Using more than one eONE-XV for measuring current on the same experiment

1 Installing EDR and EDA

EDR (Elements Data Reader) is the software that can be used to read data acquired from Elements devices.

The installer can be downloaded from Elements' website http://elements-ic.com/downloads/: EDR3 & EDA.

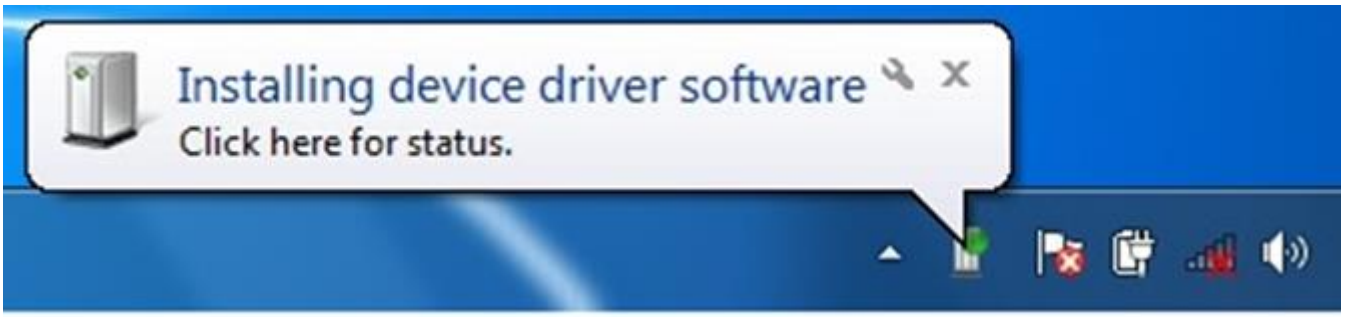
The installation will also install EDA (Elements Data Analyzer) which can be used to process saved data offline.

NOTE: the procedure described in this guide will work only with EDR version 3.6.31 or newer.

Do not run EDR yet, until explicitly said in this guide

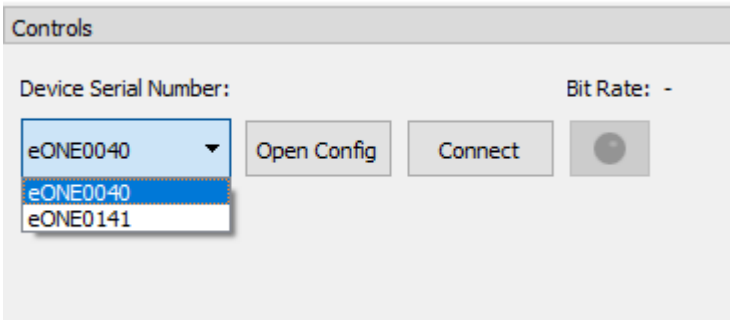
1.1 Installing FTDI USB drivers

The installation will also install the drivers needed to communicate with the devices via the USB connection. At the end of the installation the devices need to be plugged in for Windows to recognize them:



In the meanwhile, DO NOT RUN EDR SOFTWARE, as this can lead to an anomalous driver installation and may require uninstalling/reinstalling the drivers.

When the driver installation has finished open EDR and check that it recognizes your devices in the upper-left corner

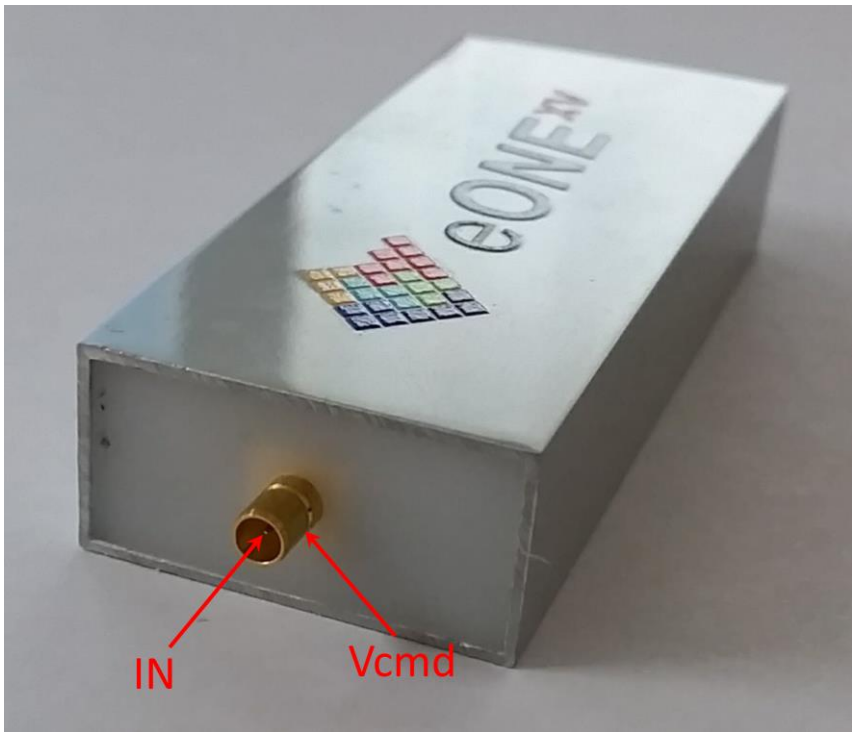


NOTE: In this case 2 eONE are connected with serial numbers eONE0040 and eONE 0141. Both will record one current channel each, but only one of them will control the voltage protocol applied, and this is just the right time to decide which one. In this guide eONE0141 will be used to apply the voltage protocols (will be referred to as curr_and_volt_dev), while eONE0040 will only be used to record one current channel (will be referred to as curr_only_dev).

2 Setting up your experiment

The devices must be properly connected in order to be able to measure currents in a reliable way.

The figures below show the available connections on each device, in particular:



IN: this is the node in which the current is measured.

