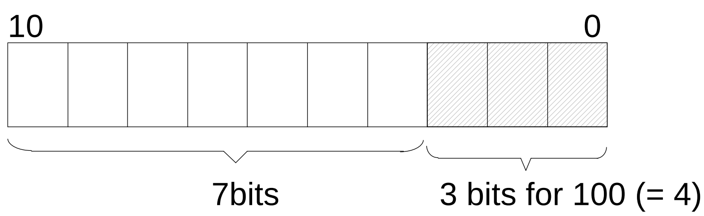
Hitachi America, Ltd.

TN-0207

Application Engineering
TechNote

Amelia Lam

The Effect of Absolute Accuracy on the A/D Converter



10-bit resolution ADC

Depending on the specification value, the absolute accuracy can somehow play a moderate role in the A/D conversion. Take the H8/510 as an example, the device includes an A/D converter with 10-bit resolution and the databook calls for ± 4 LSB maximum on the absolute accuracy. This ± 4 LSB indeed limits the extent that ADC can perform. It is because the actual resolution has gone down to 7-bit, instead of the 10-bit previously stated. This is so since 4 takes up 3 binary bits which therefore introduces the uncertainties to the least significant three bits. That is also why the accuracy is said to be only up to the seven most significant bits.

We can also see the relationship with the theoretical value, here the conversion results should lie between H'1FC to H'204,

$\therefore$ + 4LSB = H'(200 + 4) = H'204
& - 4 LSB = H'(200 - 4) = H'1FC

Please note that 4 LSB definitely is not the case where the result is accurate up to 6 bits and leaves the four least significant bits uncertain, as it may seem to be confusing sometimes.

On the other hand, let us look at the voltage coverage. With the ± 4 bit absolute accuracy, 2.5V is interpreted by the 10-bit ADC as 2.48V to 2.52V :

$\therefore$ 2.5V - 4.88mV x 4 = 2.48V
& 2.5V + 4.88mV x 4 = 2.52V

Whereas the 7-bit ADC also covers the same voltage range on its translation scale:

$\therefore$ 2.5V - 0.039V = 2.48V
& 2.5V + 0.039V = 2.52V

The result, however, is just an ideal case as it is based on the assumption that the 7-bit ADC has 0 absolute accuracy.