DISSERTATION

Cool Science

ausgeführt am Atominstitut

der Technische Universität Wien
Fakultät für Physik

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Matrikelnummer: 9-18-27-15-21-36

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Wien, am 01.04.2020

Contents

1 Cicero Word Generator

This chapter describes the installation and initial setup of Cicero Word Generator[1] on a PC running Windows 10 with analog and digital cards from National Instruments (NI). The code is freely available on Github[2]. This chapter contains only differences, problems, and possible solutions encountered when Cicero was installed for the PC 'Fritz Fantom' which will be used for the QuaK experiment. It is therefore advised to use the technical and user manual[3] in conjunction. The titles in this chapter and font style with `Courier` and **Boldface** was mirrored to fit the manual.

1.1 Installation of National Instruments drivers

Before setting up the Cicero Word Generator, it is necessary to install the newest .NET Framework[4] from Microsoft. For the first installation of NI drivers, NI-DAQmx (version 9.3), NI-VISA (newest version), and NI-4888.2 (newest version) should be downloaded from the National Instruments website[5]. When installing the NI drivers it is possible to get an 'Runtime Error!'. In this case it is necessary to set the Regional format settings of Windows 10 to 'English (United States)'[6].

1.2 Installation of National Instruments Cards

After installation of the necessary drivers, the physical cards can be inserted into the PCIe slots on the motherboard. On 'Fritz Fantom' the digital card (NI PCIe-6537B) was installed in PCIe bus 3 while the analog cards (NI PCIe-6738) were installed in PCIe bus 4 and 5.

1.3 Configuring Atticus

After installation of the NI cards, Atticus should be launched for the first time and closed without changing any settings. After this, the NI-DAQmx drivers should be

updated to the newest version. If version 9.3 was not used when launching Atticus in this step, it could result in an error. After this, "Configuring Atticus" on the user manual can be followed. The **Server Name** was set to 'Fritz_Phantom'. **Dev1** to **Dev3** were set in the same ascending order as the physical installation on the motherboard.

change server n in lab? Fantom Phantom

1.3.1 Configure hardware timing / synchronization

For synchronization, a **Shared Sample Clock** was used with **Dev1** being the master card. The settings are summarized in table 1.1 and table 1.2. For **Dev3** 'SampleClockExternalSource' should be set to '/Dev3/RTSI7'. The 'SampleClockRate' is set to 350 kHz since this is the fastest rate with all 32 analog channels active. It is possible to raise this to 1 MHz by only using 8 channels (1 channel per bank).

Table 1.1: Settings for **Dev1**.

Setting	Value
MasterTimebaseSource	
MySampleClockSource	DerivedFromMaster
SampleClockRate	350000
UsingVariabletimebase	False
SoftTriggerLast	True
StartTriggerType	SoftwareTrigger

Table 1.2: Settings for **Dev2**.

Setting	Value
MasterTimebaseSource	
MySampleClockSource	External
SampleClockExternalSource	/Dev2/RTSI7
SampleClockRate	350000
UsingVariabletimebase	False
SoftTriggerLast	False
StartTriggerType	SoftwareTrigger

1.4 Configuration and Basic Usage of Cicero

After setting up the Atticus server, Cicero can be configured. In step 3.c. it is necessary to write the full IP address and not 'localhost'. Once step 6 is finished, Cicero should run without any problems.

1.5 Saving of Settings and Sequences

The 'SettingsData' of the Server Atticus are saved in C:\Users\confetti\Documents \Cicero_Atticus\Cicero\SettingsData while the 'SequenceData' of Cicero are saved in C:\Users\confetti\Documents\Cicero_Atticus\Cicero\SequenceData.

1.6 Sequence length limit

The duration of a sequence is limited to $2^{32}/(16 * 32 * 350\,\mathrm{kHz}) = 23.967\,\mathrm{s}$ coming from a 32-bit application, 16 bit per channel, 32 channels in a NI PCIe-6738 card, and 350 kHz clock rate.

2 CRT handling

test

Todo list

References

[1] Aviv Keshet and Wolfgang Ketterle. "A Distributed, GUI-based, Computer Control System for Atomic Physics Experiments". In: *Review of Scientific Instruments* 84.1 (2013), p. 015105.

[2] Aviv Keshet. *The Cicero Word Generator*. URL: https://github.com/akeshet/Cicero-Word-Generator (visited on 02/20/2020).

[3] Aviv Keshet. *Cicero Word Generator Technical and User Manual*. URL: http://akeshet.github.io/Cicero-Word-Generator/Cicero%20Technical%20and%20User%20Manual.pdf (visited on 02/24/2020).

[4] Microsoft. *Download .NET (Linux, macOS, and Windows)*. URL: https://dotnet.microsoft.com/download (visited on 02/24/2020).

[5] National Instruments. *NI Driver Downloads - National Instruments*. URL: https://www.ni.com/en-us/support/downloads/drivers.html (visited on 02/24/2020).

[6] National Instruments. *NI Software Gives C++ Runtime Error "Terminated in an Unusual Way" - National Instruments*. URL: https://knowledge.ni.com/KnowledgeArticleDetails?id=kA00Z0000019YOnSAM&l=en-US (visited on 02/24/2020).