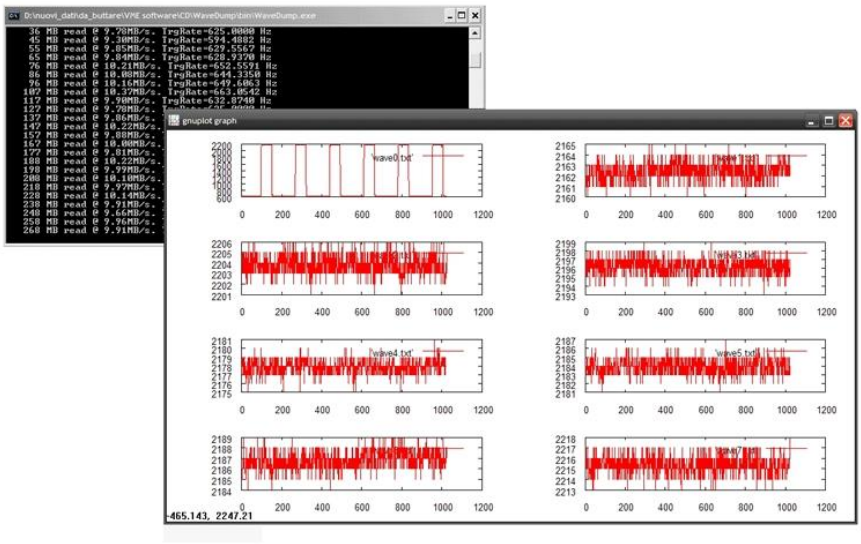
CAEN
Tools for Discovery

Electronic Instrumentation



Guide GD2483

WaveDump

The QuickStart Guide with step-by-step instructions

Rev. 5 - February 13th, 2018

Purpose of this Guide

This QuickStart Guide contains the basic information and commands that will let you use WaveDump in few steps.

Change Document Record

Date	Revision	Changes
October 18th, 2010	00	Initial release.
April 6th, 2011	01	Revised all chapters, new document format
March 1st, 2012	02	Revised Chap. **1**
June 7th, 2012	03	Updated Sect.. **System Requirements & Installation Setup**
May 31st, 2017	04	Updated Sect.. **System Requirements & Installation Setup** Revised and updated Chap. **3**
February 13th, 2018	05	Updated Chap. **3**.Added Chap. **4**.

Symbols, abbreviated terms and notation

DPP	Digital Pulse Processing
FFT	Fast Fourier Transform
SBC	Single Board Computer

Reference Document

[RD1] User Manual UM1935 - CAENComm User & Reference Manual

[RD2] Application Note AN2472 - CONET1 to CONET2 migration

[RD3] User Manual UM2091 - WaveDump User Manual

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1 Introduction

This *WaveDump Quick Start Guide* contains the basic information and commands to use *WaveDump* in few steps.

WaveDump is a C-based console application developed to control a wide selection of CAEN digitizer models running the waveform recording firmware. Digitizers running CAEN special Digital Pulse Processing (DPP) firmware must be controlled by dedicated readout software, as indicated in the relevant DPP web page.

WaveDump has been thought to demonstrate the use of CAEN libraries and methods for an efficient readout and data analysis. Besides being a ready to use software, WaveDump is povided with C source files and Visual Studio project to let the users customize the code for personalized solutions.

System Requirements & Installation Setup

OS	CAEN Library required	Third-party software required
Windows	CAENDigitizer CAENComm (rel. 1.0 or later) CAENVMELib	n/a
Linux	CAENDigitizer CAENComm (rel. 1.0 or later) CAENVMELib	gnuplot

Tab. 1.1: host PC requirements

First, be sure to have installed all the third-party software listed in the **Tab. 1.1**, then:

- go to WaveDump web page.
- Download the WaveDump software package related to your OS in the “Download” area.
- Uncompress the downloaded package.
- **For Windows users:** launch the WaveDump Setup executable file and follow the installer instructions.

Note: WaveDump for Windows OS is a standalone version which installs locally all the required libraries (see **Tab. 1.1**) and doesn’t need them to be installed apart by the user.

