

K. Chanon

Lab 3



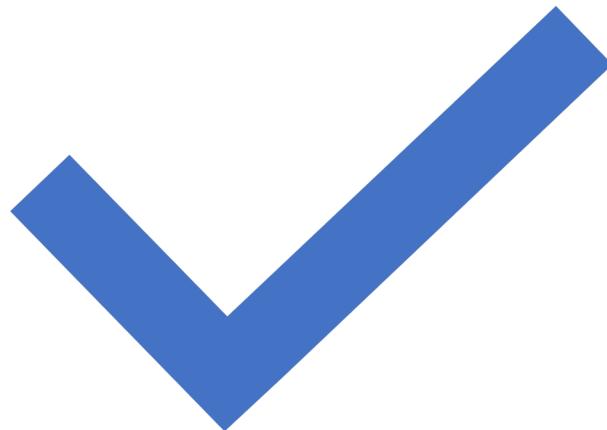
Overview

I2C to UART with ADS1115

Sensor Calibration

Report Format using Latex

Install Latex at First



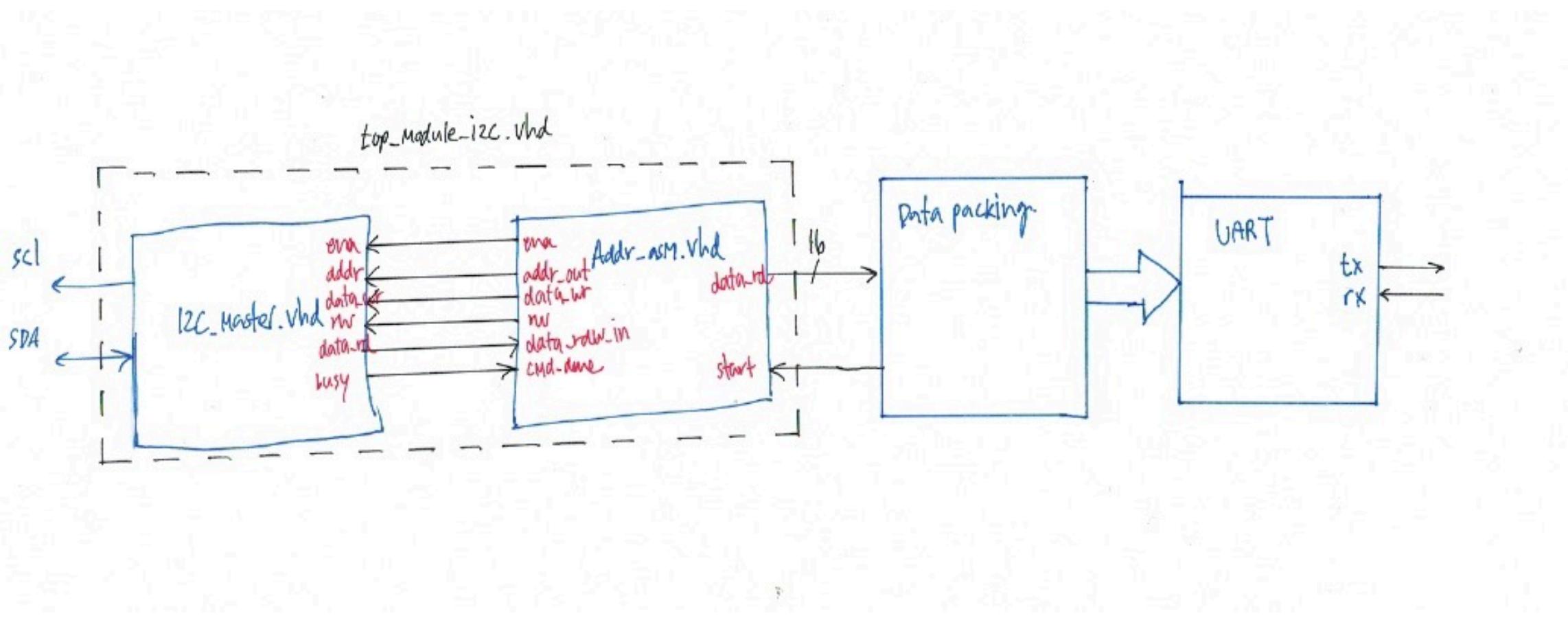
- Go to <https://miktex.org/howto/install-miktex> and follow the instruction.
- Install texmaker by go to <http://www.xm1math.net/texmaker/>

Lab 3 I2C to UART

Overview



In Depth Design



Lab 3

- Your task is to build your own data packing core.
- The i2c code is provided from lab2 in github.
- Due date is the first class after midterm.

