



# **AGATA Front End Electronic Phase**

*Oscilloscope Software - Specifications*

**Version 1.0, November 2022**

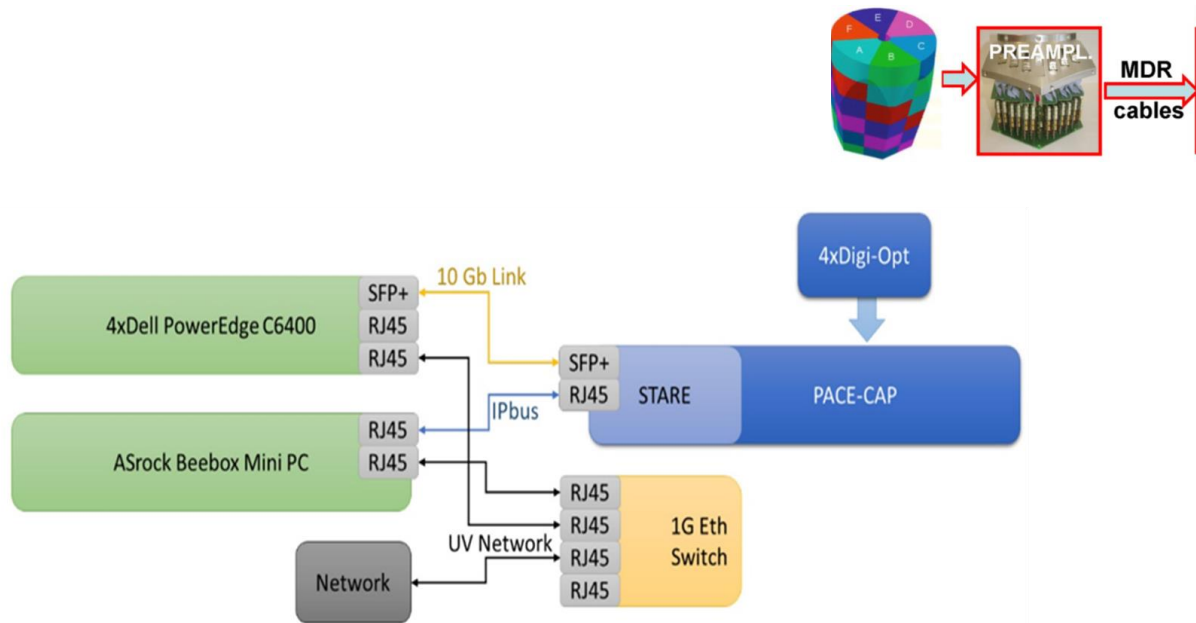
**Contributors: E. Clément, A. Gadea, O. Stézowski**

**Date : 10 November 2022**

## 1. Introduction

The AGATA Phase 2 Front End Electronic is based on 3 different hardware parts. It consists of warm pre-amplifiers located on the detector module, Fast Analog to Digital numerical convertor (DIG-OPT12) and a processing board (PACE) hosting 2 mezzanines, the CAP SOM for energy, time calculations, trigger request, event buffering and formatting, and the STARE Board for Gb readout to the HTC farm for data processing.

A schematic of the electronic system is shown below



The Project definition with the technical details can be found at :  
<https://atrium.in2p3.fr/b1eab32e-7839-4381-80d9-f8a52e5aece3>

The present architecture does not foresee an analogic inspection line from the PACE processing board to be connected to a standard oscilloscope.

## 2. General specifications

The present document describes the specifications for a digital oscilloscope software able to connect to PACE I/O using IP\_bus instructions and display the available data stream from PACE “inspection register” (To be documented by Javier).

Digital oscilloscopes exist on the market connected to analogue to digital convertor.

<https://www.farnell.com/datasheets/49665.pdf>

<https://www.sillanumsoft.org/>

[https://www.windows10download.com/w10-oscilloscope.html#google\\_vignette](https://www.windows10download.com/w10-oscilloscope.html#google_vignette)

This hardware stage doesn't exist in PACE and the needed oscilloscope software will have as input data stream, on-demand by the oscilloscope software, from PACE.

Such solutions provide display software.

The requested oscilloscope software from the User Experience point of view has to be at the minimum as

<https://www.perytech.com/Product/USB-Oscilloscope/Doc/DSO%20Manual-En.pdf>

or seen annexes for detailed functionalities.

For AGATA, the number of similar inputs can be up to 10 channels with full range from 1 micro-second to 1 second.

### **3. Additional specifications**

Additional specifications could be listed :

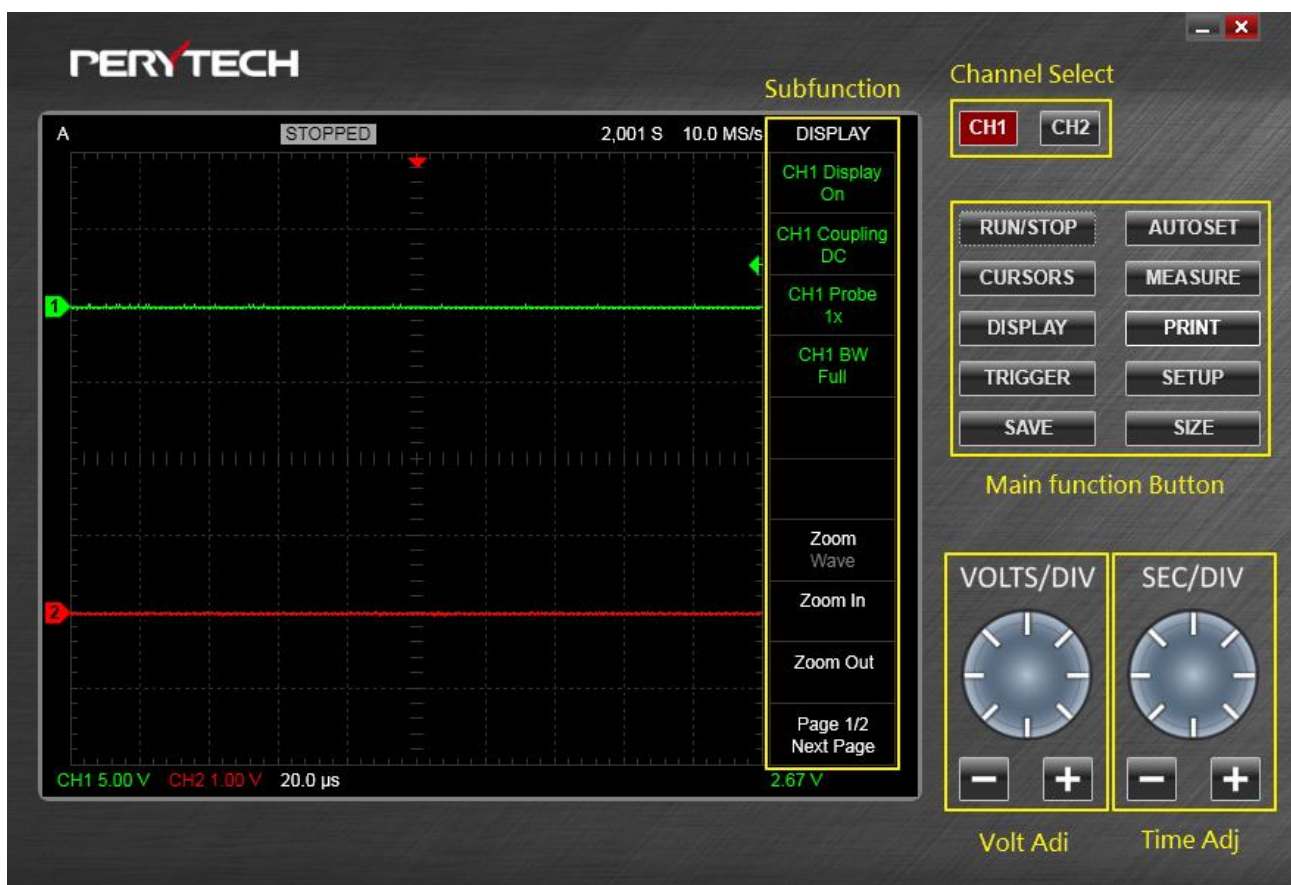
- The software must be able to run on LINUX platform using as less as possible dependences and make the best use of “standard” languages and associated packages
- The sources must be available on git-lab with proper licence
- Development documentation and user manual must be produced
- A possible web interface allowing remote activities for the hardware developer should be investigated. Otherwise, VPN access will be guaranteed.
- The software must have the capability to record data into ASCII files for later analysis
- Expected delivery is December 2023

### **~~4.~~ Detailed specifications**

## 5. Oscilloscope Operating Instructions

### 5.1. Quick start

Click the DSO shortcut on the desktop to activate the DSO software. The DSO software home screen looks like the following figure (the yellow words and the frame are added for description purpose). The following describes the various functions.



#### 5.1.1. Channel selection

The two buttons on the top right side are the **channel selection button**, as shown below. Channel selection buttons are used to select the desire channel. The selected channel button will turn red. ~~There are two channels when connected to a DSO so there are two buttons. When connected to two DSO, there will be four channels and~~

~~four buttons. A maximum of four DSO can be connected, which has a total of eight channels and eight buttons.~~

AGATA request 10 possibles inputs at the same time



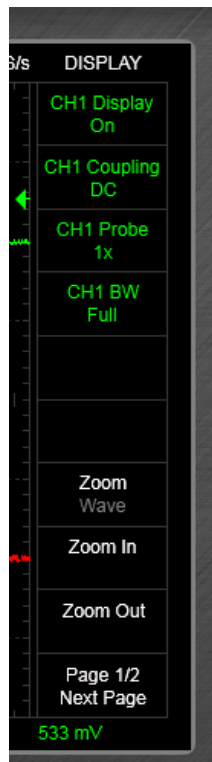
### 5.1.2. Main function keys

Below the channel selection buttons are the **main function keys**, as shown in the below figure. The main function keys are used to select the main functions to be implemented. The **RUN/STOP** button is to run or stop the oscilloscope. The **AUTOSET** button is to automatically set the appropriate voltage and time selection.



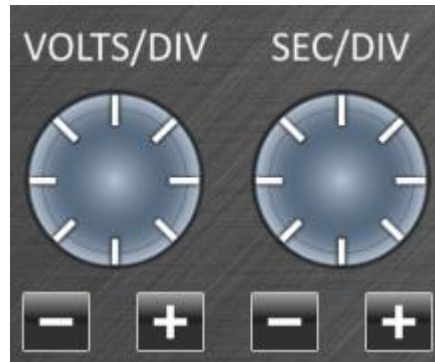
### 5.1.3. Sub function menu

The [sub function menu](#), as shown below, is on the left side of the main function keys. Just click to implement. Some main functions have a sub function menu. Select different main function keys and different sub function menus will appear. When the font is green (Channel 1 color), this means that the menu has CH1 sub functions. Red font (Channel 2 color) means the menu is for Channel 2 sub functions. You can use the channel selection button to select the channel you desire. White font indicate sub functions not related to any channels.