- **For Linux users:** before to install the CAEN WaveDump, the installation of the CAEN required libraries is needed (see **Tab. 1.1**). Click on the red link above the CAEN WaveDump package and download one by one. Install the required libraries starting with CAENVMELib, then CAENComm, finally CAENDigitizer. Now, install WaveDump following the instructions in the INSTALL file.

Figure 1: Additional CAEN libraries required by Wavedump to be installed apart in Linux environment

2 Board Connection

CAEN digitizers can be connected to the host PC through the three following ways.

Direct Link to the Module via USB

Desktop and NIM versions can be directly handled via USB, just connecting the digitizer to the host PC via the USB cable (the USB driver is available on Digitizer web page)

Direct Link to the Module via Optical Link

Every CAEN digitizer can be controlled directly via Optical Link; for this purpose, a CAEN PCI or PCIe controller (Mod. A2818 and A3818) is required. See the web pages of A2818/A3818 for more info.

In this case, the unit must be connected to the featured controller via the optical fibre cable (see the Ordering Options of the controller).

Link through a VME Bridge

VME Digitizer Boards can be controlled via VMEbus through a VME Bridge.

Two CAEN bridges are available:

V1718 / VX1718 with USB interface (requiring just a host PC with a free USB port)	**V2718 / VX2718** with Optical Link (requiring Mod. A3818 or A2818 controller)

Tab. 2.1: CAEN Bridges

Note: If you want to use a VME bridge from another manufacturer or a SBC, you must provide a CAENComm-like library. Please refer to the Application Notes AN2472 **[RD2]**.

3 Getting Started

This section will help you to understand the main features of *WaveDump* step by step: from the start-up to the first acquisition.

As an example, we feed a **DT5761 digitizer** with exponential pulses with amplitude 70 mV, rise time 0.1 us and decay time 0.1 us; the pulses have frequency 10 kHz. We use a direct USB link between digitizer and PC.

If you can use the same signal, follow this guide, otherwise try to fit these tips to your set-up.

Figure 2: CAEN DT5761 digitizer

WaveDump Configuration File Overview

Turn on the digitizer and connect your pulse generator to the channel 0 of the digitizer.

WaveDump installation directory includes different configuration text files, each one containing a list of the relevant parameters for the data acquisition:

- ***WaveDumpConfig.txt***
- ***WaveDumpConfig_X740.txt***
- ***WaveDumpConfig_X742.txt***

They are in thel ***WaveDump\bin*** subfolder.

The *WaveDumpConfig_X742.txt* file must be edited only if working with a digitizer of the 742 family; once launched, WaveDump will directly read from the file and program the target digitizer accordingly.

The *WaveDumpConfig_X740.txt* file or the *WaveDumpConfig.txt* file can be alternatively used if working with a digitizer of the 740 family; *WaveDumpConfig_X740.txt* file contains the set of parameters which specifically apply to these digitizers and must be renamed to WaveDumpConfig.txt to be read by the software.

In case of digitizers different from x742, that is the example of this chapter, the file named *WaveDumpConfig.txt* must be used.

The configuration file is divided in two Sections: *Common* and *Individual Settings*.

Common Settings are the ones common to all the channels of the digitizer.

Individual Settings[1] are the ones related to a single channel of the digitizer.

Please, note that some settings in the common section can be overwritten by the corresponding settings in the Individual section.

[1] If you are using a digitizer of the x740 family, the *Individual Settings* are referred to a group of channels, not to the single channels. This means that, for example, if you enable the group [0], channels from 0 to 7 will be enabled. In this case, you should use for each group the `GROUP_TRG_ENABLE_MASK` command that is the hex mask used to select the channels inside the group which will take part to the board auto trigger. For more details refer to the WaveDump User Manual **[RD3]**.