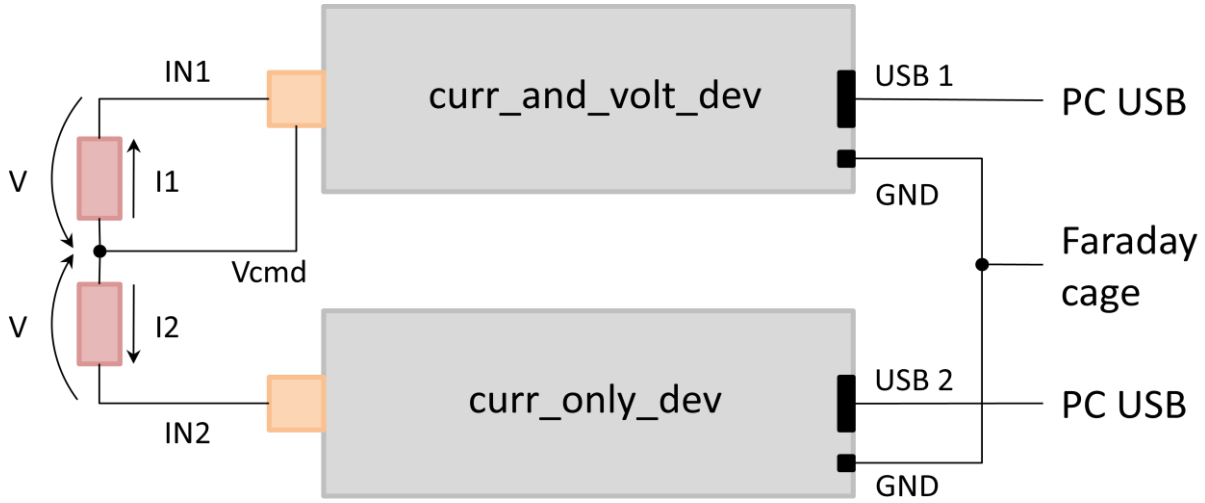
Vcmd: this is the node used to apply the voltage protocol.

GND: this is the ground node.

USB: this the USB connector.

The 2 devices should be connected as shown in the scheme below, where V is the voltage applied, I1 and I2 are the currents read by the 2 devices and the 2 red rectangles on the left represent the loads under test.

NOTE: putting the whole setup within a faraday cage connected to the GND pins of both devices can greatly reduce the amount of environmental noise recorded.

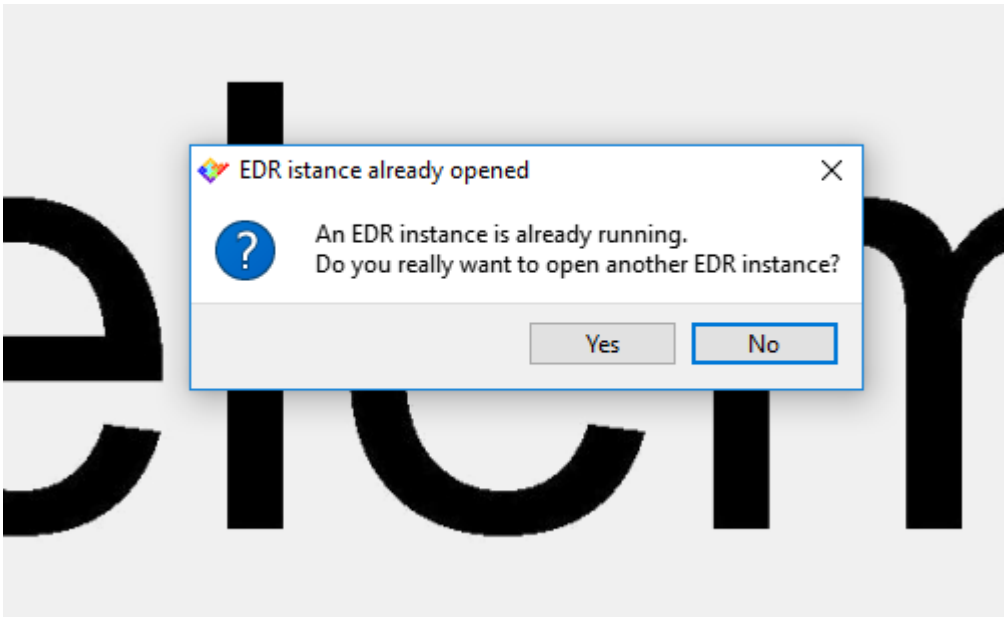


3 Using EDR to record an experiment

3.1 Connecting to the devices

Run EDR and as soon as the devices are recognized select your curr_and_volt_dev and press connect.

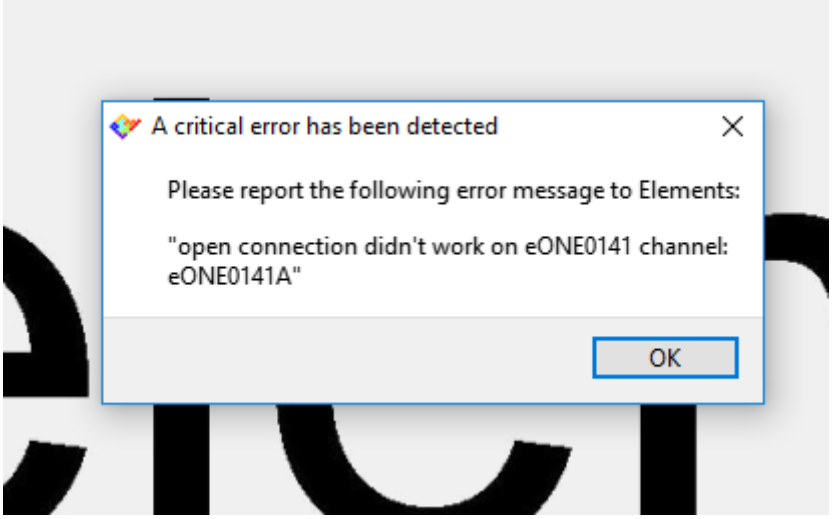
Open a second EDR instance. Upon running EDR for the second time theedr following dialog box will pop up:



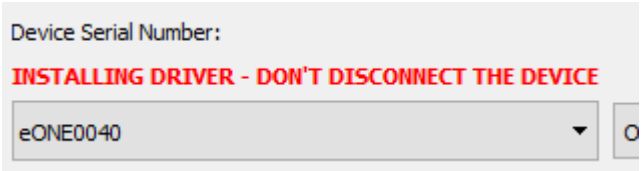
Answer yes to proceed, select your curr_only_dev and press connect.

