would effect the average as if it were linearly averaged with 99 samples at the previous value.

In the general case, each new sample added to an average will be weighted according to the formula:

$V = Vo * \{1 - e [exp(-1/So)]\}$

Where "So" is the number of samples selected for your average, and "Vo" is the full value of the sample being added. If the average were set to one sample, then each additional sample is added to the average with a 63% (one full exponential period) weight against the previous average. For So = 10 samples, each additional sample contributes .0952 Vo (about .1 or 10% weighting), and for So = 100 samples it is .00995 Vo (about .01 or 1% weighting).

When starting from a RESET of the average, the final value will behave according to the formula:

$V(S) = Vo * \{1 - e [exp(-S/So)]\}$

where S is the number of the sample (trigger) after the start. Thus, for example, if 10 samples are selected for the averaging, and S is the 20th sample taken, the value after the 20th sample will be .8647 Vo, or 86.47% of the final value.