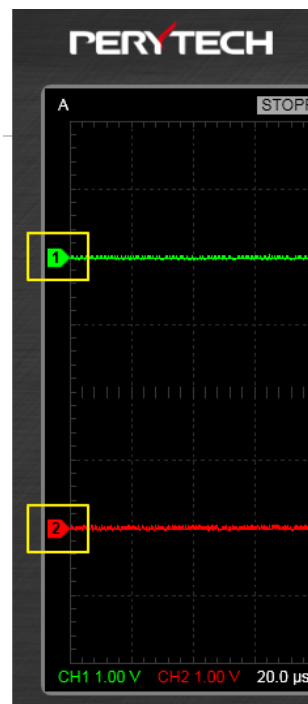


There are two knobs below the main function keys, as show in the following figure. The left side is used to adjust the voltage range and the right side is used to adjust the time range. Clicking the knob with the left button of the mouse and moving the knob up is to increase the setting. Moving the knob down is to decrease the setting. User can also use the "+" or "-" below the knob for control. Voltage range is controlled individually by each channel. When the CH1 is selected, the adjusted voltage range is

the Channel 1 voltage range. When CH2 is selected, the adjusted voltage range is the Channel 2 voltage range. The time range is controlled with all the channels.



The Mark 1 and 2 tags on the left side of the screen is the channel's benchmark point. The mouse can be used to drag the tag up and down to move the wave pattern.



## 5.2. Setting the trigger function

Press the **TRIGGER** in the main function keys and the trigger function sub function menu will appear, as shown in the following figure. Description is below.



### 5.2.1. Setting the trigger source

In the case of AGATA, source refers to a data stream from PACE.

The **Source** menu function is for selecting the trigger channel. Selectable channels include Ch1, Ch2, and the Ext (external trigger). The input point for the external trigger is on the front panel. The red rectangle in the below figure shows its position.

Ch1, ch2 etc... in AGATA becomes available registers to be defined by Javier

### 5.2.2. Setting the trigger slope

**Slope** menu function is used to select the trigger's positive falling edge. Click this can change the rising edge or falling edge trigger.



### 5.2.3. Setting the trigger mode

Mode menu function is for setting the trigger mode. There are three trigger modes to choose from:

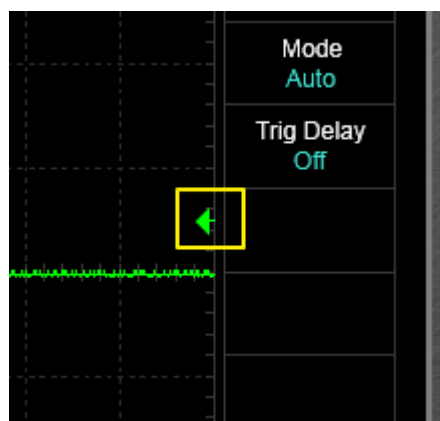
**Auto:** auto mode. After a period of time with no trigger, the system will automatically obtain the wave pattern. This is the most commonly used mode.

**Normal:** normal mode. The wave pattern will only be obtained when triggered.

**Single:** stops after being triggered one time.

### 5.2.4. Adjusting trigger level

The arrowhead on the right side of the screen is used to adjust the trigger level, as shown in the yellow frame in the following figure. The left button of the mouse can be used for dragging. When the trigger channel is set at CH1 the arrowhead is green (CH1's color). When the trigger channel is set at CH2 the arrowhead is red.

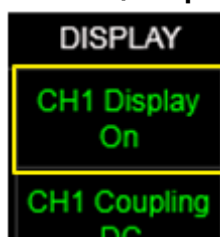


### 5.3. Display function setting

Press the **DISPLAY** in the main function keys to see the display sub function menu. There are two pages to the display sub function menu, as shown below. Select **Next Page** at the bottom of the menu of **Prev Page** to switch pages. The following describes each menu function.

DISPLAY	DISPLAY
CH1 Display On	FFT Off
CH1 Coupling DC	XY Off
CH1 Probe 1x	Math Off
CH1 BW Full	Overview Off
Zoom Wave	
Zoom In	
Zoom Out	
Page 1/2 Next Page	Page 2/2 Prev. Page

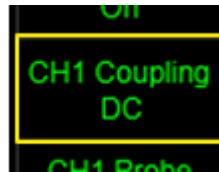
#### 5.3.1. Wave pattern display switch (Display On/Off)



**CHx Display** menu can be used to turn on and off the wave pattern display. The default is to display when turned on. Click to switch to off. When the channel is in Ch1,

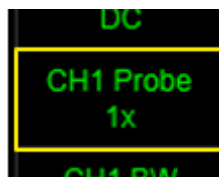
the control is displayed in Ch1. When the channel is in Ch2, the control is displayed in Ch2.

### 5.3.2. Coupling setting (DC/AC)

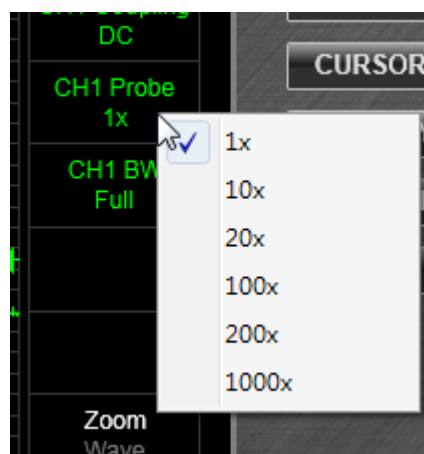


**Coupling** menu can control the input signal **DC** or **AC** coupling. The default is the DC coupling. When choosing the AC coupling, the DC signal will be filtered out and only the AC signal kept.

### 5.3.3. Probe setting



**Probe** menu can be used to set the probe. The menu will appear after being clicked, as shown below. There are six choices (1x~1000x).

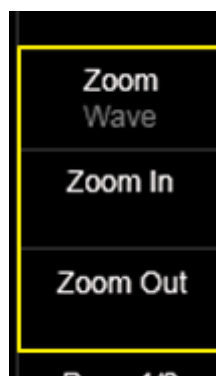


### 5.3.4. Band width setting



**BW** menu is used to set the band width of the channel. The default is **Full**, but can be switched to **20MHz** band width.

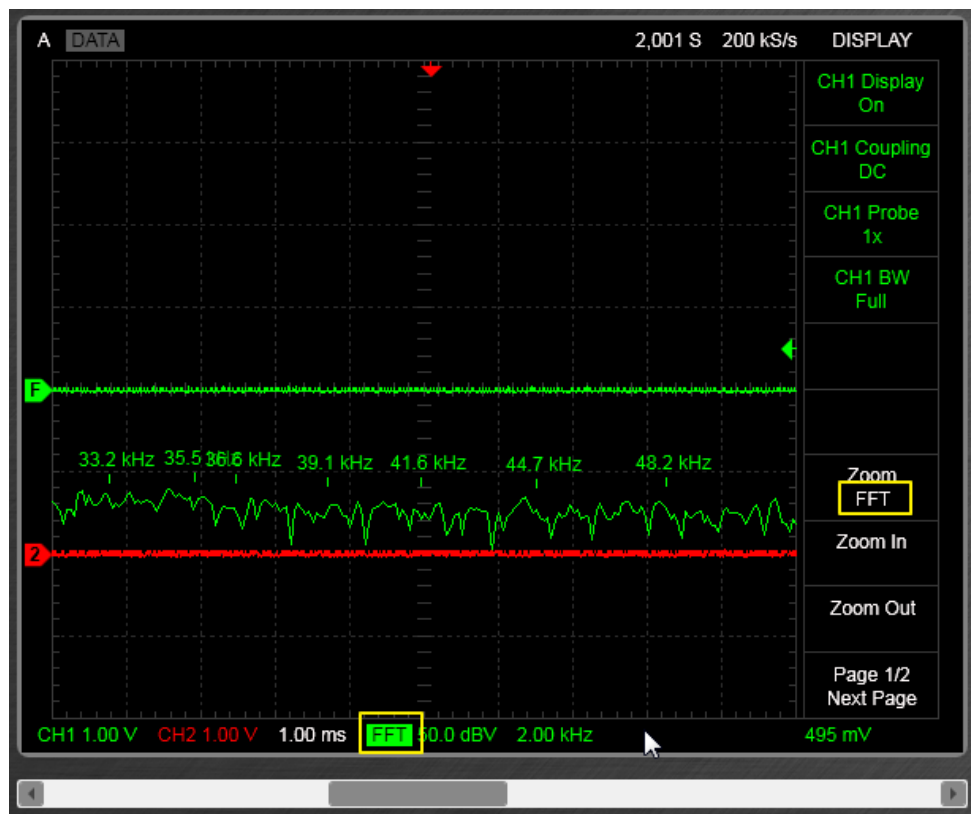
### 5.3.5. Zoom related functions



There are three zoom function menus. The **Zoom In** and **Zoom Out** is used to magnify and shrink the wave pattern. The roller of the mouse can also be used for control. After zooming in, the scroll will appear at the bottom of the screen that can used to move the screen.

The Zoom menu at the very top is used to change the magnification target (wave pattern or FFT). The default value is the grey "Wave," which is also magnifying the wave pattern. Grey means that it cannot be switched. When the FFT function is on, the color of the Wave will change to white, indicating that it can be changed.