3.1.1 *Trouble-shooting*

1. If the following dialog box pops up just click OK, then close and re-open the EDR instance that created it:



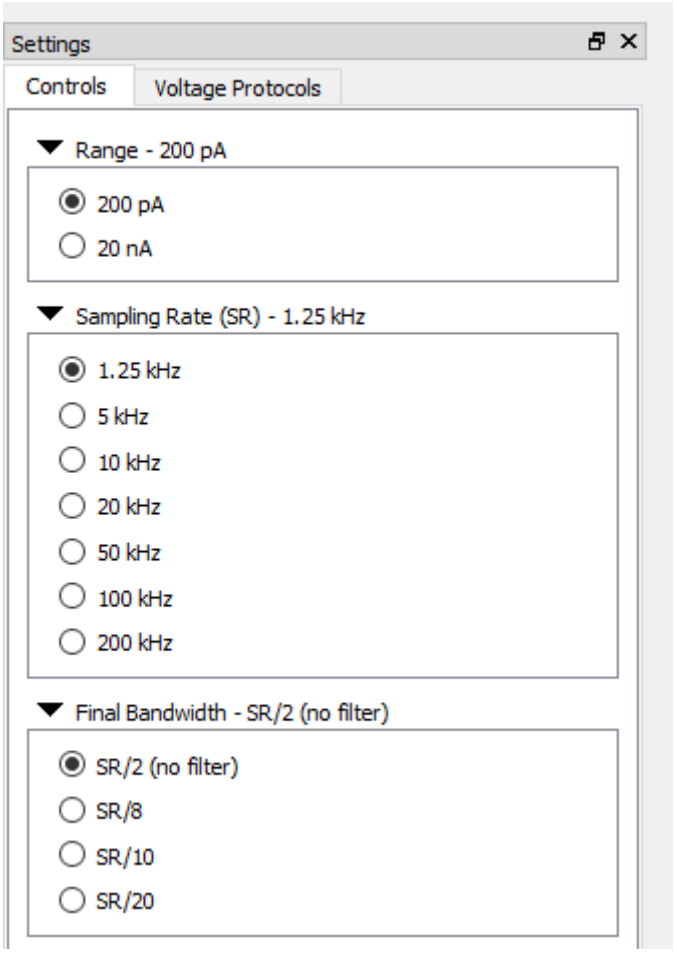
2. The following message may appear due to USB management conflicts:



This may happen on an EDR instance when another instance is already connected to a device: pressing the Disconnect button on the latter should make the message disappear. Afterwards each EDR instance can be connected to its device.

3.2 Setting up the devices controls

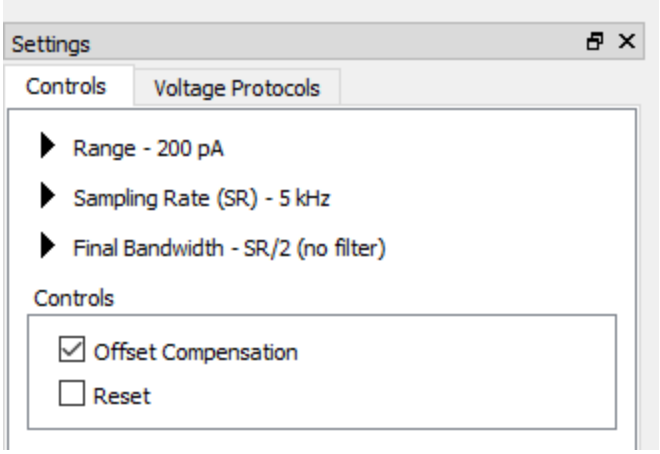
Select the current range, the sampling rate and the final bandwidth (filtering) through the radio buttons in the Controls tab.



NOTE: in order to merge correctly the currents recorded from the 2 devices into a single synchronized data file the current range and the sampling rate must be the same for both devices and thus must be configured equally on both EDR instances.

3.3 Digital offset compensation

After connecting the loads to the devices there can be a contact voltage drop. This offset can be compensated by clicking the Offset Compensation button on the lower part of the Control tab:

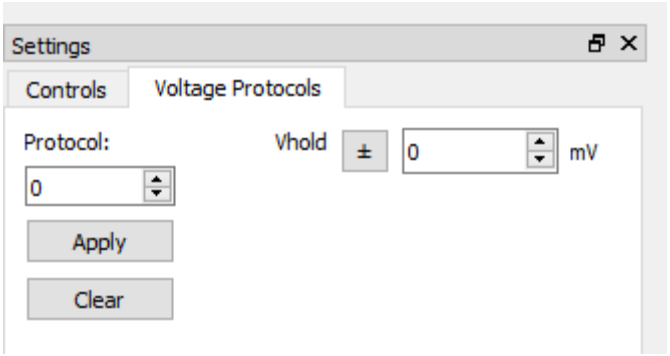


Tick the box until the current plot reaches the zero, and then untick it.

NOTE: the curr_only_dev should be digitally compensated after the curr_and_volt_dev.

