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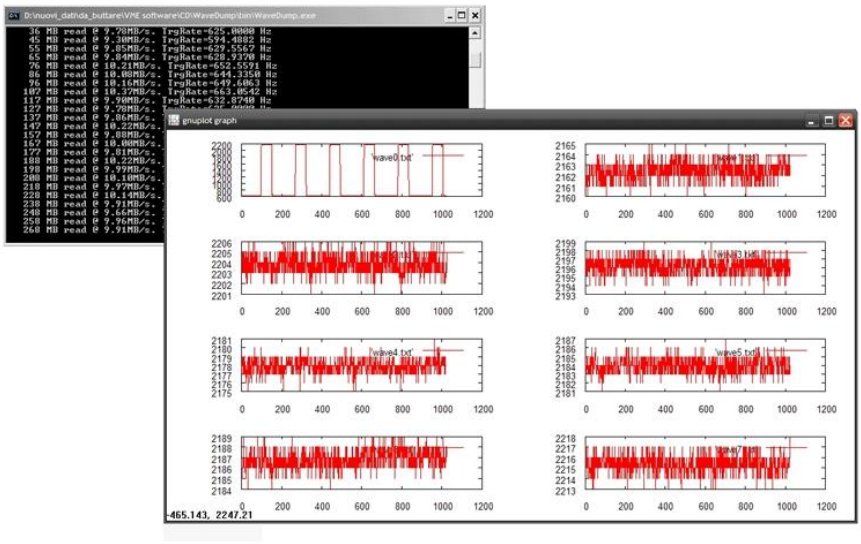
Electronic Instrumentation



GD2483

WaveDump QuickStart Guide

Rev. 8 - September 3rd, 2021

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
Oct 18th, 2010	00	Initial release.
Apr 6th, 2011	01	Revised all chapters, new document format.
Mar 1st, 2012	02	Revised Chap. **1**.
Jun 7th, 2012	03	Updated Sec. **System Requirements & Installation Setup**.
May 31st, 2017	04	Updated Sec. **System Requirements & Installation Setup**. Revised and updated Chap. **3**.
Feb 13th, 2018	05	Updated Chap. **3**.Added Chap. **4**.
Dec 17th, 2018	06	Updated Chap. **3**. Changed BASELINE_SHIFT with BASELINE_LEVEL.
Nov 8th, 2019	07	Updated Sec. **System Requirements & Installation Setup** and Chap. **4**.
Sep 3rd, 2021	08	Added support to A4818 controller in Sec. **Direct Link to the Module via Optical Link** and V3718, V4718 Bridge in Sec. **Link through a VME Bridge**. Updated Sec. **Saving Data to File**.

Symbols, abbreviated terms and notation

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

Reference Document

[RD1] UM1935 - CAENComm User & Reference Manual

[RD2] AN2472 - CONET1 to CONET2 migration

[RD3] UM2091 - WaveDump User Manual

All documents can be downloaded from: https://www.caen.it/support-services/documentation-area/

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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 (consult **[RD3]**). 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 provided 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 **Tab. 1.1**, then:

- go to WaveDump software web page;
- go to the "Downloads" page and download the software package related to your OS in the Software tab;
- 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 on **Tab. 1.1**. The user must only install the driver for the desired communication link.

- **for Linux users:** before installing the CAEN WaveDump, install the CAEN required libraries in **Tab. 1.1**. Then, Install WaveDump following the instructions in the INSTALL file.