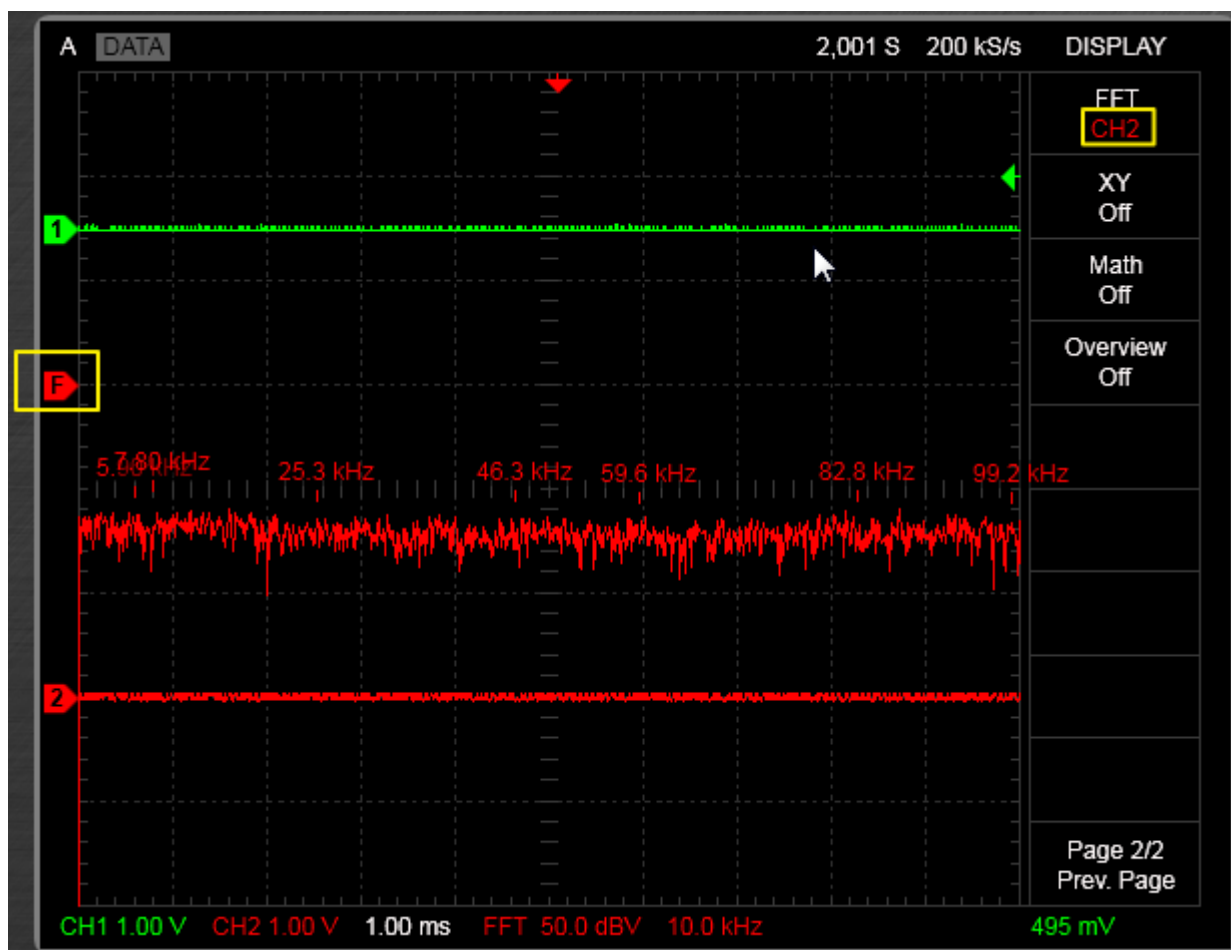
When changing to FFT, the shrinking target is the FFT, as shown below.



### 5.3.6. FFT function

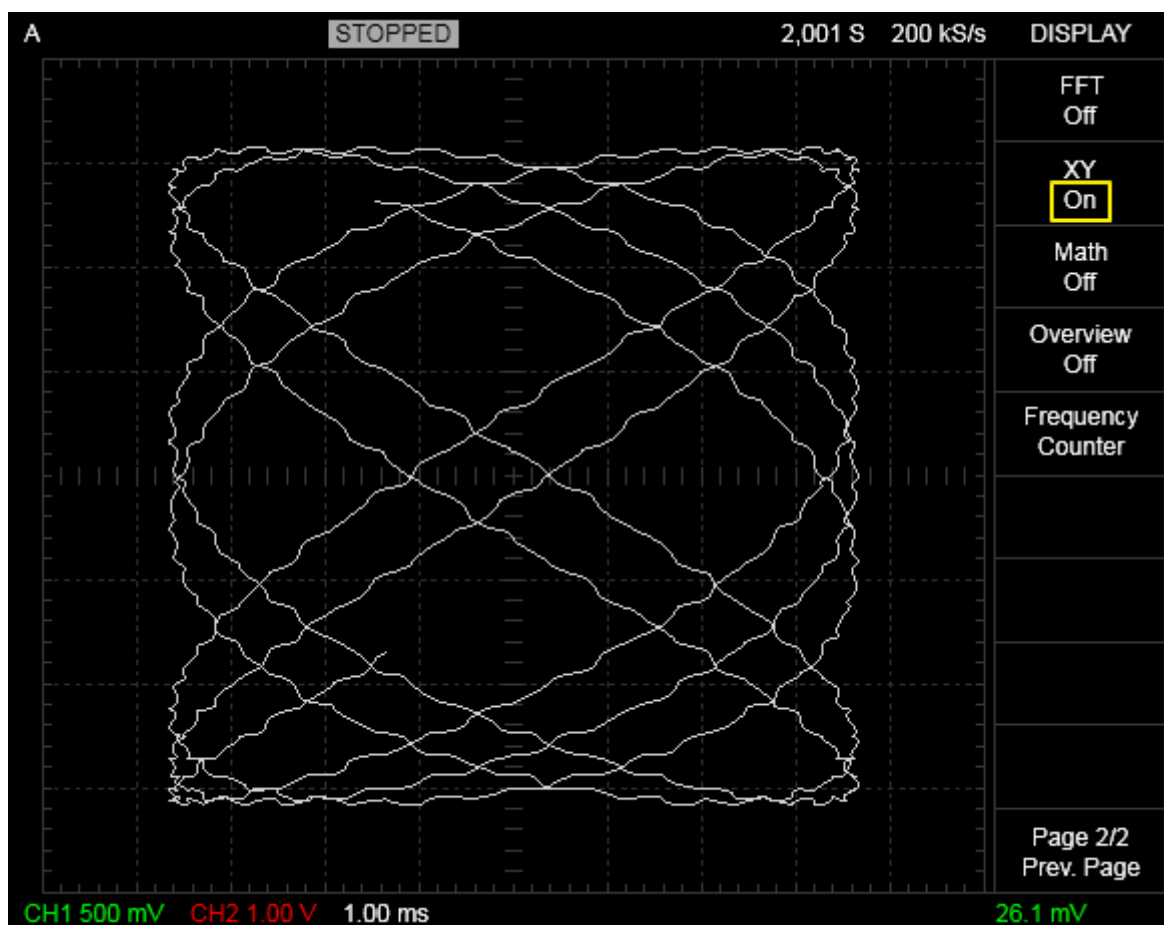
The first menu on the second page is the FFT, and is used to turn on and off the FFT function. The default is OFF. This function also includes switching between CH1 and CH2 and will separately display Channel 1 and Channel 2 FFT.

The screen after turning on the FFT is shown in the below figure. You can use the "F" tag on the left side of the screen to move the FFT wave pattern.



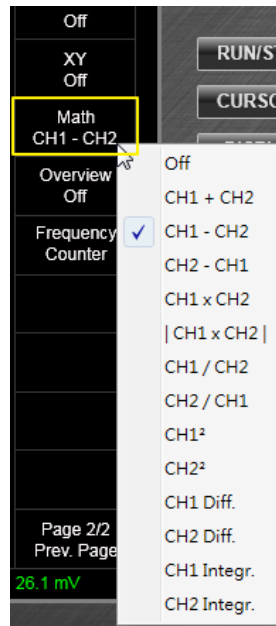
### 5.3.7. XY mode (Lissajous curve)

The XY mode is used to display the Lissajous curve. After turning on this mode, the oscilloscope wave pattern will turn off and display the white Lissajous curve, as shown below. If the user wishes to simultaneously display the oscilloscope wave pattern and the Lissajous graphic, the user can change the setting in the "Options" (please see 5.6.7.4 for curve).



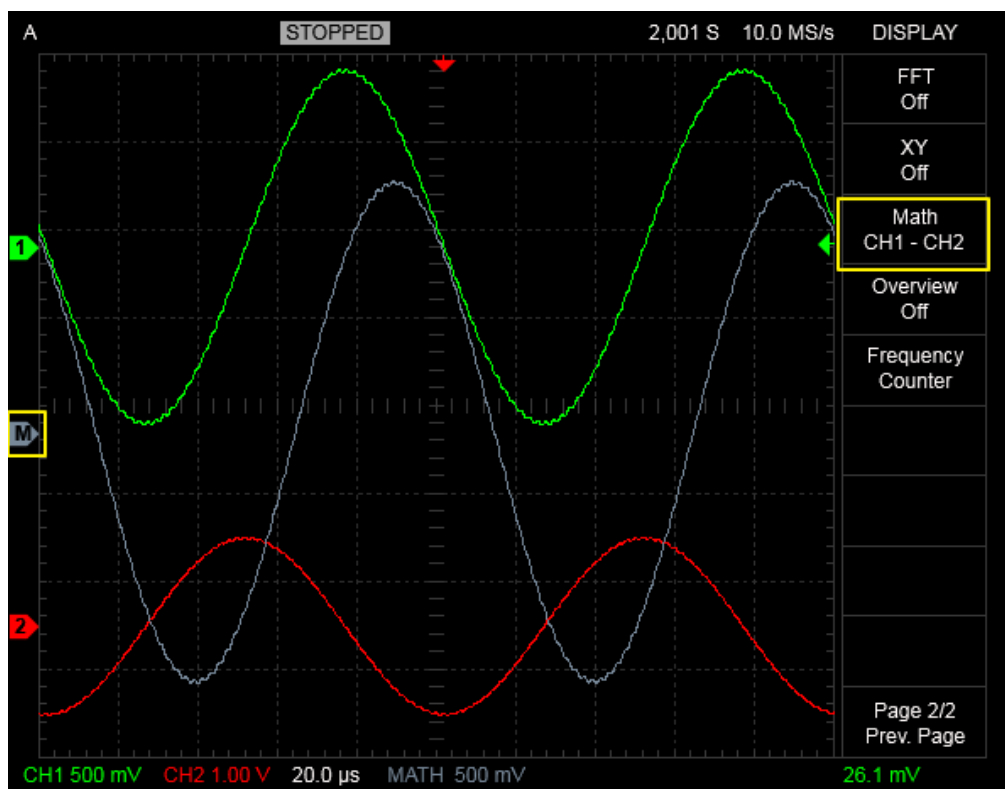
### 5.3.8. Wave pattern calculation function (Math)

The Math menu can display the wave pattern calculation, such as addition, subtraction, multiplication, division, integration, differentiation...etc. (see below figure).