3.4 Applying voltage protocols

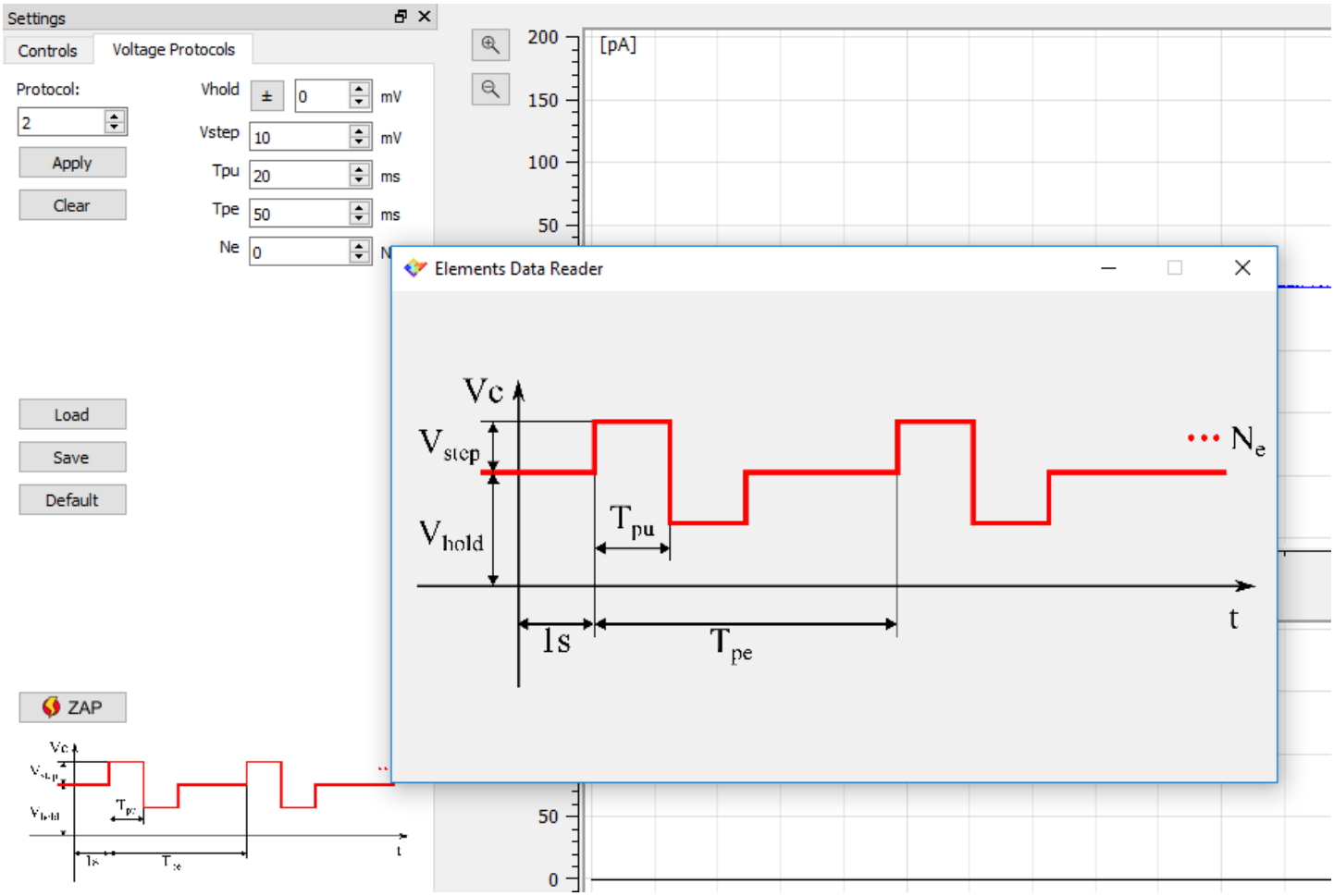
Since only the curr_and_volt_dev has the Vcmd pin connected only the corresponding EDR instance should be used to apply voltage protocols: the EDR instance connected to the curr_only_dev should always apply protocol 0 with Vhold equal to 0 in Voltage Protcols:



As an example this guide will show how to apply a seal test voltage protocol.

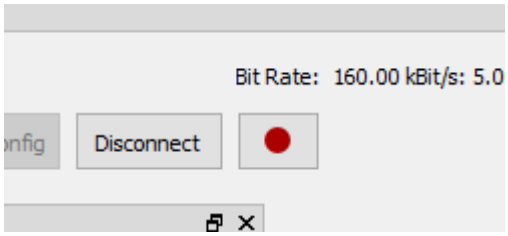
As shown in the image below, a bigger image of the protocol is shown by pointing the mouse over the smaller image within the Voltage Protocols. Such image describes the meaning of the protocol settable parameters.

Once the parameters are set to generate the desired voltage protocol the actual voltage application can be achieved either by clicking the Apply button or by pressing the Return/Enter key while one of the protocol parameters is selected with the mouse.

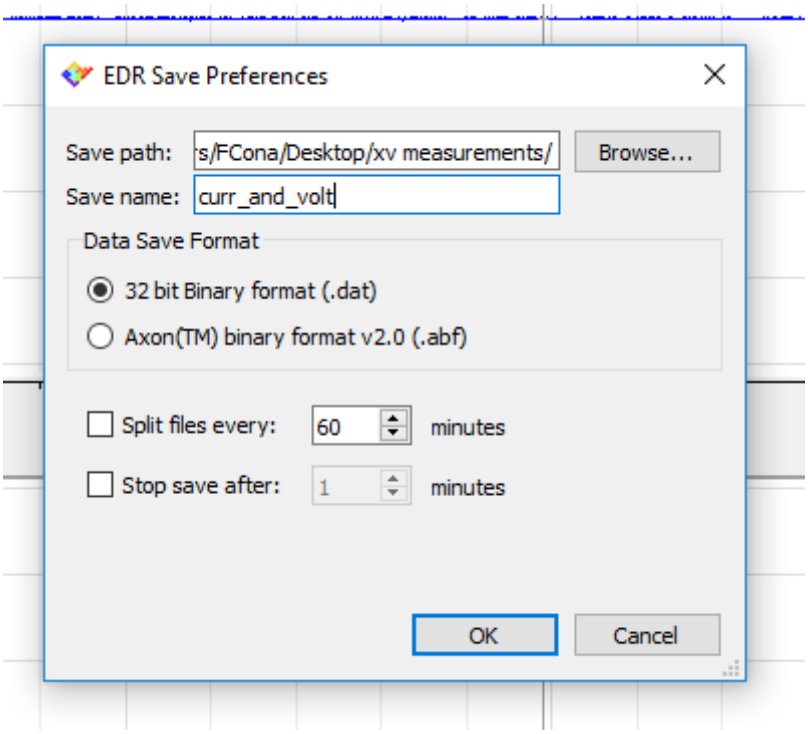


3.5 Recording data to the hard drive

In order to record the acquired data click the button with the red circle on the right of the Disconnect button:

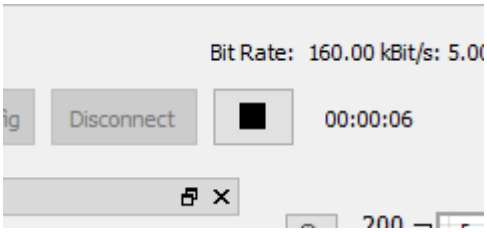


The following dialog box will pop up, which allows for the configuration of the saved data:



NOTE: The recording should be started on both EDR instances in order to record both current traces, so it is advisable to use a filename that helps telling the two devices apart. In this guide the names curr_and_volt and curr_only will be used.

