

Acquisition card : VKinging DAQ

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2026

1 Acquisition card

The acquisition card is what allows us to obtain data from the photodiode (detection). This card is a VE3664N from the brand Vkinging (4 analog inputs and 8 digital input/output). All technical specifications are provided in the file “VE3664N Hardware manual.pdf”. The advantage of this card is its resolution, which can be higher than the RedPitaya (24 bits versus 16 bits). This resolution depends on the sampling frequency. Since the frequency of the signal received from the photodiode is around 100 Hz, we therefore choose a sampling frequency of 3 kHz, which gives an effective resolution of 21 bits. The background noise, depends on the acquisition range that is selected. By choosing a range of ± 500 , mV, the systematic noise is 15 , μ V.

2 Hardware installation

Before starting the card configuration, we review the hardware setup. The card is connected to the computer with an Ethernet cable. The card must be powered with a voltage between 8 and 24 V on the + and – terminals on the back of the card. When the card is powered and connected to the computer, the green indicator LED turns on.

To enable acquisition from a trigger signal, two wires are soldered to an SMA connector. The two wires are connected to the digital input/output DIO1 (red) and to ground (black). The SMA connector is then used to make contact with the trigger source.



Figure 1: Top view of the VkDaq card

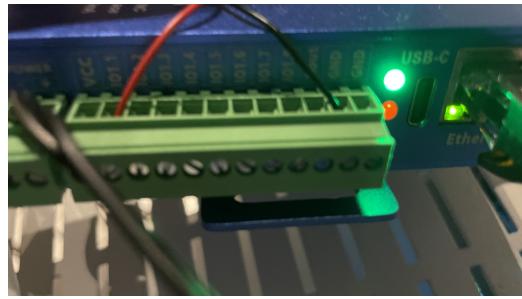


Figure 2: Back side of the VkDaq card

3 Linux Device Assistant Installation and Configuration

To operate the card on a Linux–Ubuntu computer, follow the instructions below:

Go to the Vkinging website: <https://www.vkinging.com/productinfo/5931040.html>. And download the three ‘.zip’ files. These files contain additional user manuals (notably for a Windows installation and for the software).

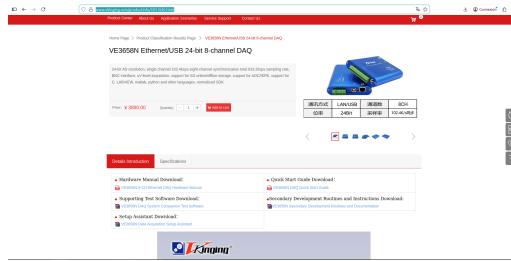


Figure 3: Screenshot VKinging website

We use the card connected to the computer via an Ethernet cable to retrieve the data, and a power supply between 8 and 24 V to power the card. The computer must detect the card via a driver installed on the system.

3.1 Preparation Before Installation

Based on the **arm64 Ubuntu 20.04** distribution, run the following command:

```
sudo add-apt-repository ppa:okirby/qt6-backports
```

Other Ubuntu distributions do not require this step.

3.2 Install the Device Assistant

In the file *“Data Acquisition Setup Assistant”*, navigate to the *“linux installer”* directory, then extract the package corresponding to the appropriate Ubuntu version into the path ***/opt/** (very important).

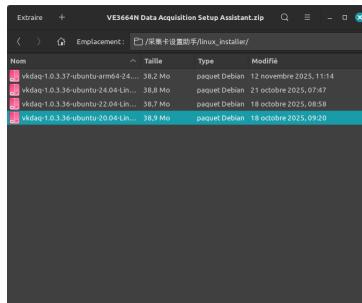


Figure 4: Screenshot of the ”linux installer” folder

Inside, there is a folder named “vkdaq”, which is organized as follows:

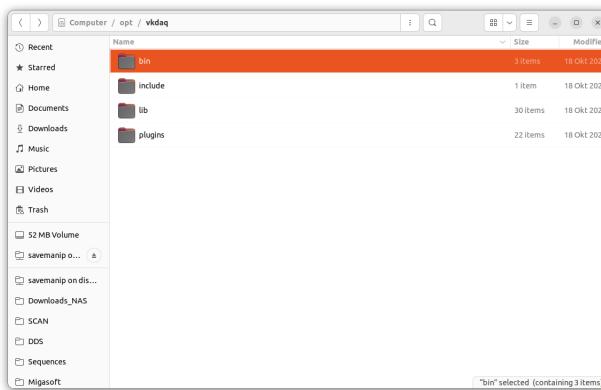


Figure 5: Screenshot of the ”vkdaq” folder inside ”/opt/”