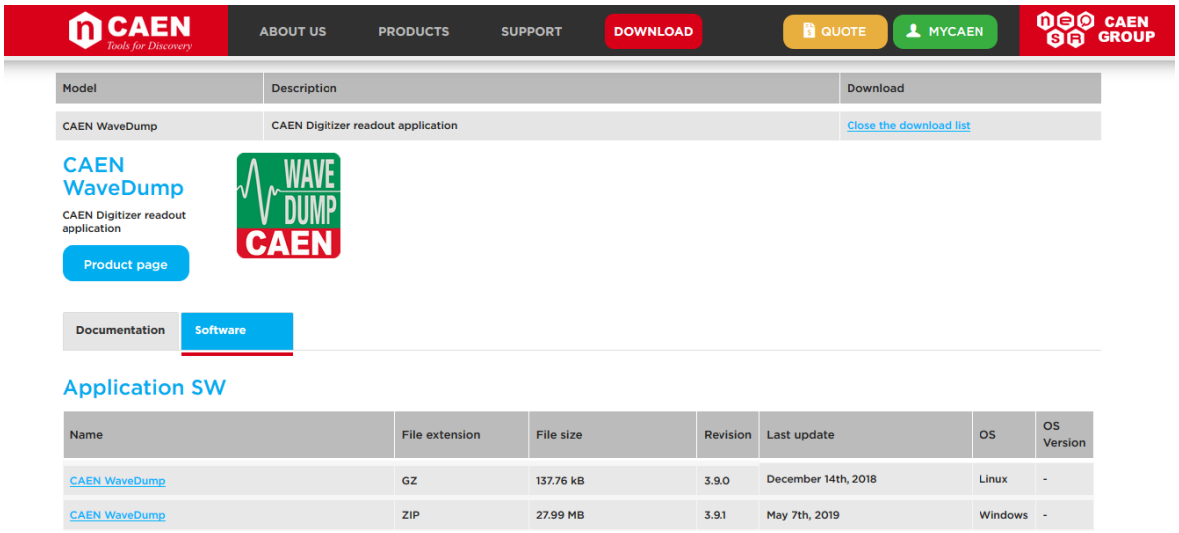

Figure 1.1: WaveDump software download page

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) or an A4818 USB 3.0 to optical link adapter is required. See the web pages of A2818/A3818/A4818 for more info.

In this case, the digitizer unit must be connected to the featured controller via the optical fibre cable (see the Accessories related to the controller).

Link through a VME Bridge

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

Four CAEN bridges are available:

V1718 / VX1718 with USB interface (OBSOLETE)	**V2718 / VX2718** with Optical Link interface (OBSOLETE)
	
V3718 / VX3718 with USB and Optical Link interface	**V4718 / VX4718** with USB 3.0, Optical Link and Ethernet interface
	

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 3.1: 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 the ***WaveDump\bin*** subfolder.

At start-up, WaveDump always parses the file named *WaveDumpConfig.txt*, then it recognizes the kind of the target digitizer.

The user must set all the parameters by editing the file named *WaveDumpConfig.txt* in case of any digitizer different from x740 and x742.

In case of a digitizer of the 742 family, the user must edit only the connection parameters (OPEN) in the *WaveDumpConfig.txt*, while all other parameters must be edited in *WaveDumpConfig_x742.txt*. Once launched, WaveDump recognizes the x742 and will directly read from this latter file to program the target digitizer accordingly.

In case of a digitizer of the 740 family, the user must edit only the connection parameters (OPEN) in the *WaveDumpConfig.txt*, while all other parameters must be edited in *WaveDumpConfig_x740.txt*. Once launched, WaveDump recognizes the x740 and will directly read from this latter file to program the target digitizer accordingly.

Note: In addition to the parameters present in the default configuration files, there is a set of further permitted parameters that the user can add. For the list of these parameters, please consult the WaveDump User Manual **[RD3]**.

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

Common Settings are the ones common to all 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.

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


...


# POST_TRIGGER: post trigger size in percent of the whole acquisition window
# options: 0 to 100
POST_TRIGGER  80
...
```

To handle the readout rate, you can choose to add the `MAX_NUM_EVENTS_BLT` setting, which is not present in the default configuration text file. It sets the number of events to read out per single Block Transfer (value range is 0:1023). The higher the value of this setting, the higher the readout bandwidth, requiring more memory allocation for the block transfer.

```
MAX_NUM_EVENTS_BLT   100
```

[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 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
...
```

Note: The DC_OFFSET setting is not included in the default configuration text file, but it can be added by the user (reference to document **[RD3]**).

