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# Hantek

## USER'S MANUAL

**6022BE**

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## General Safety Summary

Review the following safety precautions carefully before operate the device to avoid any personal injuries or damages to the device and any products connected to it.

To avoid potential hazards use the device as specified by this user's guide only.

- ◆ **To Avoid Fire or Personal Injury**
- ◆ **Use Proper Power Cord.** Use only the power cord specified for this product and certified for the country of use.
- ◆ **Connect and Disconnect Properly.** Do not connect or disconnect probes or test leads while they are connected to a voltage source.
- ◆ **Connect and Disconnect Properly.** Connect the probe output to the measurement device before connecting the probe to the circuit under test. Disconnect the probe input and the probe reference lead from the circuit under test before disconnecting the probe from the measurement device.
- ◆ **Observe All Terminal Ratings.** To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.
- ◆ **Use Proper Probe.** To avoid shock hazard, use a properly rated probe for your measurement.
- ◆ **Avoid Circuit or Wire Exposure.** Do not touch exposed connections and components when power is on.
- ◆ **Do Not Operate With Suspected Failures.** If suspected damage occurs with the device, have it inspected by qualified service personnel before further operations.
- ◆ **Provide Proper Ventilation.** Refer to the installation instructions for proper ventilation of the device.
- ◆ **Do not operate in Wet/Damp Conditions.**
- ◆ **Do not operate in an Explosive Atmosphere.**
- ◆ **Keep Product Surfaces Clean and Dry.**

# Chapter 1 Getting Start

The oscilloscope is small, lightweight, no external power required, portable oscilloscopes! The oscilloscopes is ideal for production test, research and design and all of the applications involving analog circuits test and troubleshooting, as well as education and training.

In addition to the list of general features on the next page, this chapter describes how to do the following tasks:

- ◆ **System Requirements**
- ◆ **Install Software**
- ◆ **General Features**
- ◆ **General Check**
- ◆ **Probe compensation**
- ◆ **Function check**
- ◆ **Self calibration**
- ◆ **Accessories**

## System Requirement

To run the oscilloscope software, the needs of computer configuration are as follows:

### **Minimum System Requirements**

#### **Operating System**

Window 2000/XP/VISTA/7

#### **Processor**

Upwards of 1.00G processor

#### **Memory**

128M byte

#### **Disk Space**

500M disk free space

#### **Screen resolution**

800 x 600

### **Recommended Configuration**

Windows XP SP2 System

2.4G Processor

512M Byte Memory

80G Disk Space

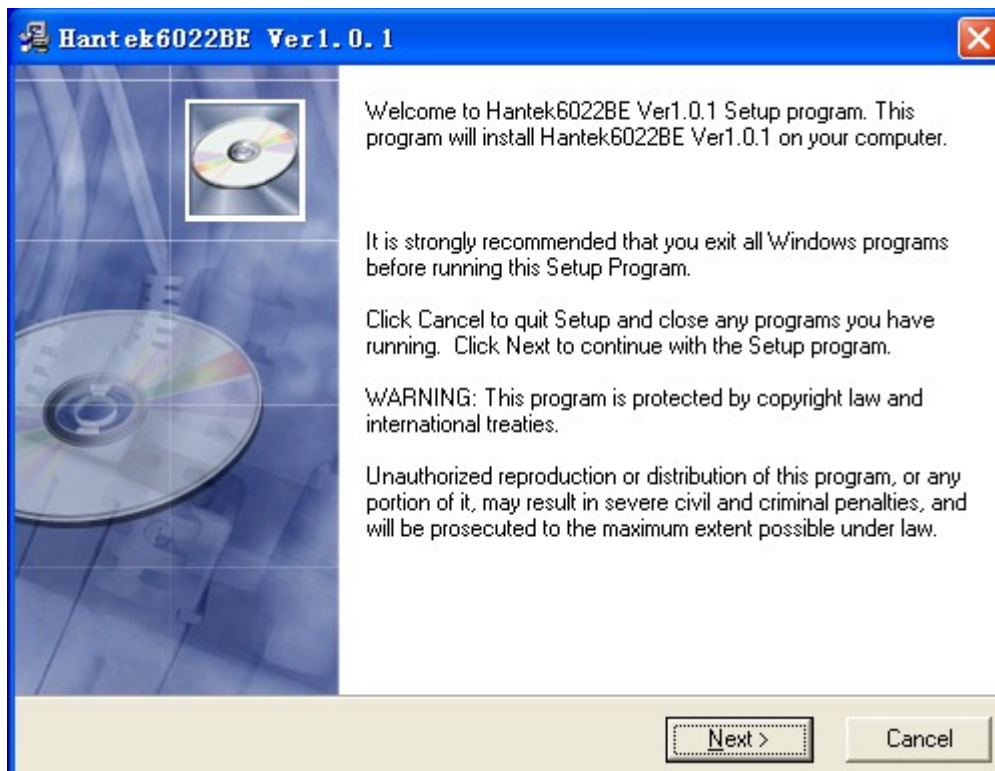
1024 x 768 or 1280 x 1024 resolution

DPI Setting: Normal Size (96DPI)

