## Application Note: AZD024
Graphical Representation of the IIR Filter

The ProxSense™ controller measures capacitance: The immediate readings are used to derive steady state values. The immediate values or current samples (CS) are filtered by an IIR filter to produce the steady state, or LTA (Long Term Average) values.

Figure 1 illustrates the level shift in the counts registered between the LTA and the current sample when a proximity and touch condition occurs. The current sample is the solid (thick blue) line while the LTA is the dashed (thin blue) line. As illustrated in Figure 1, the proximity event has a smaller influence on the current sample in comparison to a touch event. The proximity and touch threshold are indicated by the green and red horizontal lines respectively. Note that the filter is halted during the proximity and touch events to prevent a loss of sensitivity. The halt time is configurable.
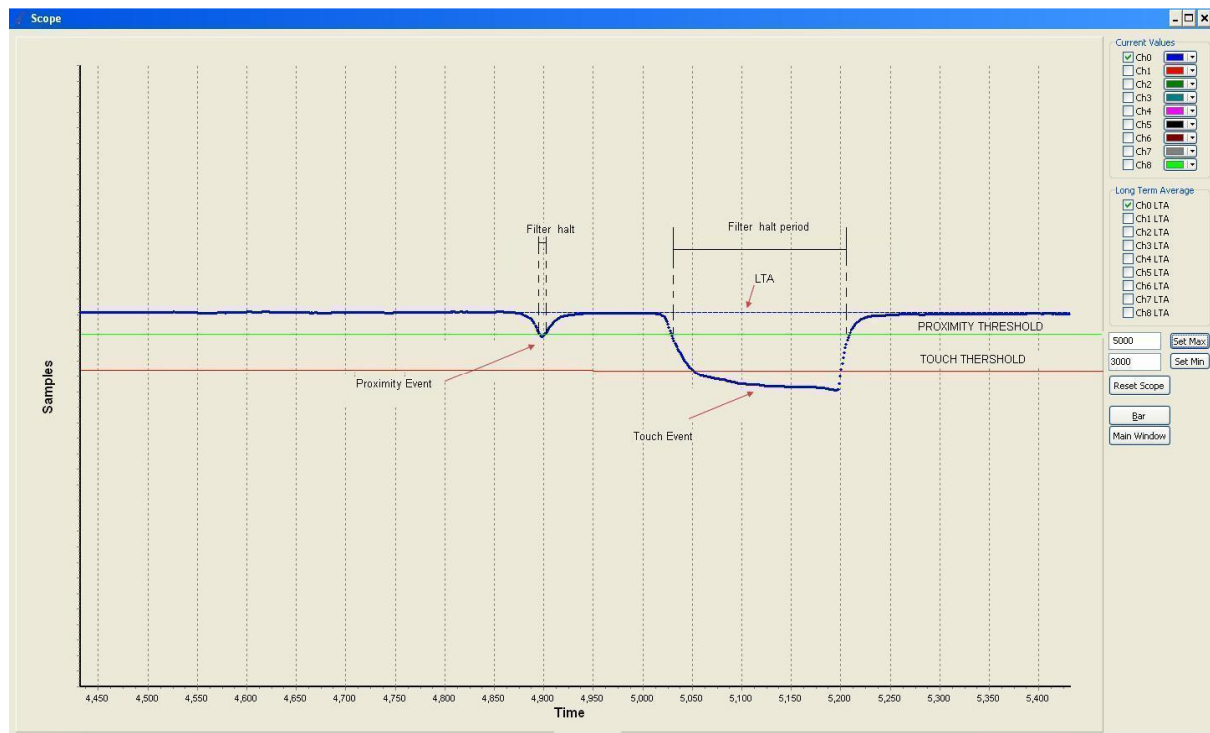
Figure 1. Proximity and touch event.

Figure 2 illustrates how the LTA compensates for foreign objects introduced to the environment for longer than the T_{halt} (filter halt period). If an object or a hand comes into proximity with the sensor the current sample is affected. If the objected is not removed after a set time (adjustable) the LTA is adjusted as can be seen in Figure 2. The sensor is now calibrated to the new environmental condition and can register proximities to the same level of accuracy (sensitivity) as before the object was introduced to the environment.