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

```
[0]
ENABLE_INPUT YES
PULSE_POLARITY   NEGATIVE
BASELINE_LEVEL 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_LEVEL`) 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 that shown in **Figure 3.2**.

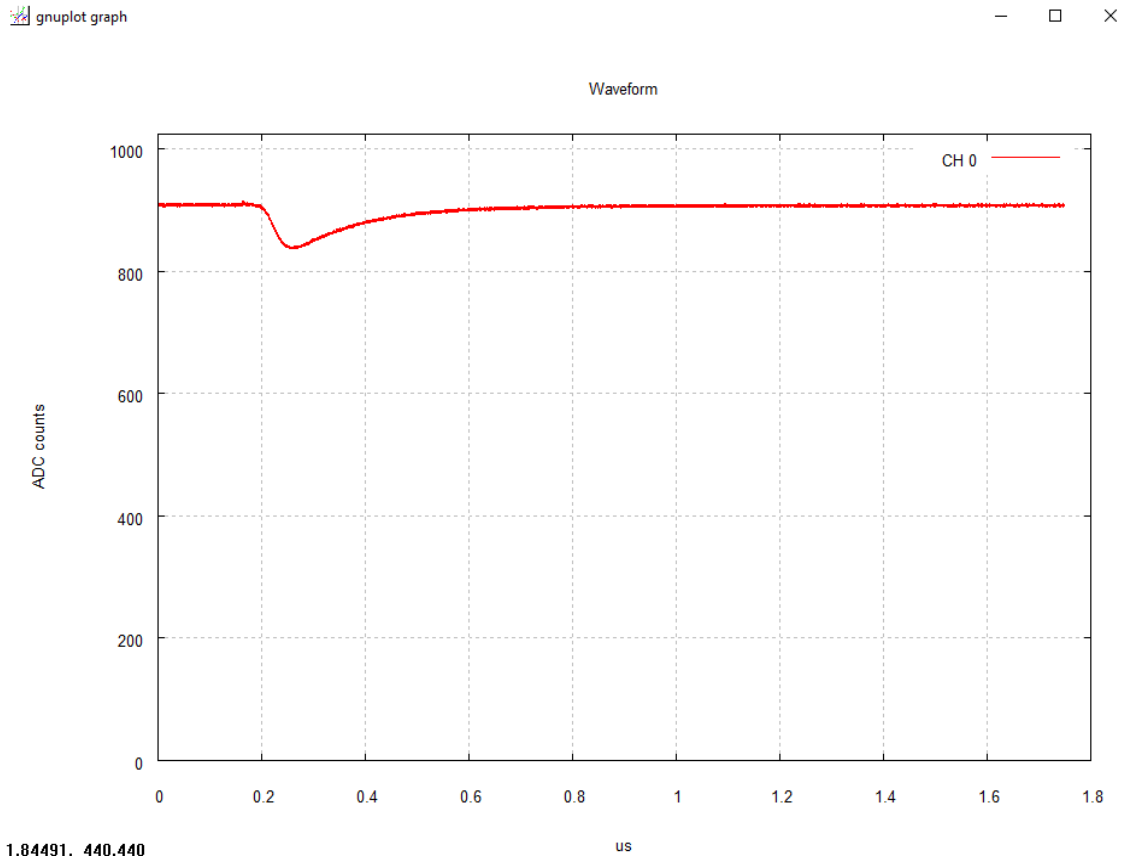

Figure 3.2: Gnuplot window showing acquired data

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

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

Press "h" (after selecting the WaveDump console window) and *Gnuplot* will show you the histogram of the sample amplitude. With our set-up, we obtain a plot like that shown in **Figure 3.3**.

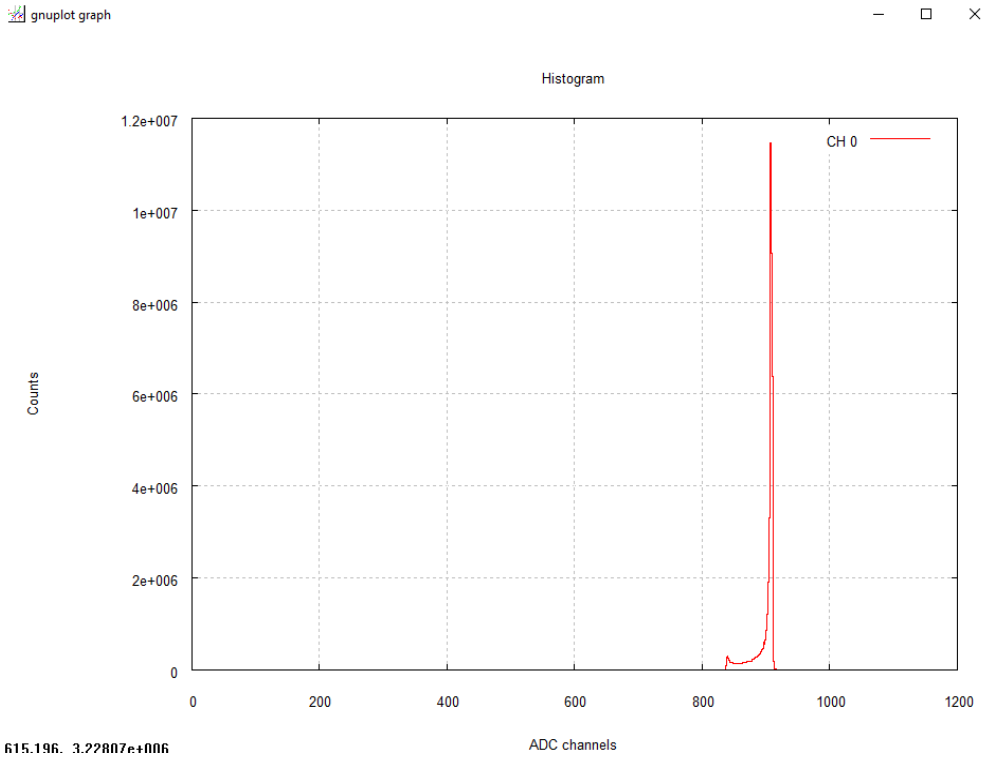

Figure 3.3: Gnuplot window showing the histogram of the sample amplitude

Press "f" (after selecting the WaveDump console window) and the *Gnuplot* will show the Fast Fourier Transform of your signal. With our set-up, we obtain a plot like that shown in **Figure 3.4**.

