

ActiGraph White Paper:

What is a Count?

ActiGraph routinely fields questions and inquiries regarding the definition of a ‘count’, the unit of measure for activity for ActiGraph’s monitors. Users are concerned about the ambiguity of this term and how it relates to the physical world. Although the origin of the term ‘count’ is unknown in its general sense, ActiGraph’s interpretation and use of this unit of activity measure is described below.

A significant percentage of the inquiries fielded question why the unit of measure for activity is not in the form of velocity. This seems a valid argument due to the relationship between linear displacement, velocity, and acceleration as shown below.

$$\text{displacement} = x = d_2 - d_1$$

$$\text{velocity} = v = \frac{dx}{dt}$$

$$\text{acceleration} = a = \frac{dv}{dt}$$

$$v = \int_{t_1}^{t_2} a(t)dt$$

When the above relationships are taken into account, along with the fact that an accelerometer’s output yields, as the name implies, an acceleration, it is only reasonable to assume that if integrated over the user selected epoch period that the resulting value should be velocity. The error in this line of thinking is the belief that the collected data is numerically integrated over the epoch, when in actuality the individual samples are merely summed over the epoch period.

In order to acquire velocity, one would need to integrate each sample collected over the sample time (33 ms for ActiGraph products). Furthermore, each data sample is passed through a band limiting filter intended to remove non-humanlike motion. By doing so, the acceleration signal is altered, thus making it impossible to obtain velocity directly through the equations above.

It is believed that the origins of the term count can be traced to early generation activity monitors which had little or no solid-state devices capable of quantizing multiple levels of activity. These legacy devices utilized a threshold crossing technique to monitor activity. Activity that caused the acceleration signal to exceed the threshold was ‘counted’ as activity; anything below this threshold was ignored. At the end of the measurement period, the number of activity “counts” would be recorded. The use of this term, “count”, is believed to have carried over to modern day monitors.