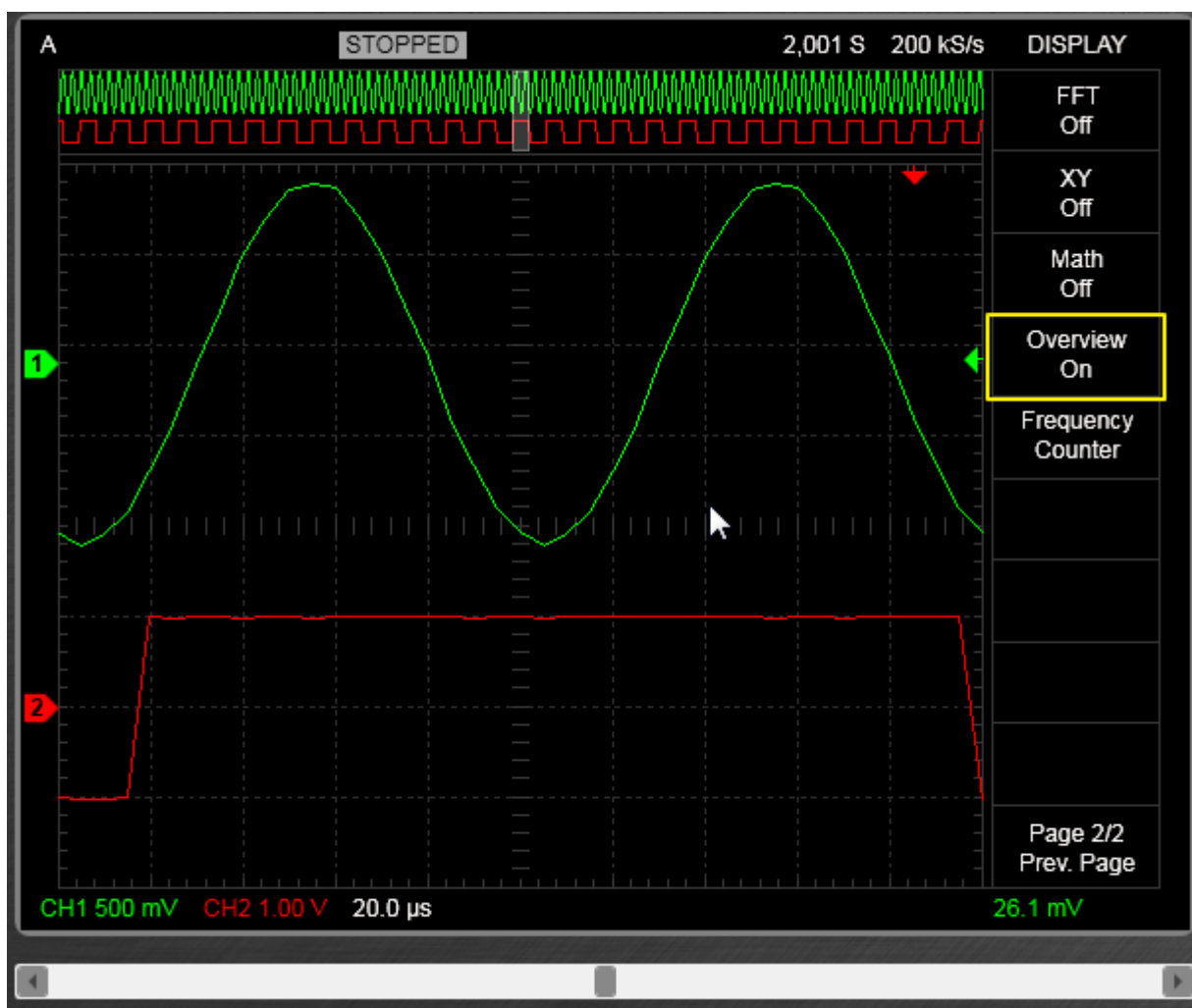
After turning on this function, the grey wave pattern will appear. That is the calculation result, as shown below. The mouse can be used to drag the "M" tag on the left side of the screen to move the wave pattern.





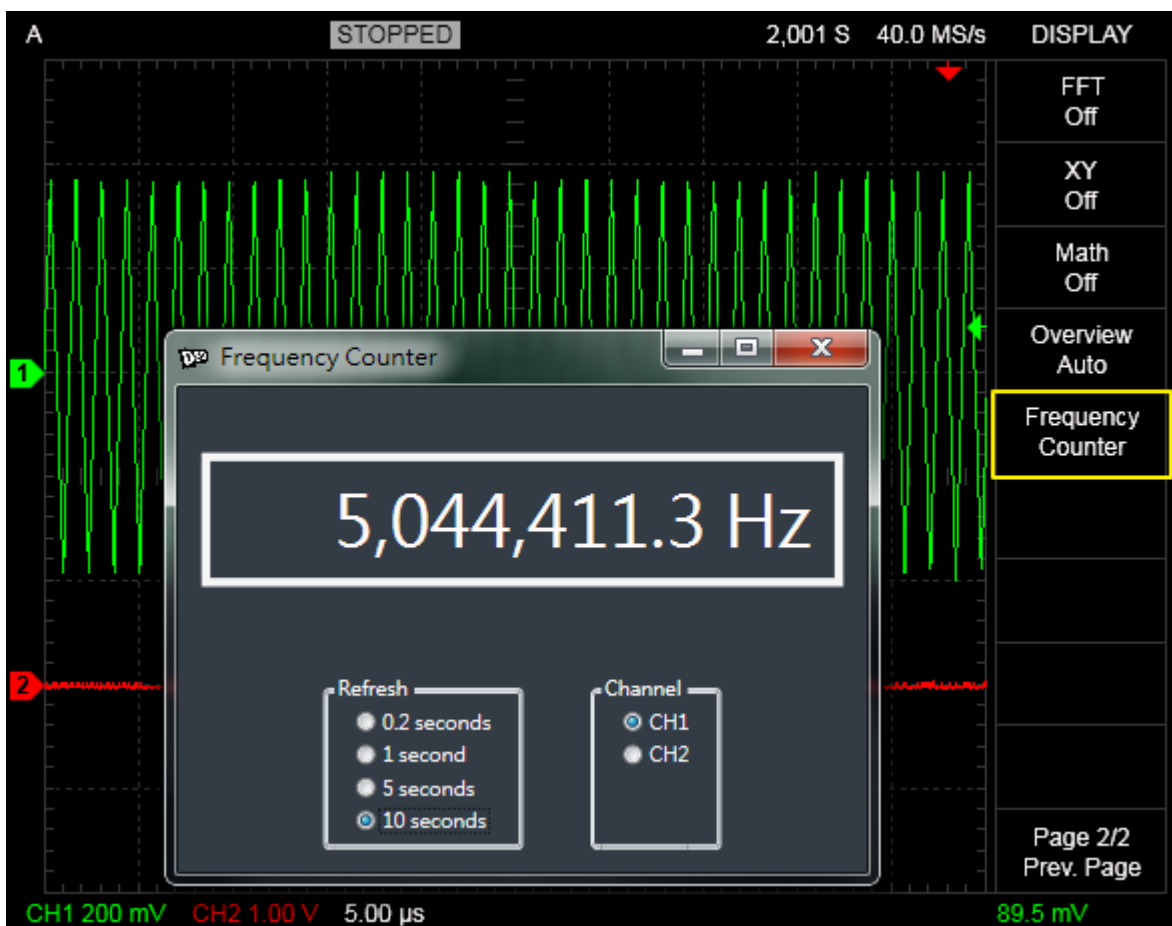
### 5.3.9. Overview function

Overview function displays all the wave patterns on the top of the screen, as seen below. The default is off, but can also be changed to On or Auto. ON means that the display is always on. In Auto, the wave patterns will only be displayed in wave pattern Zoom In.



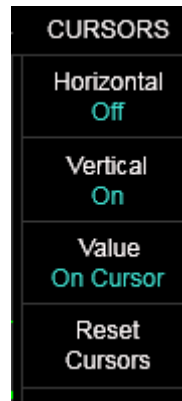
### 5.3.10. Frequency Counter function

The frequency counter function can accurately measure the signal frequency. After clicking the Frequency Counter menu the Frequency Counter window will appear on the screen, as shown below. The user can select the channel to be measured (CH1 or CH2). There are four updating time to choose from (0.2, 1, 5, and 10 seconds). The longer the updating time, the higher the precision will be. When using the frequency counter function, we recommend adjusting the oscilloscope sampling frequency to the maximum setting to increase precision. The signal must be able to induce trigger so the frequency counter can display the accurate data.



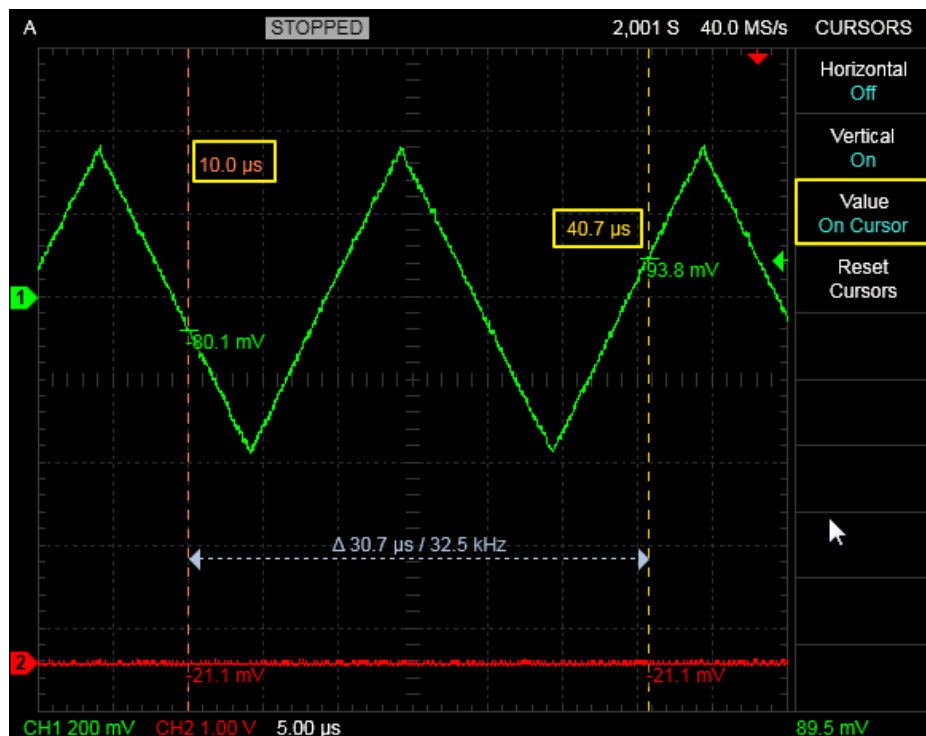
## 5.4. Cursor function setting

Press the CURSORS key from the main function keys to bring up the cursor sub function menu.

