Electrical Engineering
Energy in Transition

THE HAGUE UNIVERSITY OF APPLIED SCIENCES

DC Project – PC Oscilloscope ²

A low cost USB oscilloscope for use in practical assignments

Client:	*The Hague University of Applied Sciences* *Research Group Energy in Transition*	
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Duration:	*Shift 3 & 4*	
Start date:	*PROk 2020-2021*	
Location:	*The Hague University of Applied Sciences – Delft*	
Theme:	*Direct Current Research*	

Introduction

The student group should continue the development of an USB based PC oscilloscope. Use has to be made of a low-cost microcontroller or development board. The assignment both considers the development of an instrumental amplifier as well as optimizing the sample-rate and accuracy in the microcontroller. The students have to design, build and implement the hard- and software for a two prototypes, one based on the Arduino and the second one the ARM architecture. The arduino based scope is targeted at multichannel low frequency signals <1kHz. The ARM based scope is targeted at single or dual channel high sample rate.

Assignment

You should be able to perform the following measurement with the PC-Scope, see figure 1 & 2. This signal is a saw tooth with an F of 52kHz. This circuit can be built if a function generator is not within reach. The results are simulated and alsmo measured with the Tektronix TBS 2000 Series.

Figure 2. Measured results on the Tektronix Scope

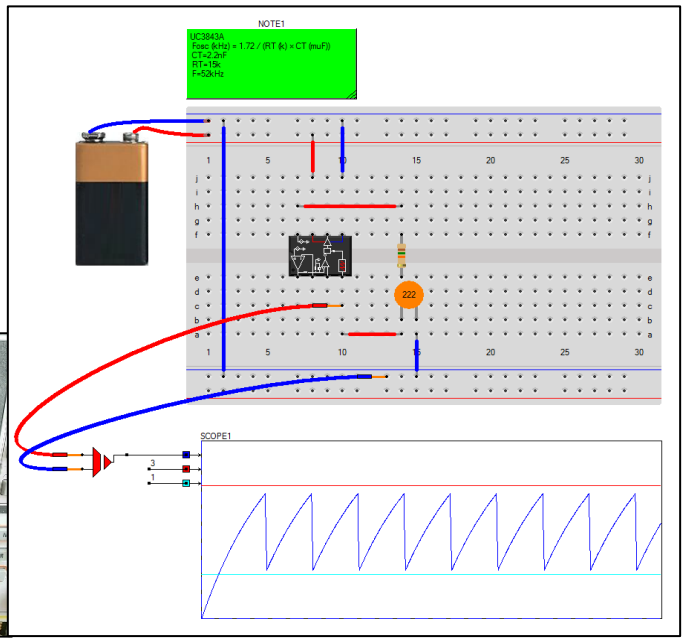

Figure 1. Simulated results with CASPOC

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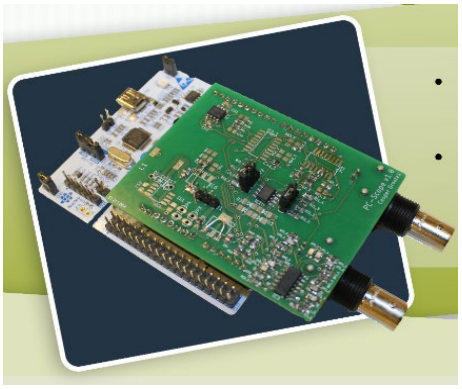
For this assignment we have an overview of the requirements below:



1. Channels: Choice of 8 channels (software), 2 channels via the signal conditioning PCB, other 6 software only
2. Measuring ranges: 1V, 2V, 5V, 10V, 20V, 50V, 100V
3. Resolution: 8bit / 12bit depending on sample rate and microcontroller used
4. Sampling Rate (not for Arduino): at least 3MS/s at 2 channels, > 7MS/s at 1 channel
5. Input selector: AC / DC
6. Input impedance: 1MOhm
7. USB connection with powersupply from PC (5V)
8. User interface: Basic windows program (GUI) with display on PC-screen and setting control from PC, preferably in C.
9. Assembly test circuit, sawtooth 40kHz, Vpp = 2 volts, Vdc = 2 volts + square wave (duty cycle = 0.95, Vpp = 8volt, Vdc = 4), using IC: UC3843A, power from 9 volt battery
10. Design input selector with SMD relay
11. Design/modification 4th order anti-aliasing filter
12. Modification power supply on PCB
13. Documentation in the source code per code-line

Not within the scope of this assignment:
The GUI for interfacing the measured signals from the USB scope should be a simple as possible and is only required for validating the resulting measured signals.

Deliverables

The following products must be delivered during the assignment :

- A plan of approach with an analysis of what is needed to achieve the desired result within the first two weeks.
- Simulation models (if needed) (using CASPOC Simulations). (http://www.caspoc.com/support/download/)
- A new PCB design of the PC-Scope² (modifications on the PC-Scope[1])
- Final report in Paper format (not more than 6 pages), include additional Appendix I, II, III (this can be Simulations/PCB-Designs/Measurements/etc.) and all in one LaTaX file.
- Progress report from all students in a weekly progress format, all in one LaTaX file.
- All reporting is done online with Overleaf (LaTaX). (https://www.overleaf.com/) and the online files are shared with the mentors.
- All documents / designs / simulations are shared online trough Microsoft Teams. All organized within folders and sub-folders, all files should have a good name, version numbers and date stamps.
- Design a project poster on A1 format, this poster should be able to sell your product.
- YouTube recording with a step by step system overview, this should be an educative clip where you give a demonstration, use recorded material you gain during the weeks you work on this project.
- Use the PCB design and optimized code during a final demonstration and Power Point presentation in the assessment-week.

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