Why we need to calibrate sensor?

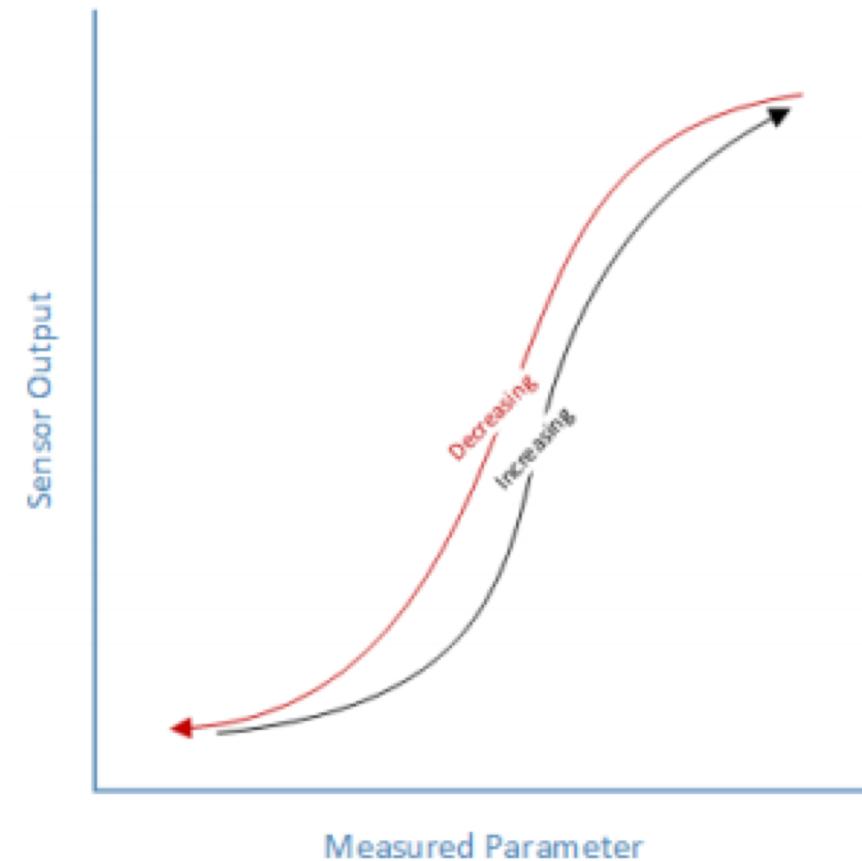
- No sensor is perfect
- The sensor is only one component in the measurement system

What makes a good sensor?

- Precision
 - The ideal sensor will always produce the same output for the same input
- Resolution
 - A good sensor will be able to reliably detect small changes in the measured parameter.

What affect precision?