The LTA is also capable of readjusting upwards as soon as the object causing the interference is removed (as the current sample will move up), see Figure 3.
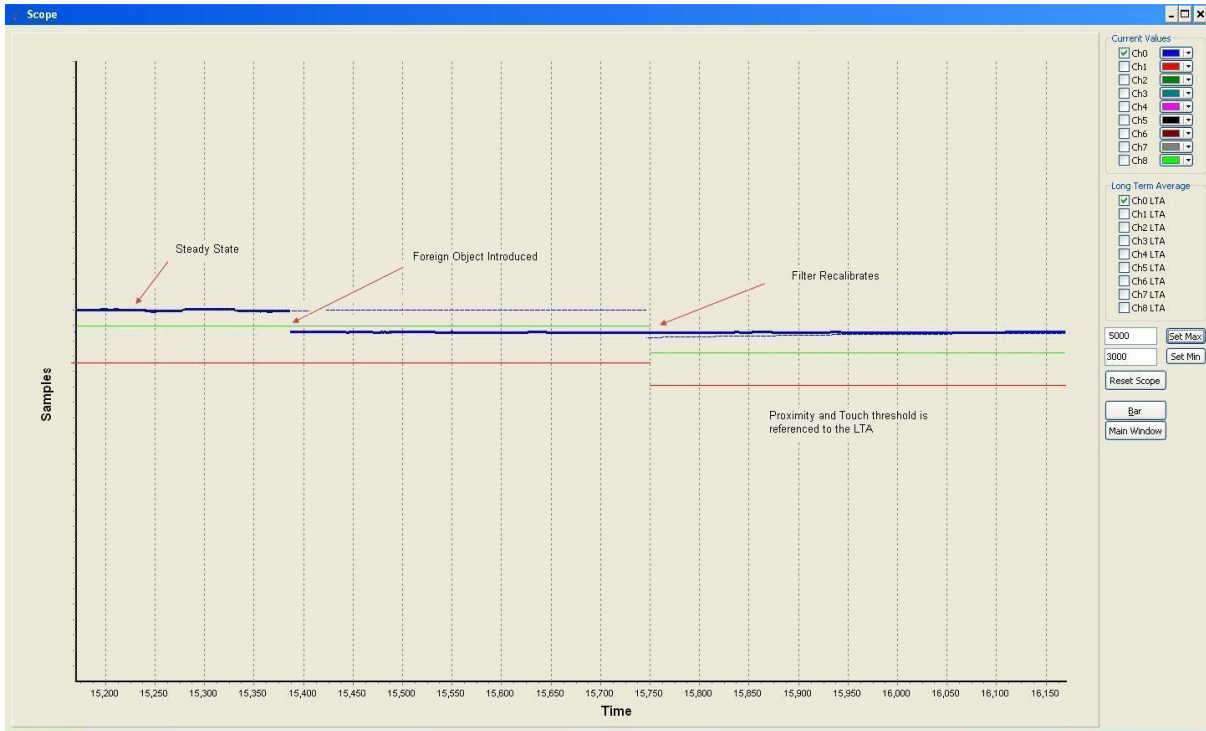
Figure 2. IIR filter adjusts the LTA after a set time of interference being introduced. The interference produces a proximity event (in this case) until the LTA is adjusted.
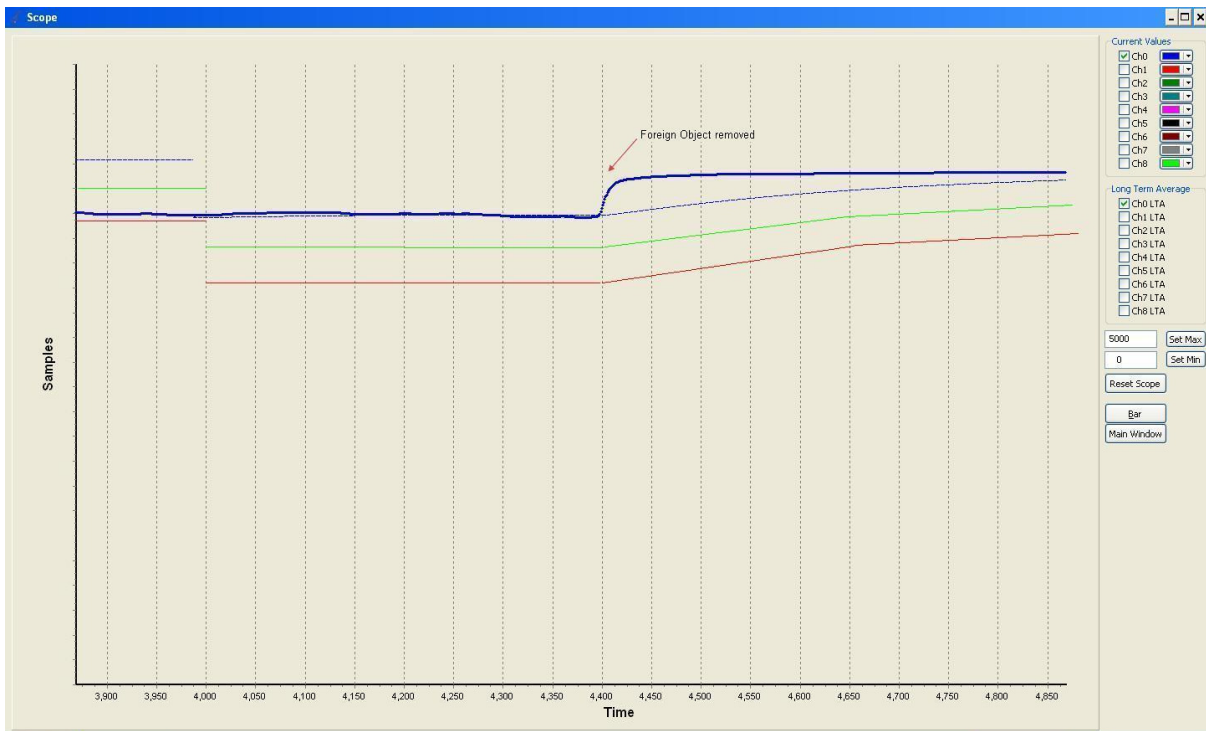

Figure 3. IIR filter readjusts the LTA after interference is removed.

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