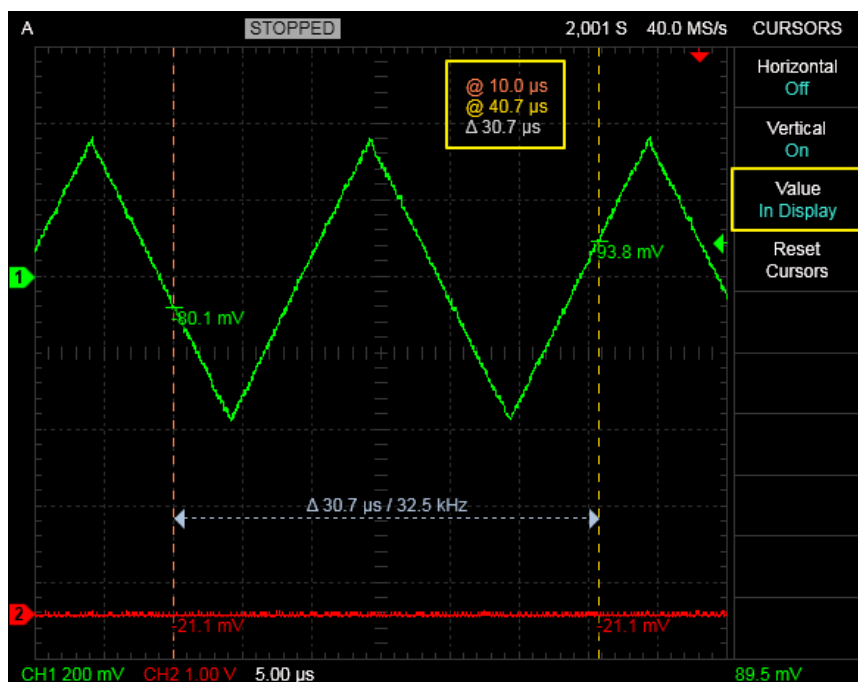


**Horizontal** is the cursor that measures the voltage. After turning on, two parallel horizontal dotted lines will appear that measures the voltage. **Vertical** is the cursor that measures time. After turning on, two vertical dotted lines will appear that measures the time. The mouse can be used to drag the dotted line to measure wave pattern.

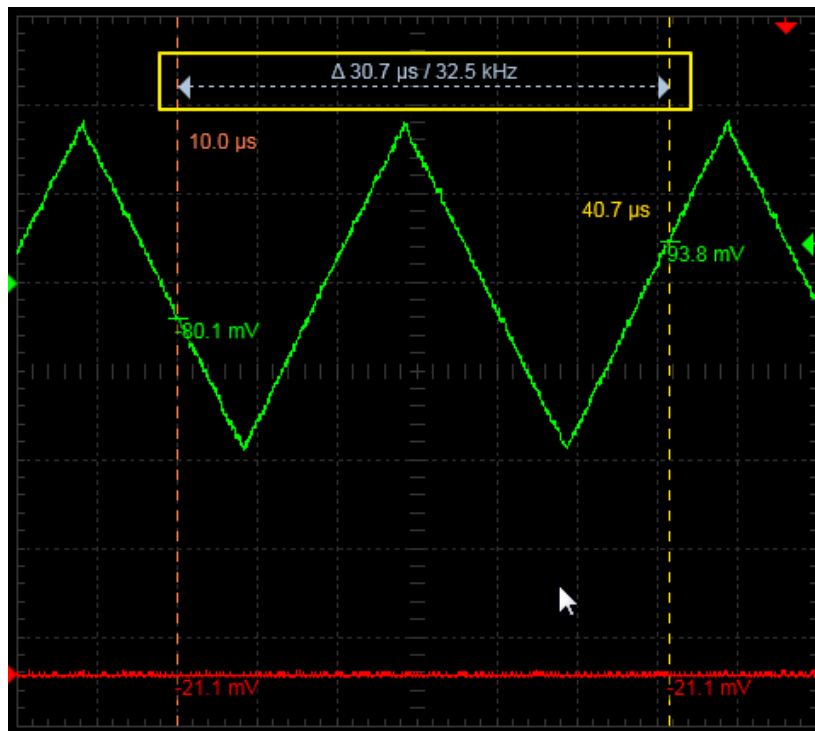
The **Value** option is used to set the display of the cursor value on the dotted line or at the top of the screen. The default is **On Cursor**, which is display on the dotted line, as shown below.



If the Value menu is switched to **In Display**, the value will be displayed on the screen, as in the following figure. The value can be moved. User can use the mouse to drag the value to the location the user desires.



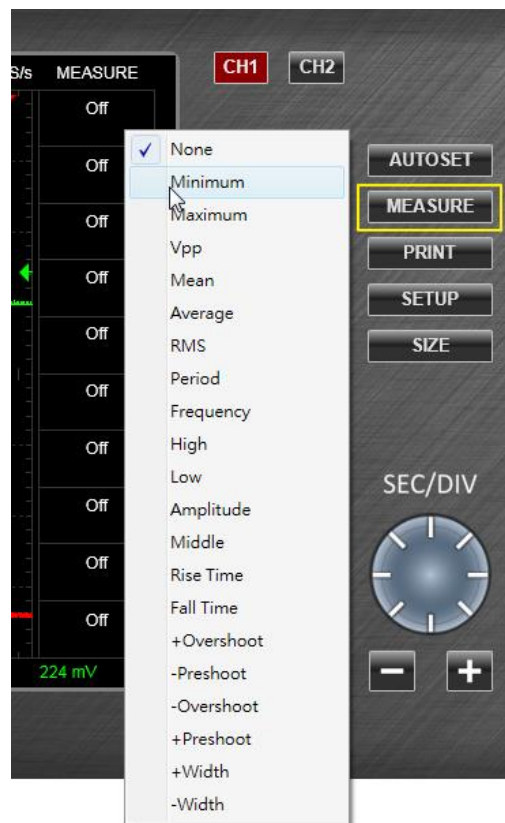
The white dotted line shows the difference between the two cursors, as shown below. The cursors can be moved, all the user has to do is use the mouse to drag the cursor to the position you desire.



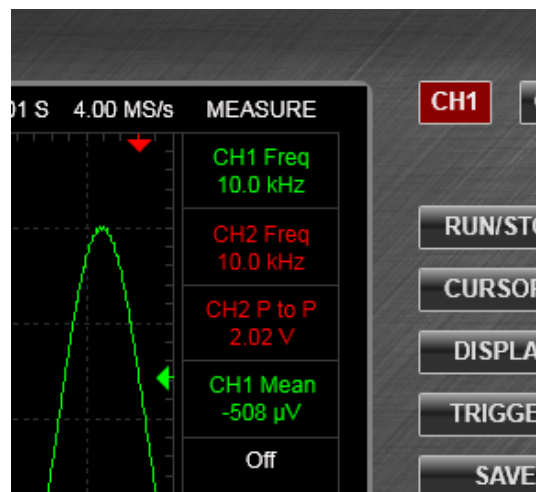
The last menu item, Reset Cursor, is used to reset the cursor setting.

## 5.5. Automatic Measurement Function

Press the "MEASURE" in the main function keys and the automatic measurement function menu will appear, as shown in the following figure. The user can choose any automatic measurement function.

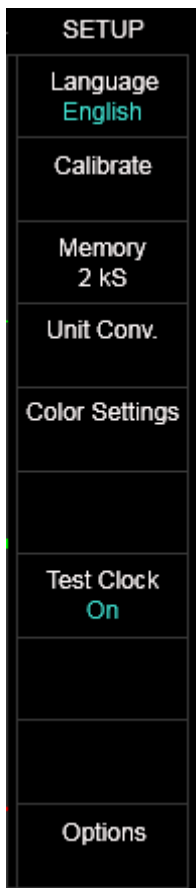


After selection is complete, the measurement result will appear in the sub function menu. When the channel is in CH1, the automatic measurement is for CH1. When the channel is set at CH2, the automatic measurement is for CH2.



## 5.6. Setting Function

Press the **SETUP** button in the main function keys and the setting sub function menu will appear, as shown in the following figure.



### 5.6.1. Set language

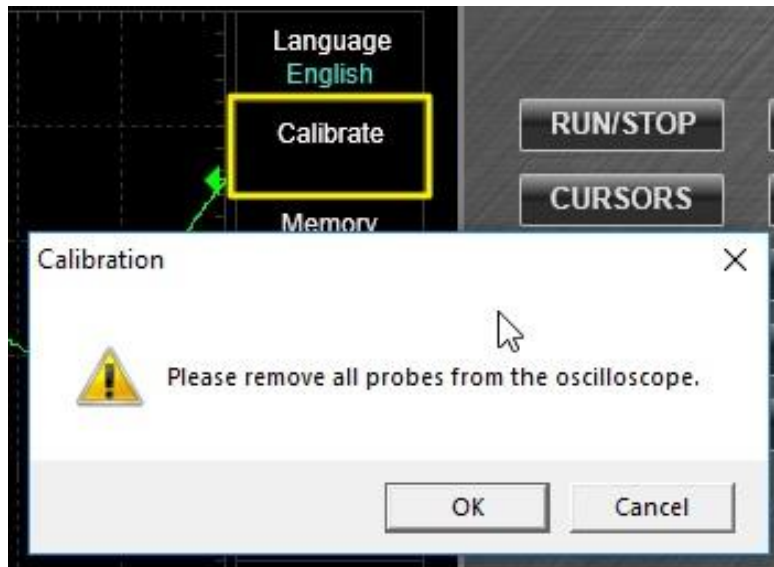


The function of the **Language** menu is to set the language. There are three languages to choose from, English, traditional Chinese, and simplified Chinese. The default is English.

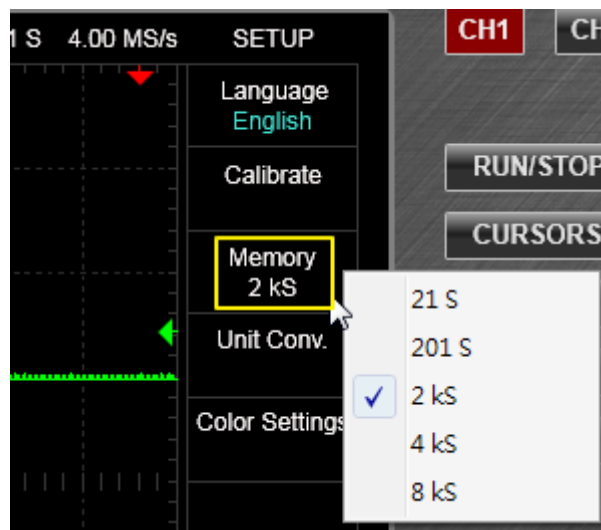


## 5.6.2. Calibration function

**Calibrate** menu is for the calibration function. After selection, a window will appear on the screen. Please disconnect the probe of your oscilloscope. Press confirm and the oscilloscope will begin calibration.