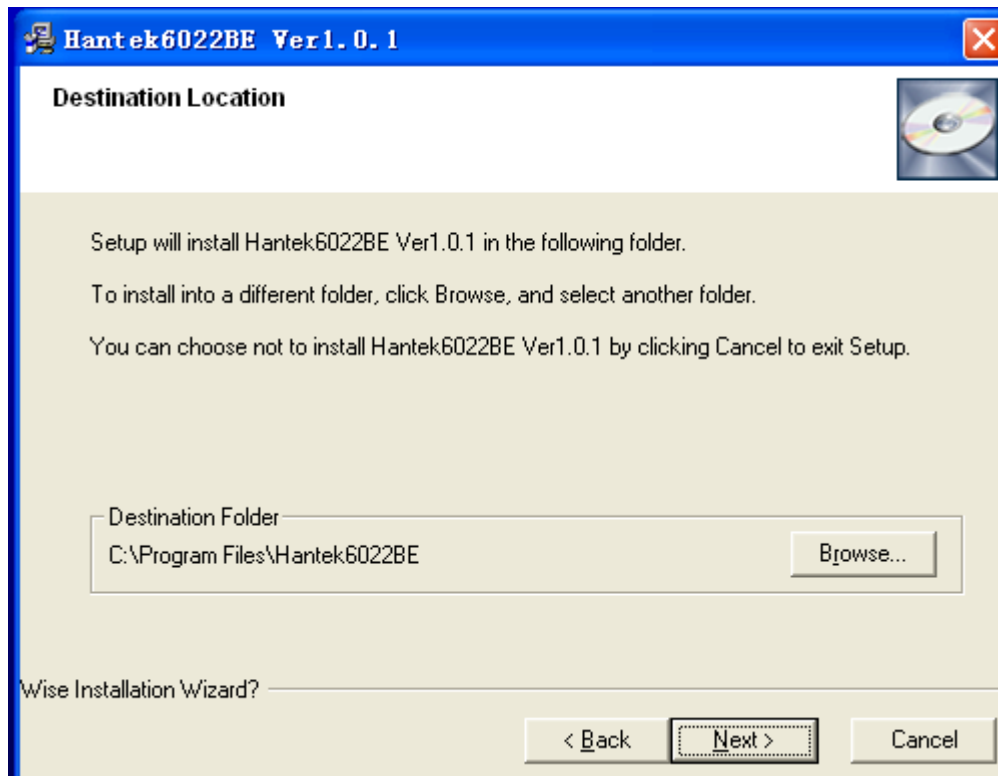
## Install Software

**Caution:** You must install the software before using the oscilloscope.

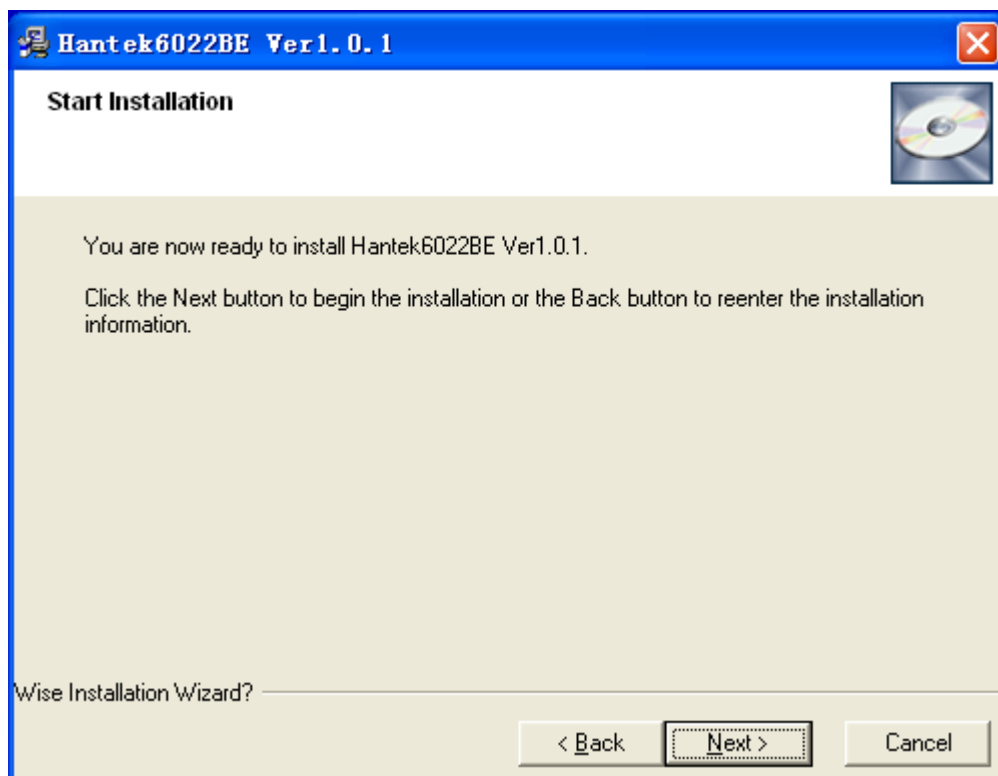
1. While in Windows, insert the installation CD into the CD-ROM drive.
2. The installation should start up automatically. Otherwise in Windows Explorer, switch to the CD-ROM drive and run Setup.exe.