In our example, the main configurations are:

In the Common Section:

```
[COMMON]
# OPEN: open the digitizer
OPEN USB 0 0
...
# RECORD_LENGTH = number of samples in the acquisition window
RECORD_LENGTH 7000
...
# EXTERNAL_TRIGGER: external trigger input settings.
EXTERNAL_TRIGGER DISABLED



# MAX_NUM_EVENTS_BLT: maximum number of events to read out in one Block
#Transfer. Higher values may lead to higher readout bandwidth, requiring
#more memory allocation for the block transfer.
# options: 1 to 1023
MAX_NUM_EVENTS_BLT   100
...
# POST_TRIGGER: post trigger size in percent of the whole acquisition window
# options: 0 to 100
POST_TRIGGER  80
```

In the Individual Section:

- If you are using the `DC_OFFSET` option (absolute trigger threshold):

```
[0]
ENABLE_INPUT YES
PULSE_POLARITY   NEGATIVE
DC_OFFSET -25
TRIGGER_THRESHOLD 850
CHANNEL_TRIGGER ACQUISITION_ONLY
...
```

- If you are using the `BASELINE_SHIFT` option (trigger threshold relative to the baseline), the equivalent configuration is:

```
[0]
ENABLE_INPUT YES
PULSE_POLARITY   NEGATIVE
BASELINE SHIFT 11
TRIGGER_THRESHOLD 50
CHANNEL_TRIGGER ACQUISITION_ONLY
...
```

Signal Acquisition

Launch the executable file ***WaveDump.exe***. After the start up, WaveDump reads the configuration file and sets the parameters on the board.

A command shell will appear showing the firmware release loaded on the digitizer and the main control commands.

Press "`Space`" to visualize all the available commands.

If you want to start the acquisition press "`s`". On the digitizer's front panel the "RUN" LED should be on.

At this point you may observe two different messages on the screen:

1. A message "`No Data`". This means that the board is not triggering. On the digitizer's front panel the "TRG" LED should be off.

2. A successful acquisition message "`Reading at xx MB/s (Trg Rate: yy Hz)`". This means that the digitizer is triggering correctly. Both RUN and TRG LEDs should be on.

In the first case Channel 0 is not triggering. This can be due to an incorrect trigger threshold setting or to the dynamic range of the signal that does not match the input dynamic range of the digitizer.

To visualize an acquisition window press "`T`" and "`p`": the first command enables the continuous Software Trigger, while the second one plots one acquired event.

Considering the baseline (or the saturation) and the `PULSE_POLARITY` of your signal, set suitable values of `DC_OFFSET` (or `BASELINE_SHIFT`) and `TRIGGER_THRESHOLD` in the Individual Section of the configuration file.

Press "`R`" in the *WaveDump* shell to reload the parameters and see if Channel 0 is now triggering.

With our set-up, we obtain a plot like in **Figure 3**.