After the OK button is clicked, the record button will turn from a red circle to a black square:



It can be clicked at any time to stop the recording.

4 Using EDA to merge 2 data files into a single synchronized data file

The recordings on the 2 EDR instances will create 2 distinct desynchronized files. EDA allows to synchronize and merge the 2 files.

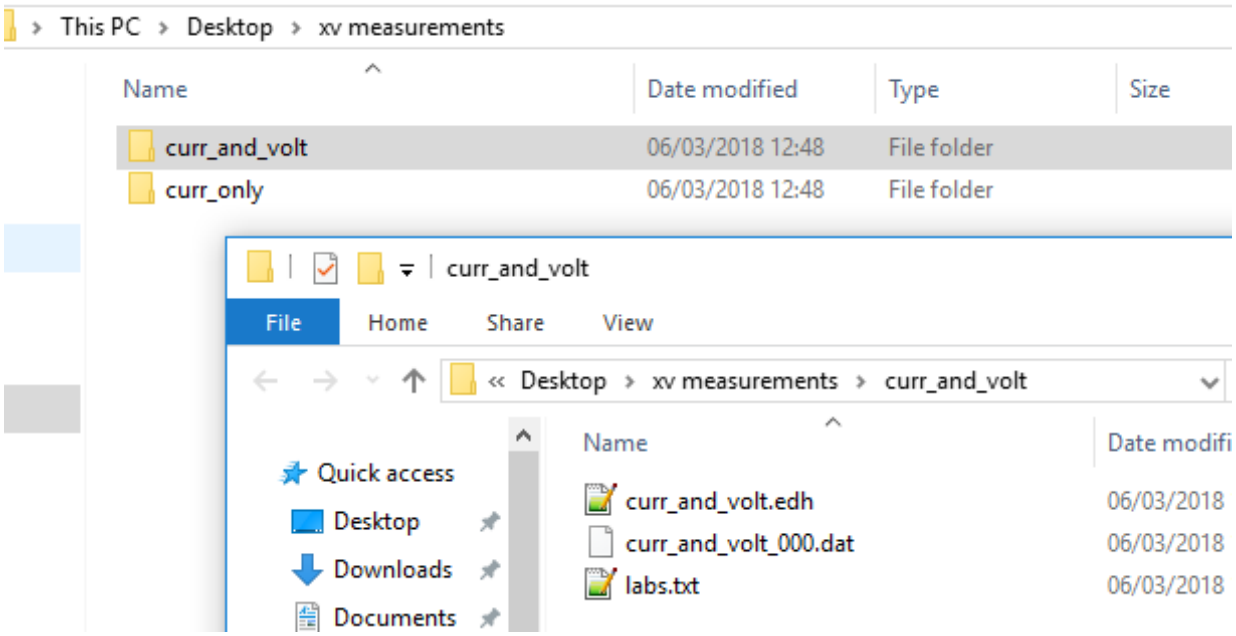
4.1 Sample recording

To illustrate how to merge the data files let's record 2 sample data files with the following procedure:

1. Start a recording on both EDR instances as described in 3.5. In this guide the 2 data files will be called curr_and_volt and curr_only for curr_and_volt_dev and curr_only_dev respectively.

2. Apply a seal test protocol on the EDR instance connected to curr_and_volt_dev as described in 3.4.
3. Wait for some seconds and stop both recordings.

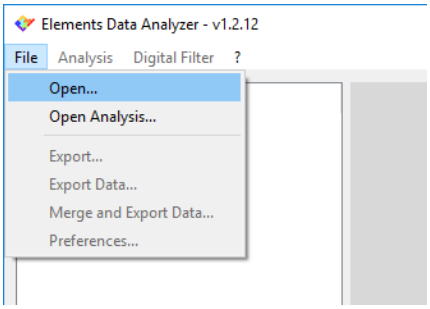
This is what you should get:



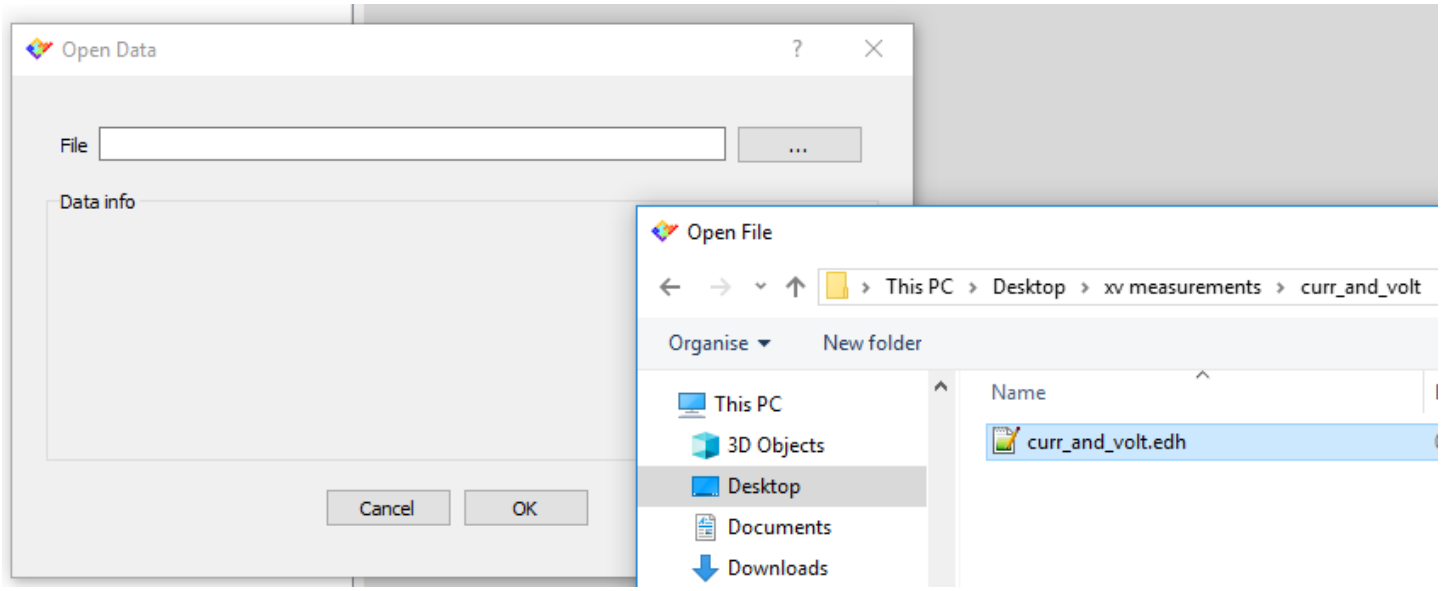
Each recording will create and header file (.edh) and a data file (.dat or .abf depending on the choice made during recording configuration; EDA can be used to convert between the 2 formats).

