

## Simplifying Parameter Extraction from 10-bit ADCs on simple Microprocessors

General conversion equation: (assumes *Slope* and *Offset* are integers)

$$Value = \frac{Slope \times ADC}{1023} + Offset$$

Double top and bottom (avoids fractional rounding factor):

$$Value = \frac{2 \times Slope \times ADC + 2046 \times Offset}{2046}$$

Add rounding:

$$Value = \frac{2 \times Slope \times ADC + 2046 \times Offset + 1023}{2046}$$

$$Value = \frac{2 \times Slope \times ADC + 1023 \times (2 \times Offset + 1)}{2046}$$

Multiply top and bottom by 1024/1023 to make the denominator a binary power:

$$Value = \frac{(2 \times Slope \times ADC + 1023 \times (2 \times Offset + 1)) \times \frac{1024}{1023}}{2046 \times \frac{1024}{1023}}$$

$$Value = \frac{2 \times Slope \times ADC \times \frac{1024}{1023} + 1024 \times (2 \times Offset + 1)}{2048}$$

Substitute 1025/1025 for 1024/1023 (0.95 PPM less than required value):

$$Value = \frac{2 \times Slope \times ADC \times \frac{1025}{1024} + 1024 \times (2 \times Offset + 1)}{2048}$$

Algorithm:

*Const* = 1024 × (2 × *Offset* + 1)      Generate a program constant from the *Offset*

*Part* = 2 × *Slope* × *ADC*      First part of calculation

*Part* = *Part* + (*Part* >> 10)      Add *Part*/1024 to give *Part*\*1025/1024

*Value* = (*Part* + *Const*) >> 11      Final Rounded Result