

ADC Resolution

Electrical Engineering

Step size, reference voltage, and why more bits alone add no accuracy.

An ADC's step size is its reference voltage divided by the number of available codes.

$$\text{LSB} = V_{\text{ref}} / 2^n \cdot \text{codes} = 2^n$$

12-bit, 3.3 V ref

3.3 ÷ 4096.

0.81 mV per step

10-bit, 5 V ref

5 ÷ 1024.

4.9 mV per step

True accuracy

Not by bit count.

Set by the reference

THE COMMON MISTAKE

× **Reading extra bits as extra accuracy**

✓ **Accuracy comes from reference and noise**

Resolution is only step size. A drifting reference or a noisy ground makes the lowest bits meaningless however many there are.

Give the sample-and-hold capacitor time to charge: a high source impedance needs a longer sampling window, or a buffer.