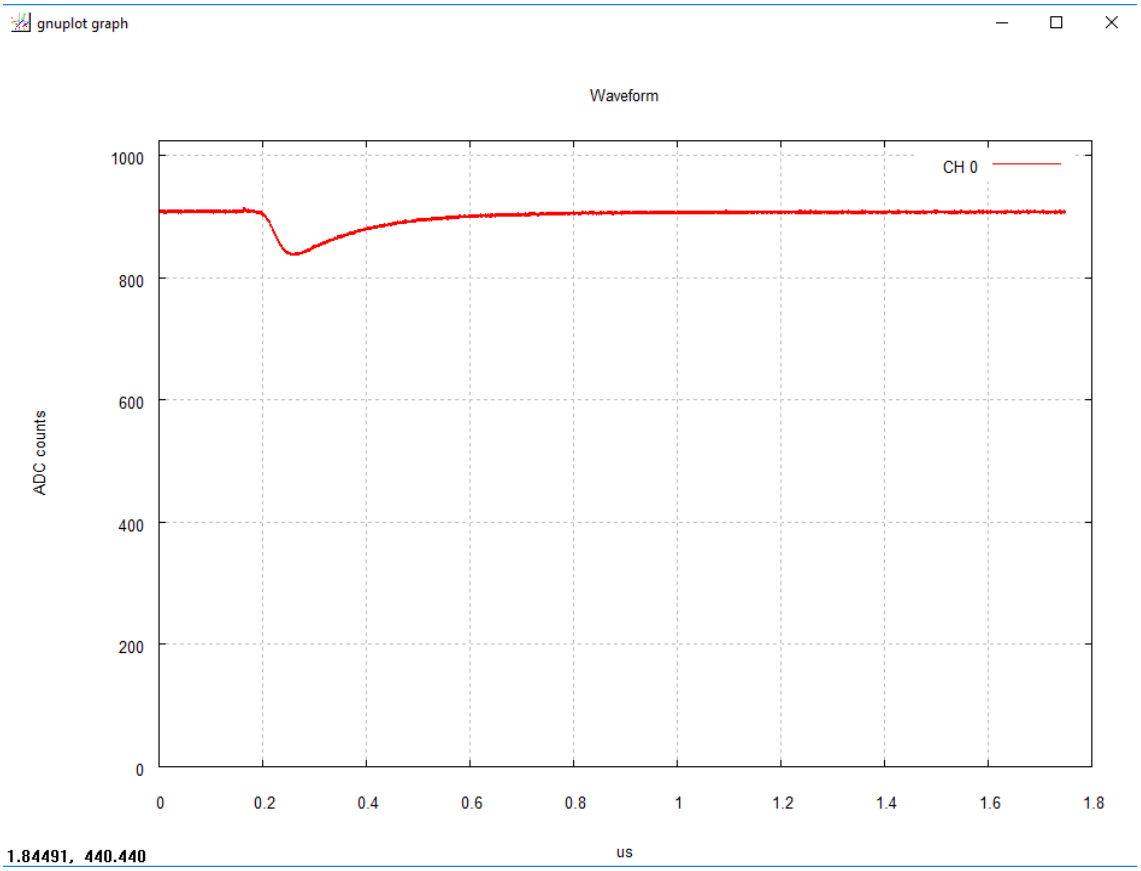

Figure 3: Gnuplot window showing acquired data

Try to change some other parameter until you are satisfied with your configuration.

WaveDump features two more acquisition modes: **Samples Amplitude Histogram** and **FFT**.

Press "h" and *Gnuplot* will show you the histogram of the samples amplitude. With our set-up, we obtain a plot like **Figure 4**.