4.2 Load the files into EDA

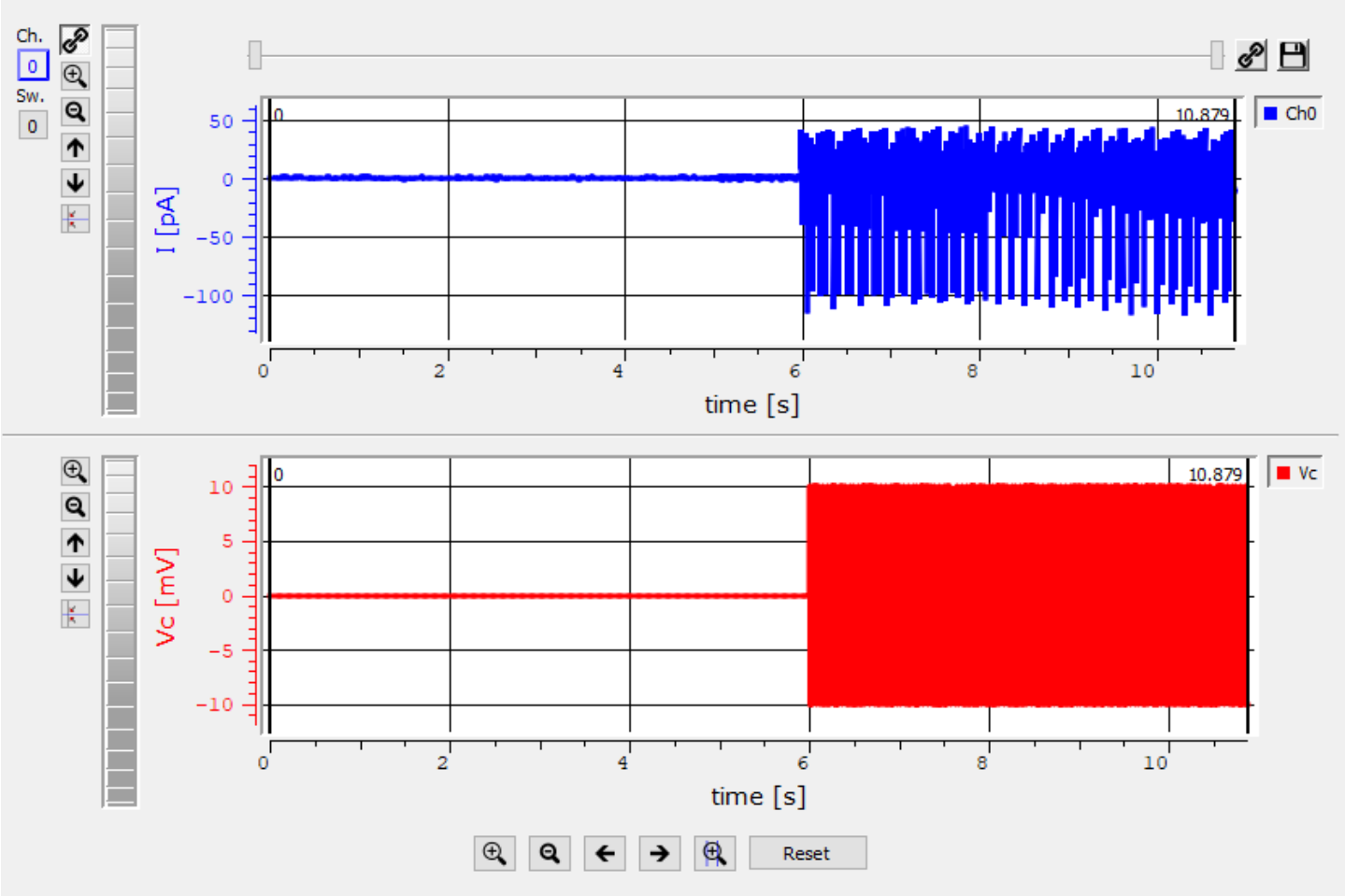
Launch EDA. This time it can be run only once since EDA can manage multiple recordings at once.



To load a file just click on file -> Open… and use the dialog box that will open to select one of your .edh files:



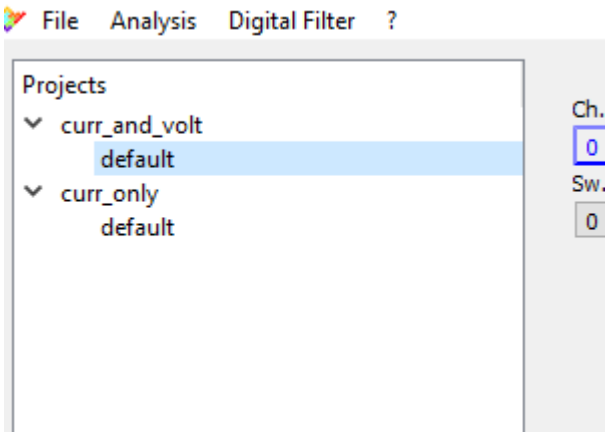
Press OK and the traces will be loaded plotted:



Traces can be zoomed by either using the lens buttons or by selecting a rectangle with the left button of the mouse around the area you want to enlarge.

The mouse right click will back track your zoom operations.