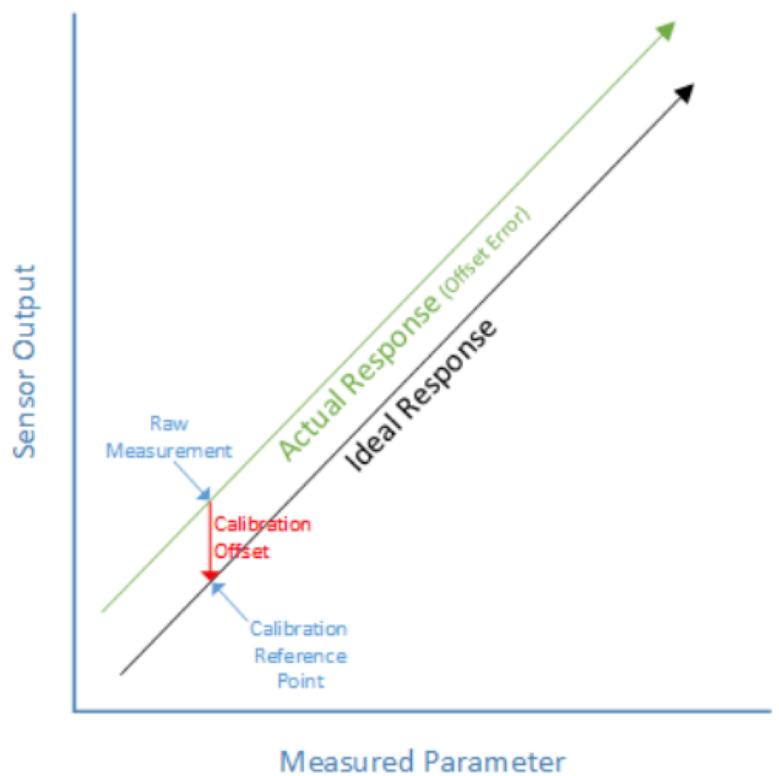
- Noise
- Hysteresis



How do we calibrate

- A standard physical reference
 - Rangefinders
 - Rulers and Meter sticks
 - Temperature Sensors
 - Boiling Water – 100 Celsius at sea level
 - Ice-water Bath – The “Triple Point” of water is 0.01 Celsius at sea level
 - Accelerometer
 - Gravity is a constant 1G on the surface of the earth

One Point Calibration

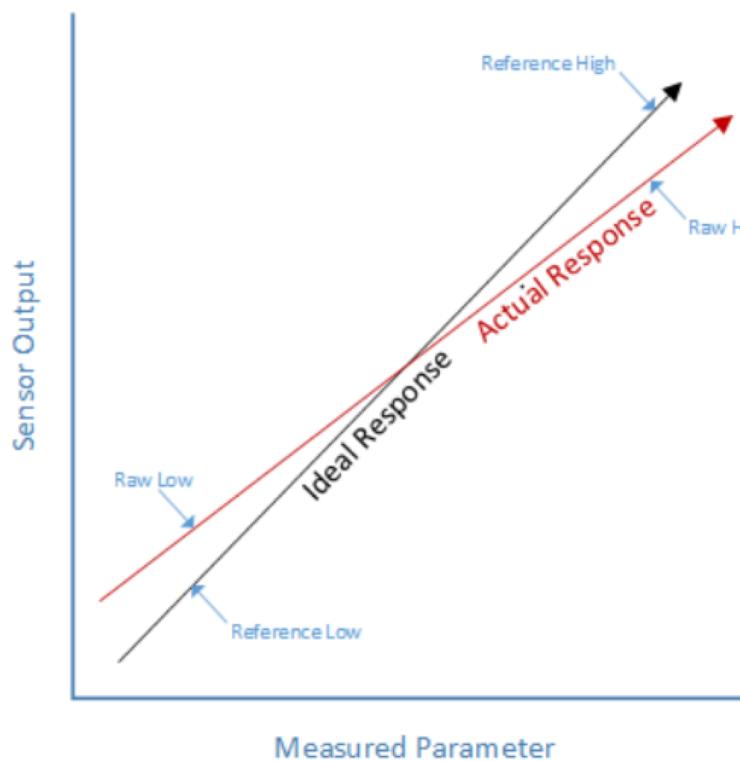


How to do it:

To perform a one point calibration:

1. Take a measurement with your sensor.
2. Compare that measurement with your reference standard.
3. Subtract the sensor reading from the reference reading to get the offset.
4. In your code, add the offset to every sensor reading to obtain the calibrated value.

Two Point Calibration



How to do it:

To perform a two point calibration:

1. Take two measurements with your sensor: One near the low end of the measurement range and one near the high end of the measurement range. Record these readings as "RawLow" and "RawHigh"
2. Repeat these measurements with your reference instrument. Record these readings as "ReferenceLow" and "ReferenceHigh"
3. Calculate "RawRange" as RawHigh – RawLow.
4. Calculate "ReferenceRange" as ReferenceHigh – ReferenceLow
5. In your code, calculate the "CorrectedValue" using the formula below:

$$\text{CorrectedValue} = (((\text{RawValue} - \text{RawLow}) * \text{ReferenceRange}) / \text{RawRange}) + \text{ReferenceLow}$$

Latex

- Let's do a mini tutorial for latex