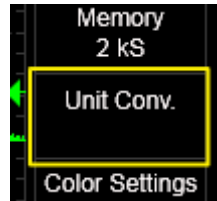


## 5.6.3. Memory setting

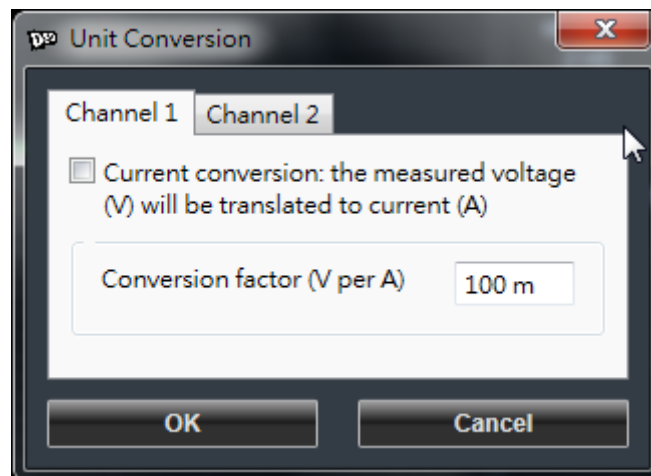


**Memory** menu can be used to set the size of the memory. After selection, a menu will appear and the user can click on the size of the memory they desire. The default is 2k and the maximum is 8k.

#### 5.6.4. Unit conversion (when using the current probe)

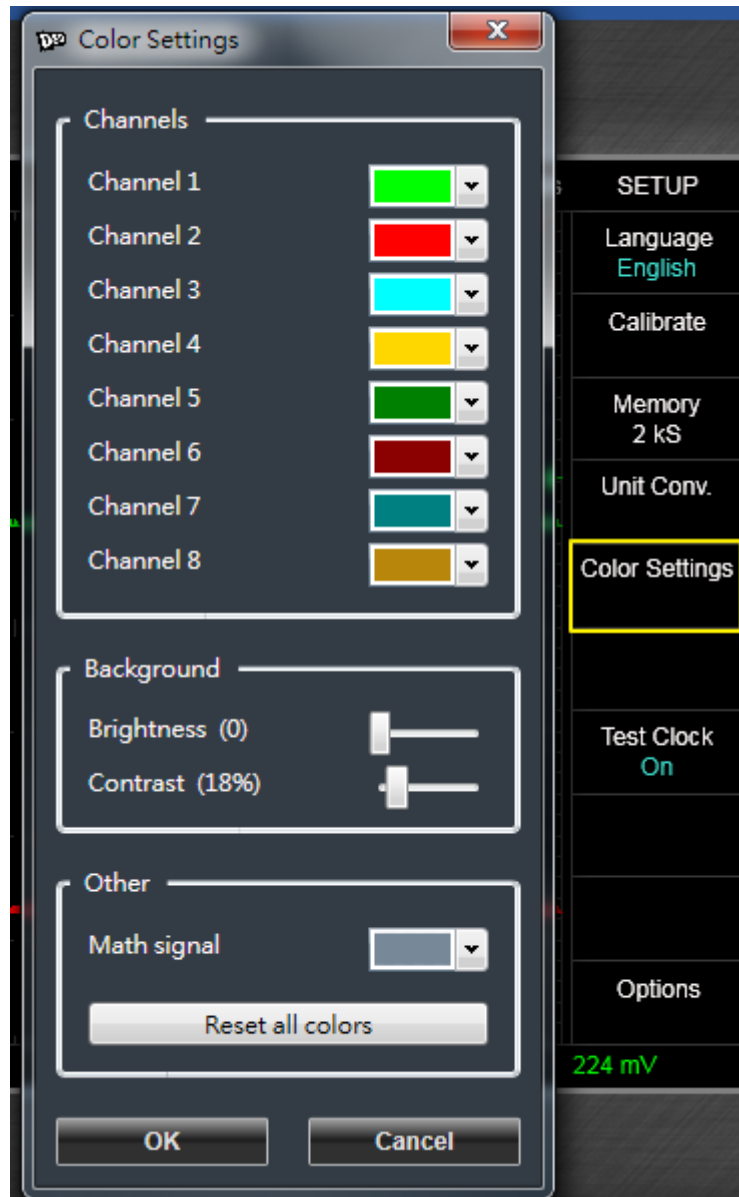


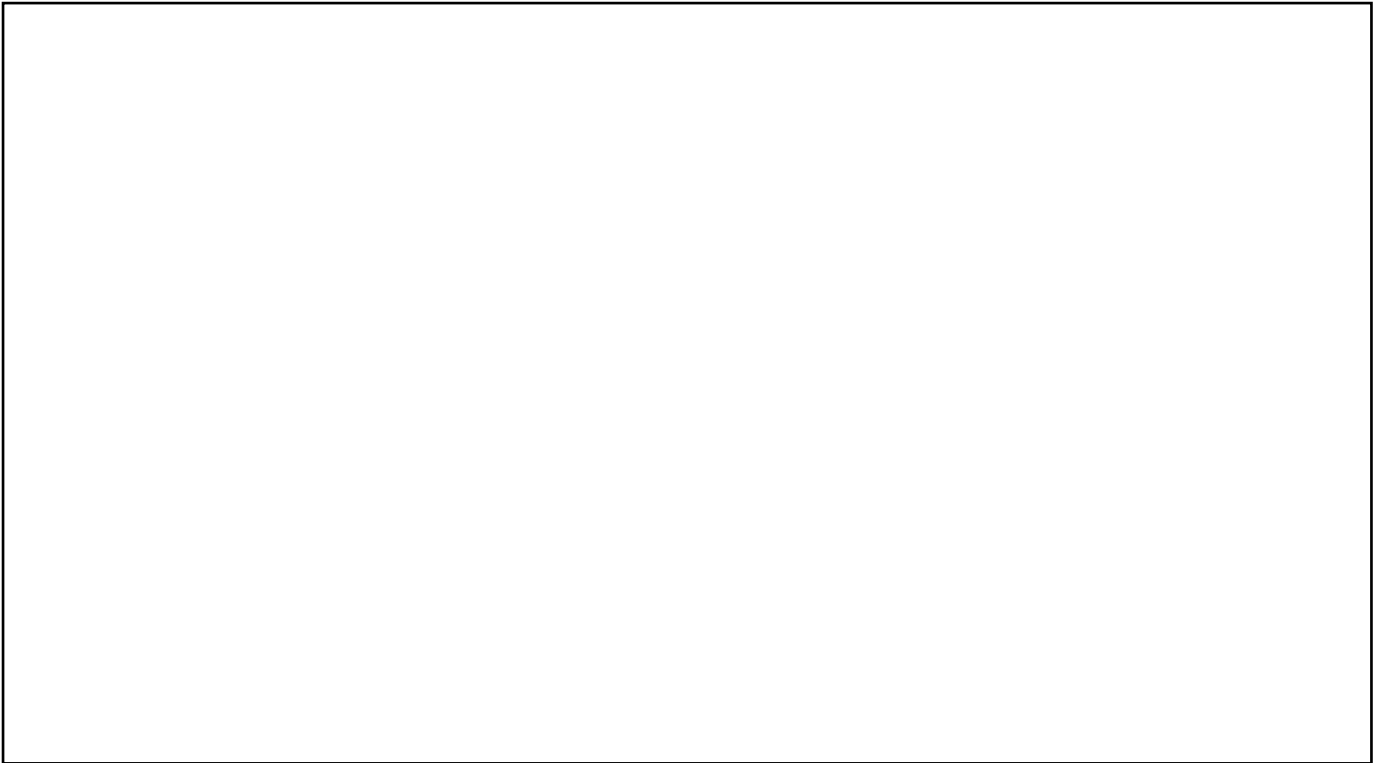
**Unit Conv.** menu is used to change the measurement unit from voltage to current. When using the **current probe** this function must be used. A window will appear after choosing this function, as shown in the below figure. After selection, the measurement unit will change to current. The two channels have independent settings. In addition, the conversion factor can be set. The conversion factor refers to converting X-number of voltage into 1A. The 100m inputted in the column shown below represents converting 100mV into 1A. When the measured voltage is 500mV, this is converted to 5A. The conversion factor's value is determined by the current probe's specifications.



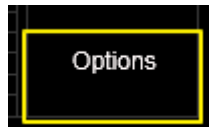
### 5.6.5. Color setting

[Color Settings](#) menu can be used to set the color, contrast, and background brightness of the wave pattern. A window will appear after selection, as shown below. The user can choose their preferred color.