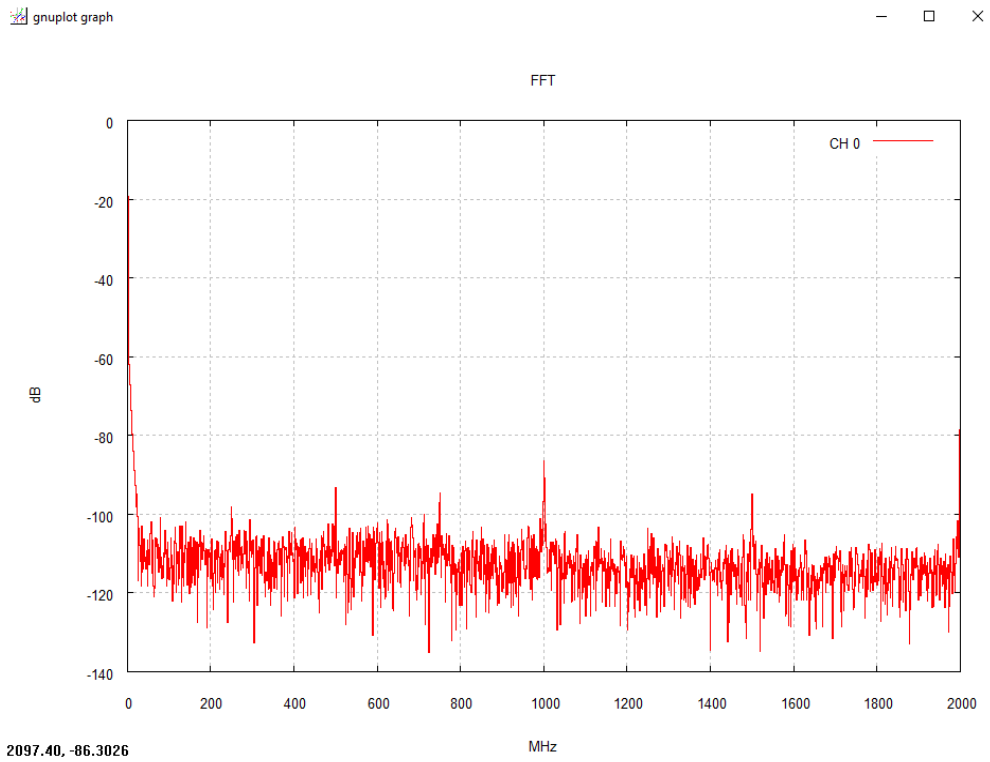

Figure 3.4: Gnuplot window showing the FFT of the signal in **Figure 3.2**.

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 inside 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. A file called ***wave0.txt*** with all the data ready for a further analysis is produced.

For Windows OS, and starting from rel. 3.10.2 of the WaveDump software, data files are saved at the following path:

- *C:\Users\UserName\WaveDump*

For Linux OS, data are directly saved inside the WaveDump software folder.

To interrupt the acquisition, press “s” and then “q” to quit.

4 Technical Support

CAEN makes available the technical support of its specialists for requests concerning the software and hardware. Use the support form available at the following link:

https://www.caen.it/support-services/support-form/

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