In the “bin” directory, execute the program “VkDaqAssistant”:

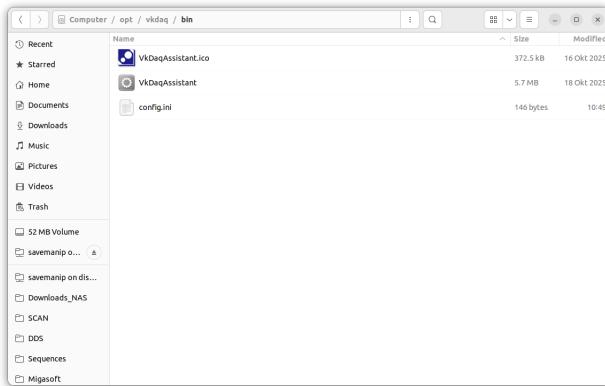


Figure 6: Screenshot of the "bin" folder

```
sudo ./VkDaqAssistant
```

The software should work, but there is no acquisition card recognized.

3.3 Ethernet Configuration

That's why we configure the Ethernet interface connected to the device as follows:

- IPv4 Method: Manual
- IP Address: 192.168.1.whatever you want
- Netmask: 255.255.255.0

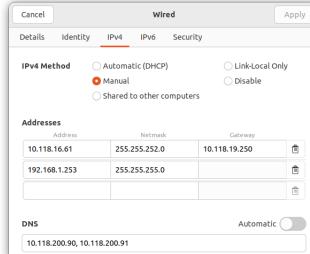


Figure 7: Screenshot of the IP address configuration

In this way, the computer can recognize all devices of the type "192.168.1.*" and therefore the acquisition card. Click on "refresh", and the card should appear in the "VkDaqAssistant" software.

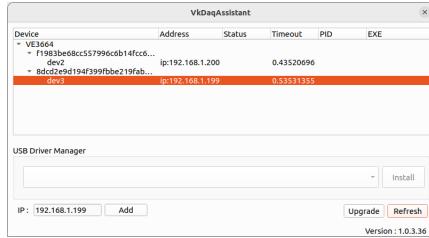


Figure 8: Screenshot of the "VkDaqAssistant" software (2 devices detected)

By double-clicking on the name of the card in the "device" window (dev1 highlighted), it is possible to change its name. It is also possible to change the IP address by double-clicking on the IP address highlighted. The default address is "192.168.1.199".

4 Python interfacing

To send commands and receive the acquired data, we use the manufacturer-developed Python library "libvkdaq.py". All information regarding the functions, their purposes, and how to use them is compiled in the file "libvkdaq-en.pdf". There is an example Python program that presents some essential functions and helps to understand how they are used. To interface with Python, follow the instructions below:

4.1 Using libvkdaq

Header file path:

```
/opt/vkdaq/include/libvkdaq.h
```

Library file path:

```
/opt/vkdaq/lib/libvkdaq.so
```

Additional required library:

```
/opt/vkdaq/lib/libstdc++.so.6
```

When using the library, either explicitly link the above paths or add `/opt/vkdaq/lib` to the system library search path. To do this we execute:

```
sudo nano ~/.bashrc
```

After the last line of the displayed program, add:

```
export LD_LIBRARY_PATH=/opt/vkdaq/lib:$LD_LIBRARY_PATH
```

Close the programm and execute:

```
source ~/.bashrc
```

After this, `libstdc++.so.6` will be correctly linked and no GLIBCXX compatibility issues will occur. Now that the file path is set up for the compiler, locate the file "libvkdaq.py". At the line:

```
vkdaq_home = os.getenv( 'VKDAQ_HOME' )
```

Replace by :

```
vkdaq_home = os.getenv( 'VKDAQ_HOME' ,” / opt/vkdaq/lib ”)
```

4.2 Assistant Configuration

Configuration file path:

```
/opt/vkdaq/bin/config.ini
```

5 Conclusion

Once all these steps have been completed, the VkDaq acquisition card is recognized by the computer, and it is possible to communicate with it by using Python code that uses “libvkdaq.py”. There are example Python scripts to start acquisitions in the “Examples” folder, as well as a more concrete use of the VkDaq card in the MIGA2 experiment.

By using the acquisition and sequencing software “MIGA Controller”, it is possible to launch an experimental sequence from a .mot file, visualize the data acquired by the card for each sequence, and analyze the acquired data. The details of the “MIGA Controller” software are available on the GitHub page: <https://github.com/Quantum00man/MIGA-controller>.