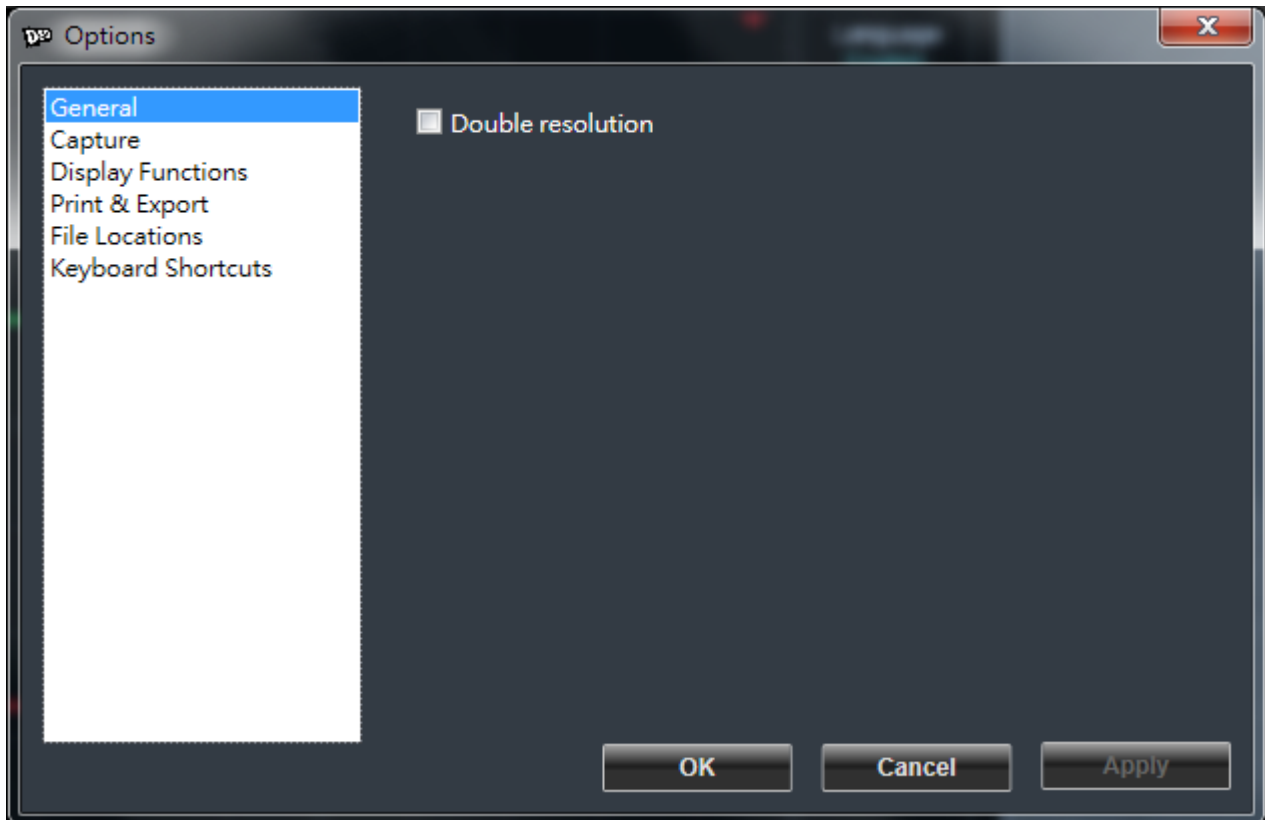
### 5.6.7. Options setting



The **Option** menu is used to set the software options. A window will appear after selection. On the left side of window is a menu that can be used to change pages. There are a total of six pages, which are described separately below.

### 5.6.7.1.Double resolution setting

The [General](#) page can be used to choose double resolution. When selected, the resolution will double, but the screen updating will also be slower. The default for this function is OFF.

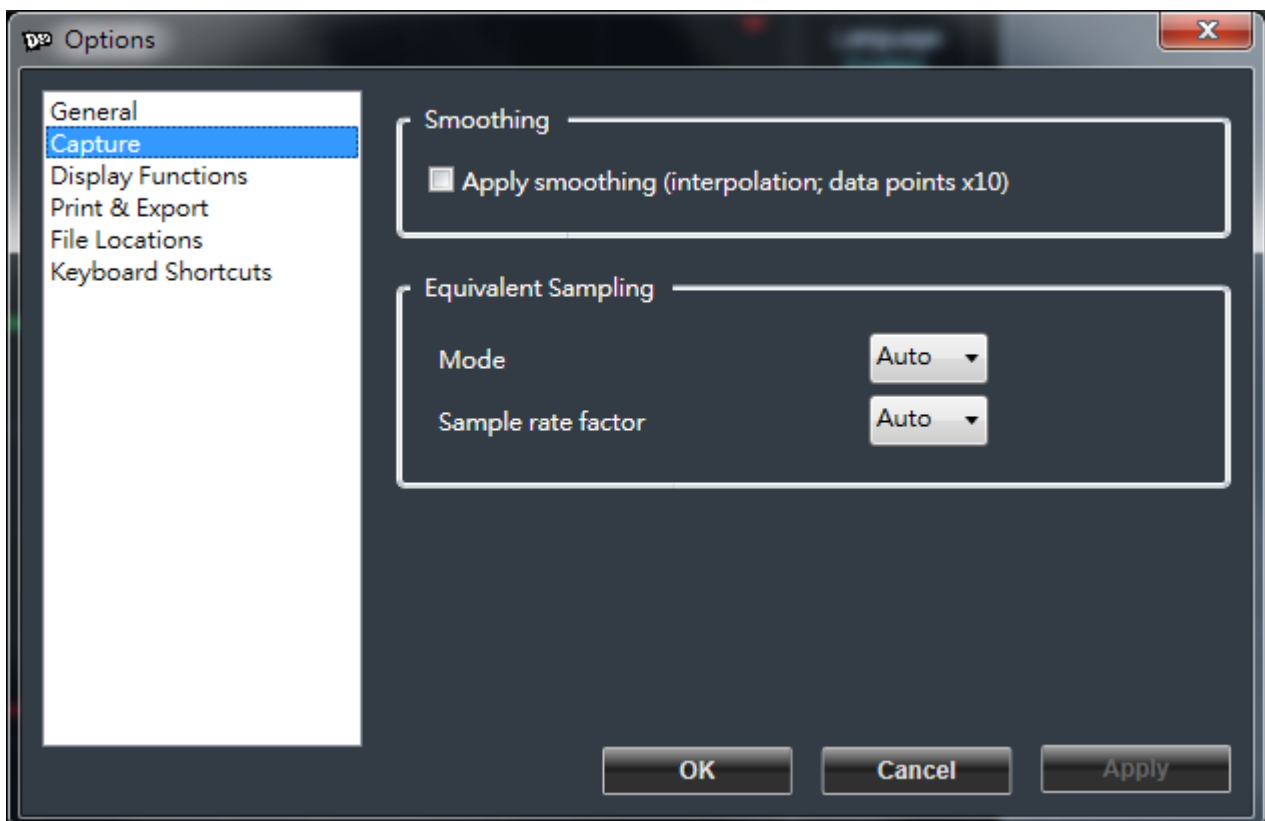


### 5.6.7.2. Wave pattern smoothing function

The [Capture](#) page has two selections to choose from. The top is the [Smoothing](#) function. Turning on the Smoothing function will make the wave pattern look smoother. The default is OFF.

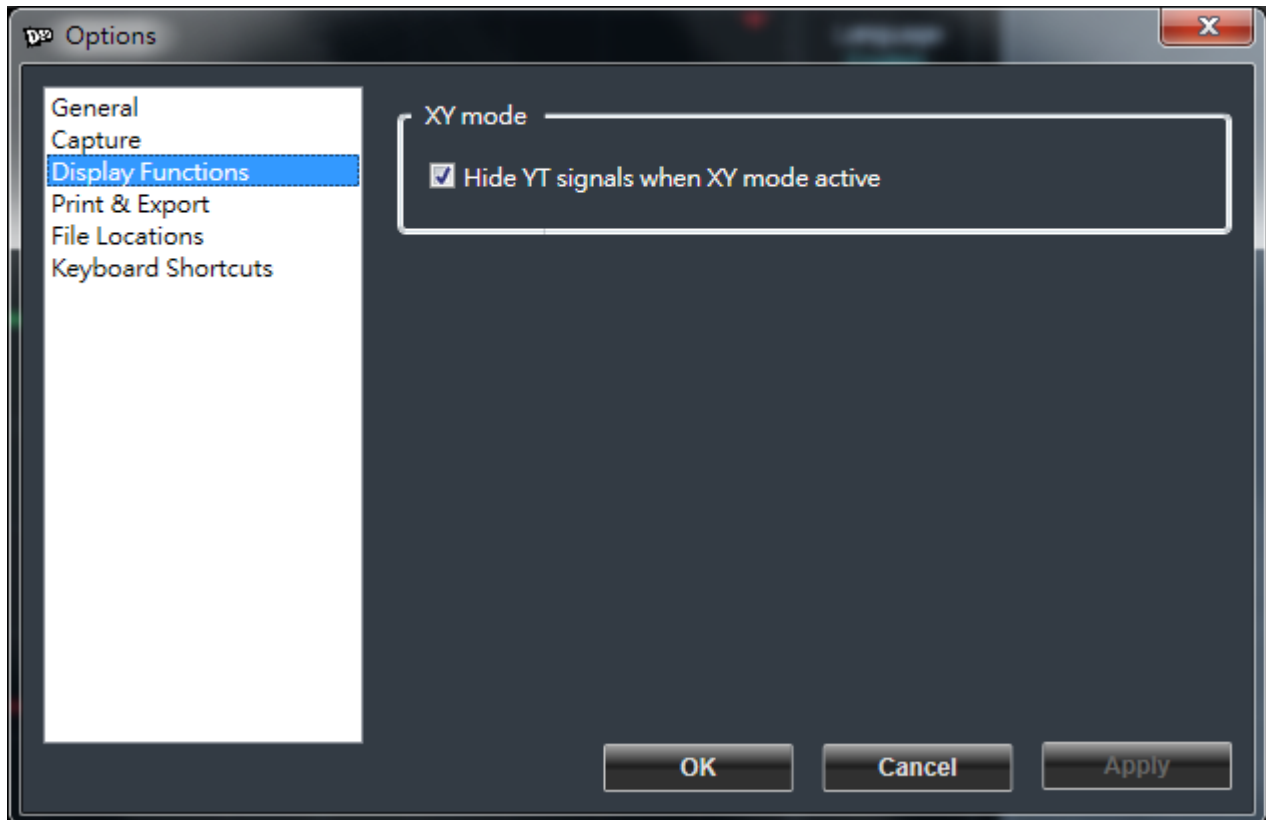
### 5.6.7.3. Equivalent sampling function options

On the bottom of the Capture page is the [Equivalent Sampling](#) setting. This mode is used to set the equivalent sampling function to On, Off, or Auto. The default is Auto. Sample rate factor is used to select the wave pattern quantity analyzed by the equivalent sampling. The higher the value the more detailed the wave pattern; however, the time also takes longer. The maximum value is 100. The default is automatic.