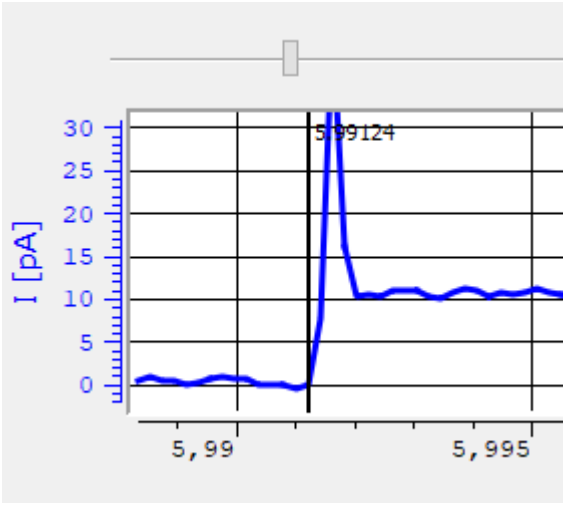
After loading the second file the tree view on the left will allow navigating between all the loaded data files:



4.3 Synchronizing the traces

In order to synchronize the traces the user needs to provide a common time indication to the 2 data files with the following procedure for both the data file:

1. Select the data file by double clicking on its default view on the left tree widget;
2. Zoom around an easily recognizable mark point: for this purpose in this guide the beginning of the protocol application will be used;
3. Move the left one of the two cursors above the current plot and place the corresponding vertical line on the designed mark point (the position of the second cursor does not matter for this application):

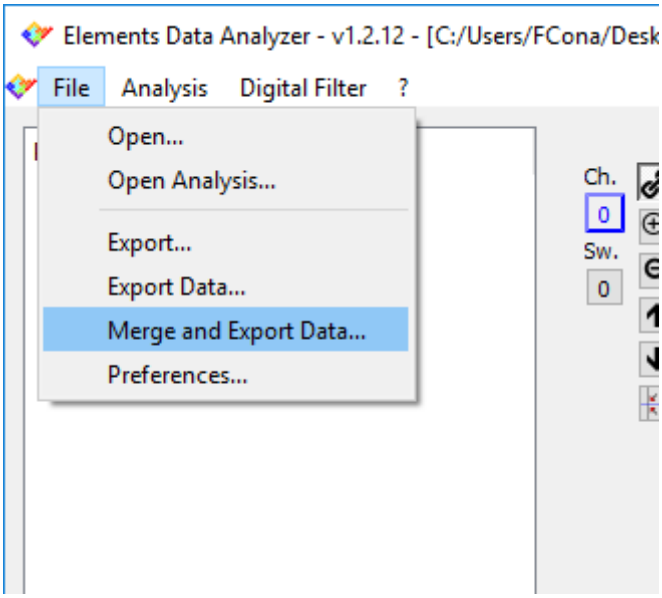


4. Click the save button on the right of the cursors:

Repeating the procedure for both the saved data file will inform EDA that the two time positions indicated with the left cursors represent the same absolute time, so EDA will be able to synchronize them.

4.4 Merging the files

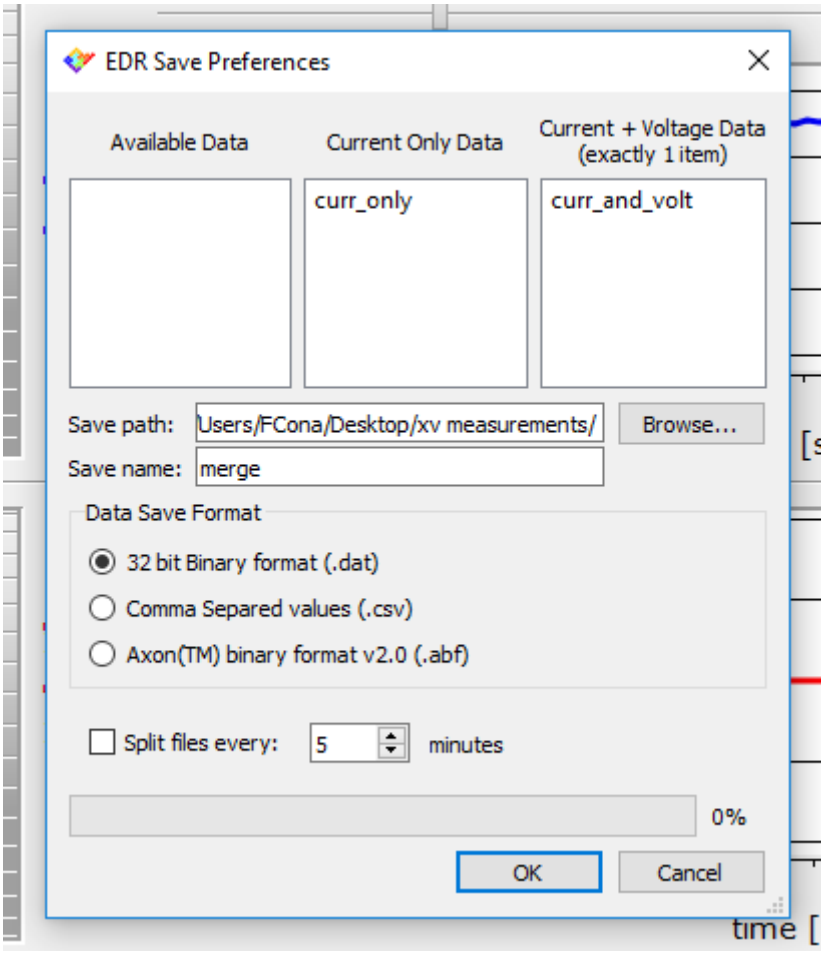
Once the two data files are loaded and synchronized a new data file containing traces from both of them can be created using the Merge and Export Data functionality:



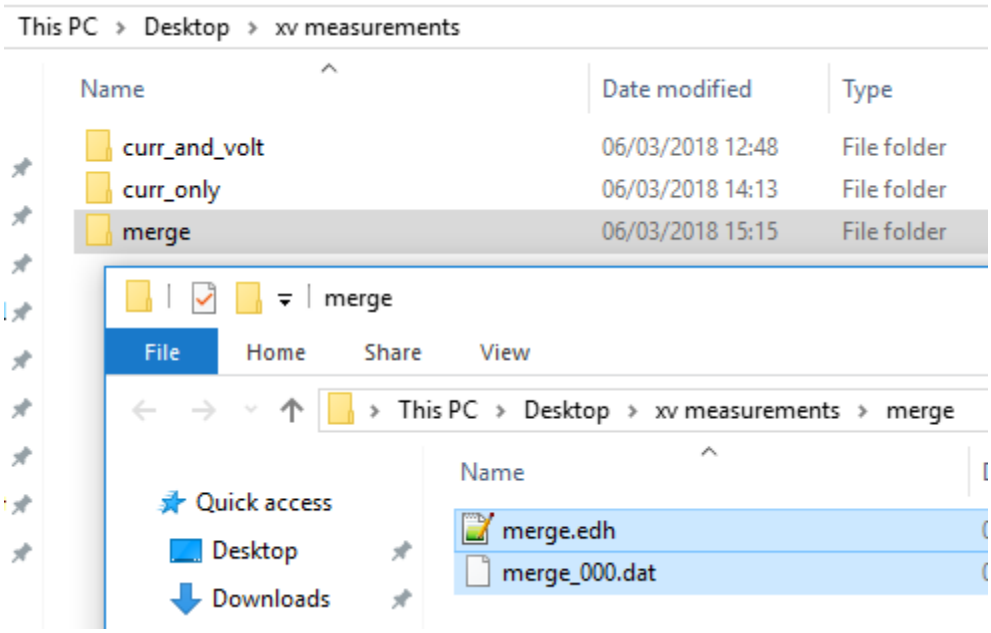
This is an extended version of the Export Data functionality: the latter only allows to export data file to different format, while the former allows doing the same but starting from more than one imported data file.

NOTE: as stated in 3.2 the merge operation is possible only if the source data file have been recorded using the same current range and sampling rate.

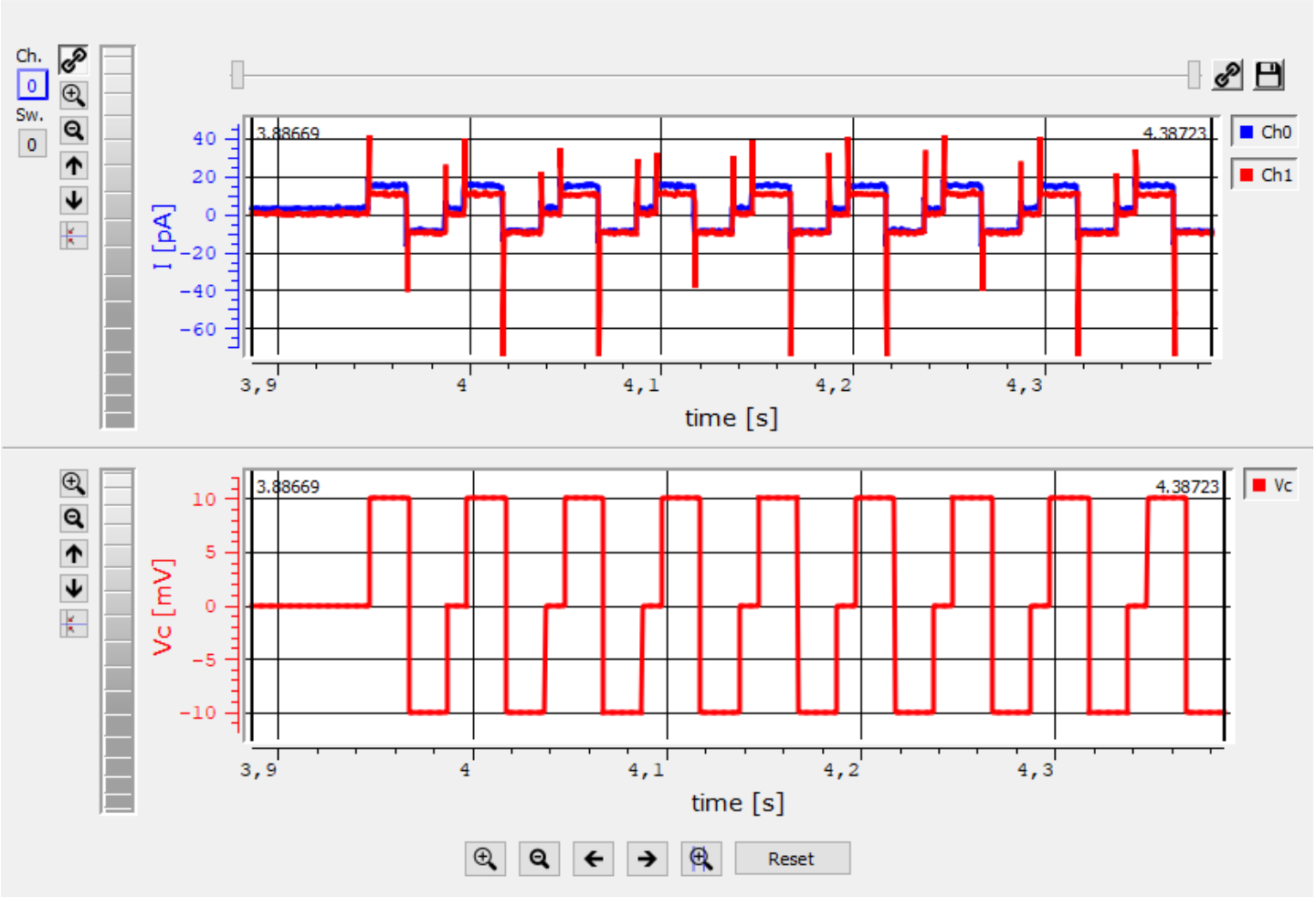
In the dialog box that opens drag and drop your source data file to the correct boxes, select and output file destination and format and click OK:



A new header file and data file will be generated as if they were recorded from a device with 2 channels:



The .edh can indeed be loaded into EDA as described in 4.2 to analyze the traces together:



NOTE: the current trace in Ch0 is the one recorded by curr_only_dev, while Ch1 and Vc are the current trace recorded and the voltage applied by curr_and_volt_dev.