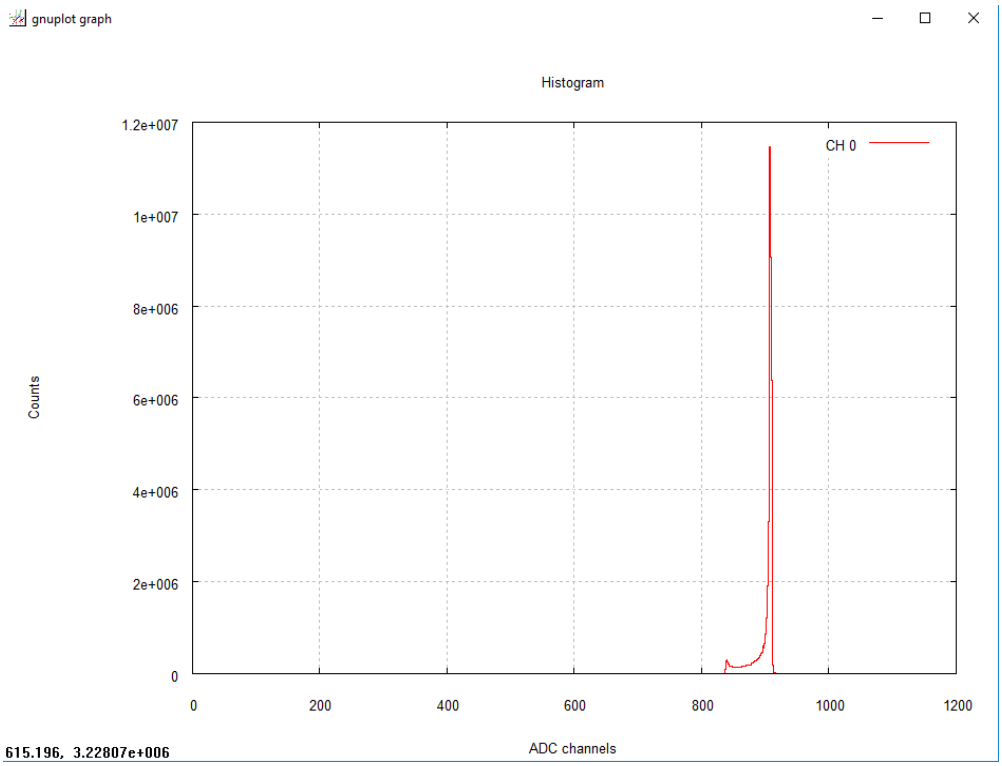

Figure 4: Gnuplot window showing the histogram of the samples amplitude

Press "f" and the *Gnuplot* will show the Fast Fourier Transform of your signal. With our set-up, we obtain a plot like **Figure 5**

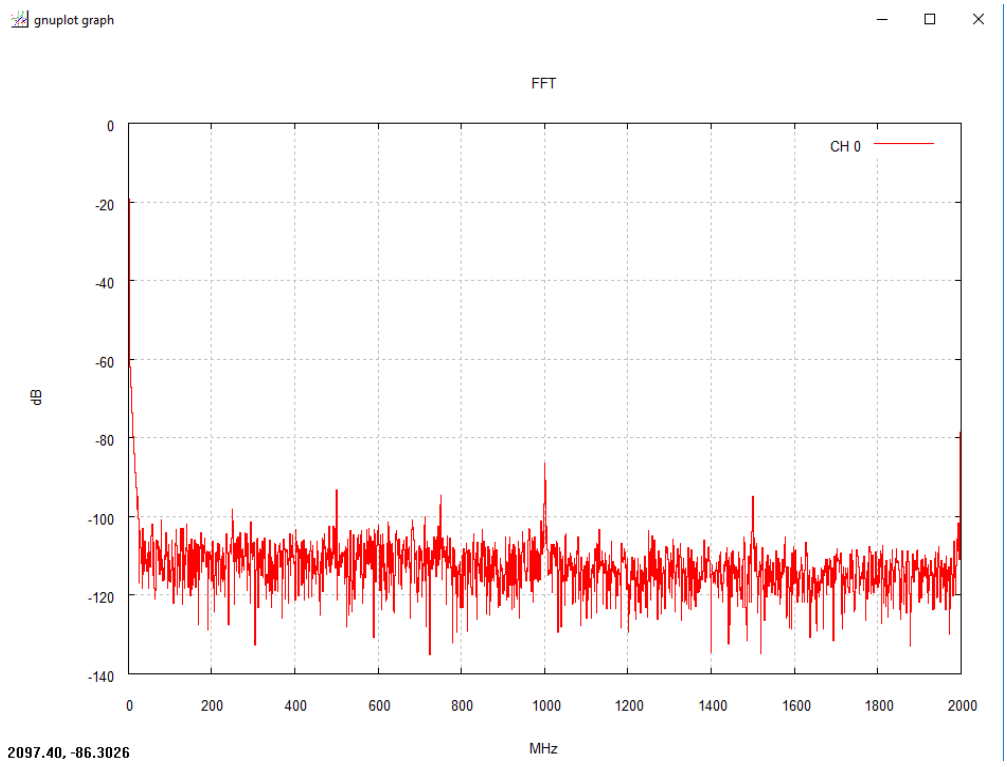

Figure 5: Gnuplot window showing the FFT of the signal in **Figure 3**

Saving Data to File

To enable the record of the data to file, press "w" or "W": The first choice will save only an acquisition window (i.e. one event), the latter will save data continuously. The data will be saved in the format set in the configuration file; ASCII in our case. The option OUTPUT_FILE_HEADER in the configuration file allows to include, in the output file, a header for each acquired event.

To interrupt the acquisition, press “s” and then “q” to quit. In the same folder, you will find a file called ***wave0.txt*** with all the data ready for a further analysis.

4 Technical Support

CAEN experts can provide technical support at the e-mail addresses below:

support.nuclear@caen.it
(for questions about the hardware)

support.computing@caen.it
(for questions about software and libraries)

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