#### 5.6.7.4. XY Mode display options

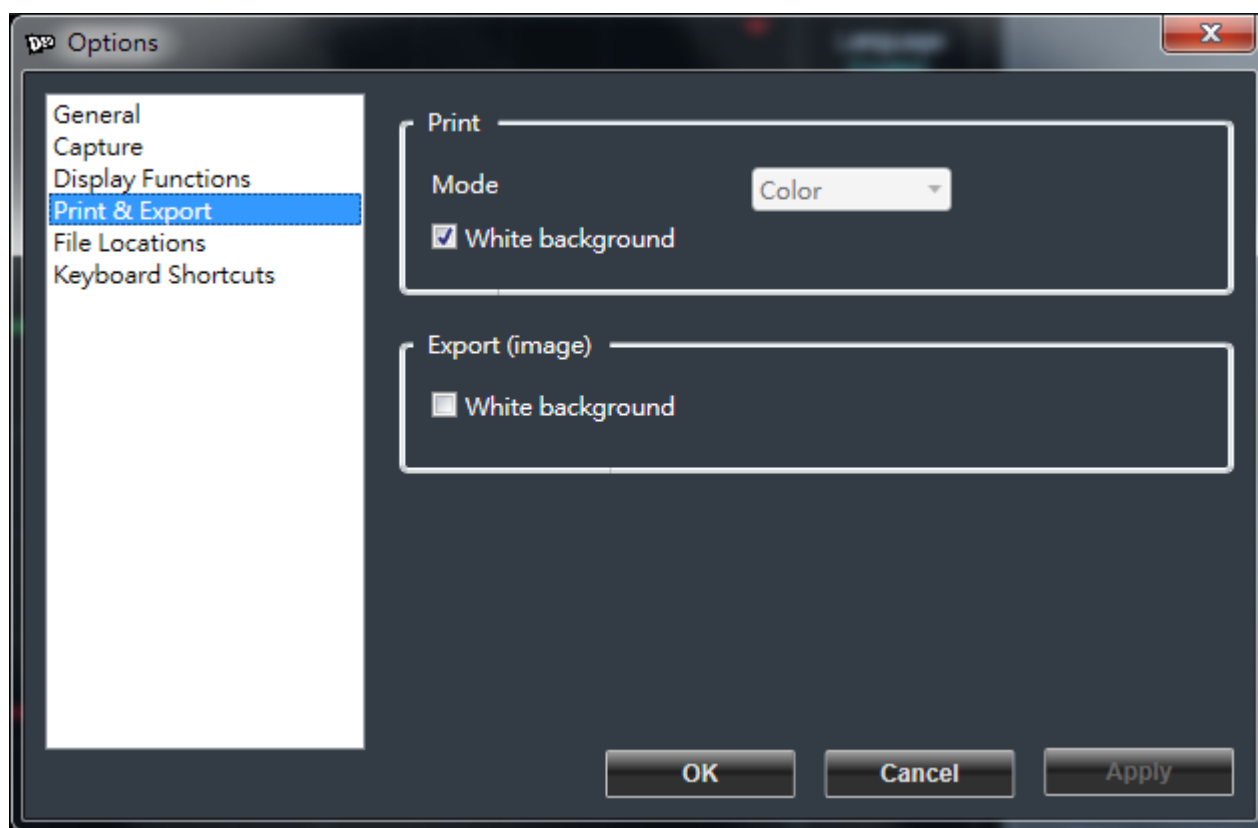
The [Display Function](#) can be used to select the XY Mode display. The default in the XY Mode is to turn off the wave pattern display. The user can turn on the display to display the XY Mode and the wave pattern together.



### 5.6.7.5. Print & export options

The **Print & Export** page is used to set the print & export options. To save ink the default for the printed background is white. If the selection is canceled, the printed background will be black.

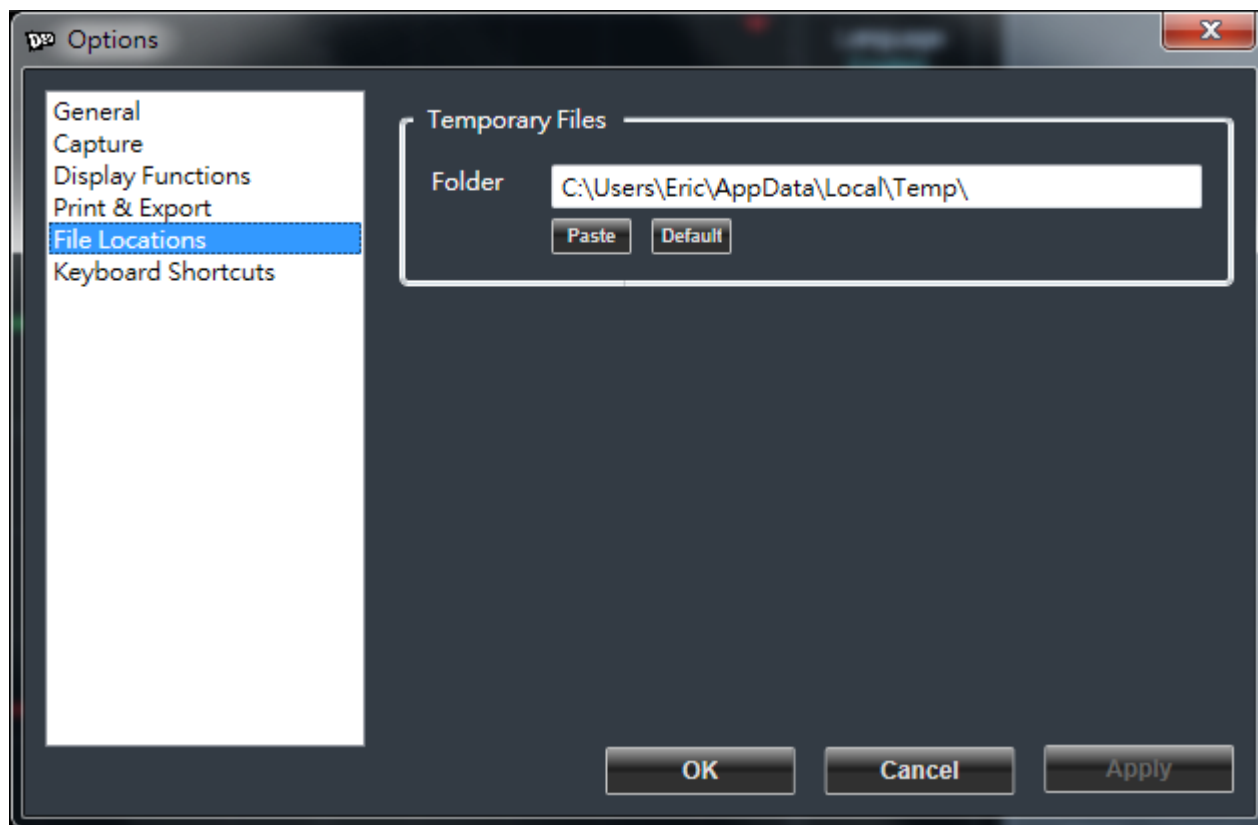
The default background for the exported image is black. If the selection is canceled the background of the exported image will be white.





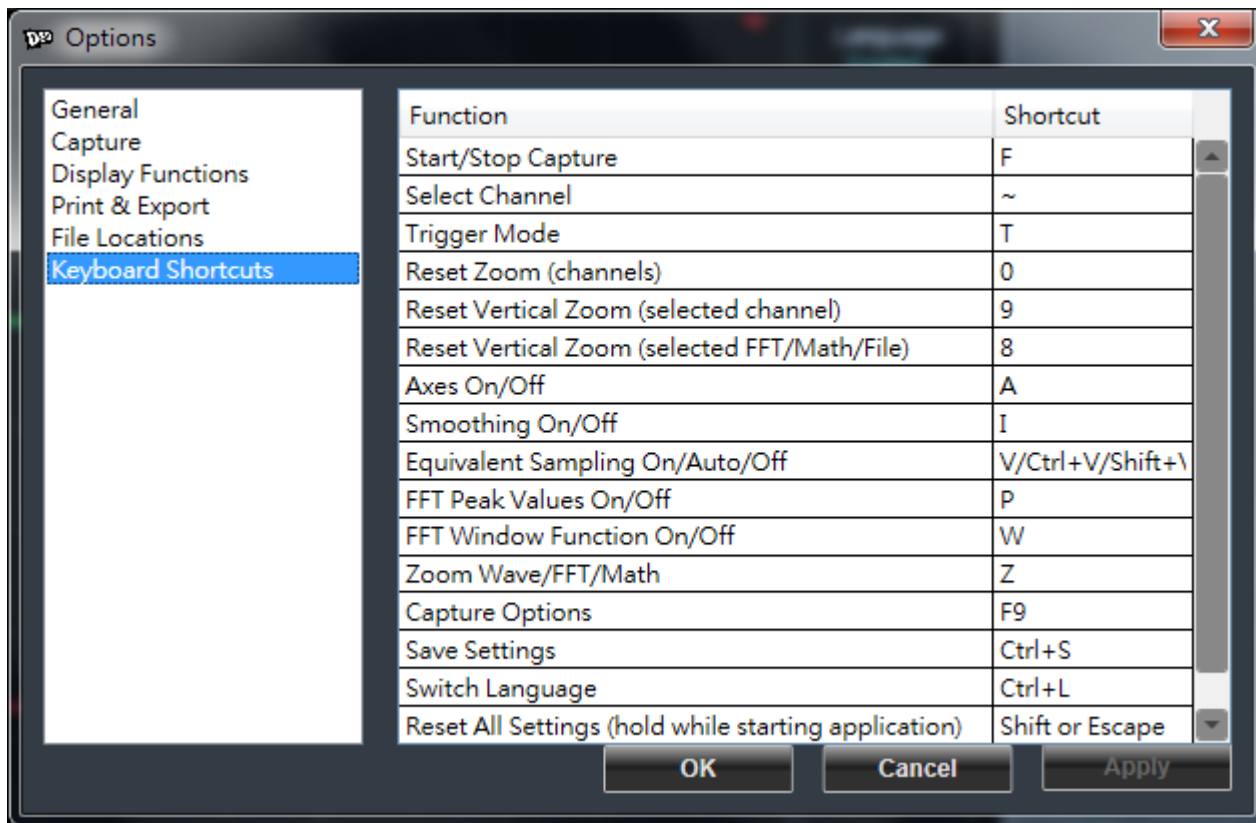
### 5.6.7.6. Software temporary file directory setting

The [File Locations](#) page is used to set the software's temporary file directory. Unless necessary, we do not recommend changing the default value.



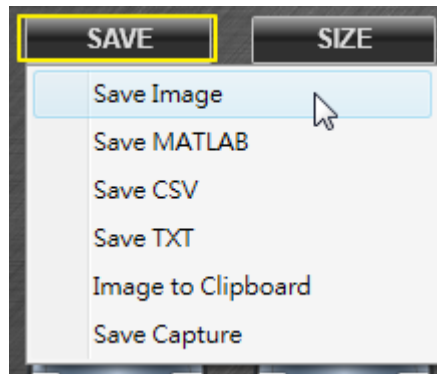
### 5.6.7.7. Shortcut key setting

The [Keyboard Shortcuts](#) page is used to set the shortcut key. Users can set according to their own preference.



## 5.7. Save function

Press the **SAVE** button in the main function keys to bring up the save menu. Users can choose the file type to be saved, as shown below.



There are five file types to choose from. Save Image is to save the file as an image file. When saving as an image file, the user can choose to save as a png file or a bmp file. Save MATLAB is to save the data as the m file used by MATLAB software. Save CSV is to save the data as a csv file (for Excel ). Image to Clipboard is to save to the clipboard, which can be pasted on pictures used in document software.

## 5.8. Print Function

Press the **PRINT** in the main function key to display the print window. User can choose the printer to print the wave pattern.

## 5.9. Adjust Screen Size

Press the SIZE button in the main function keys to bring up the screen size menu, as shown below. There are five sizes to choose from. The Maximized is the full screen display.