3. The software Installation is started. Click 'Next' to continue.



4. Choose a destination directory. Click 'Next' to continue.

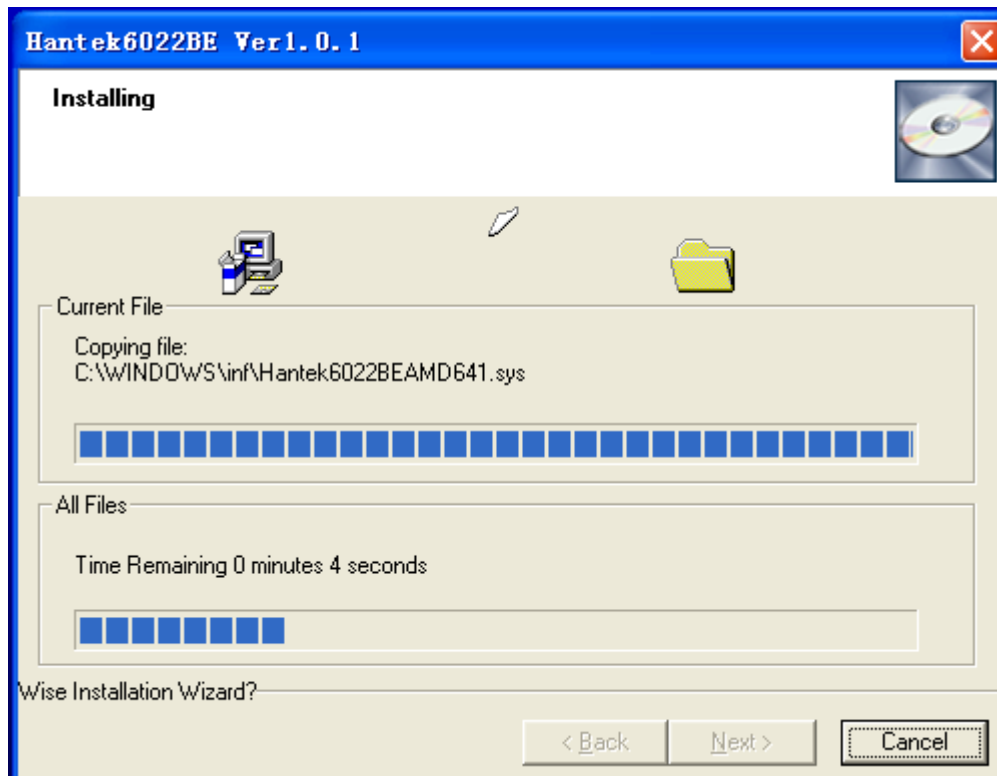


5. Check the setup information. Click Next to start copying of files.

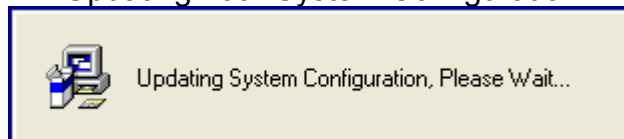


6. This Status dialog is displayed during copying of files.

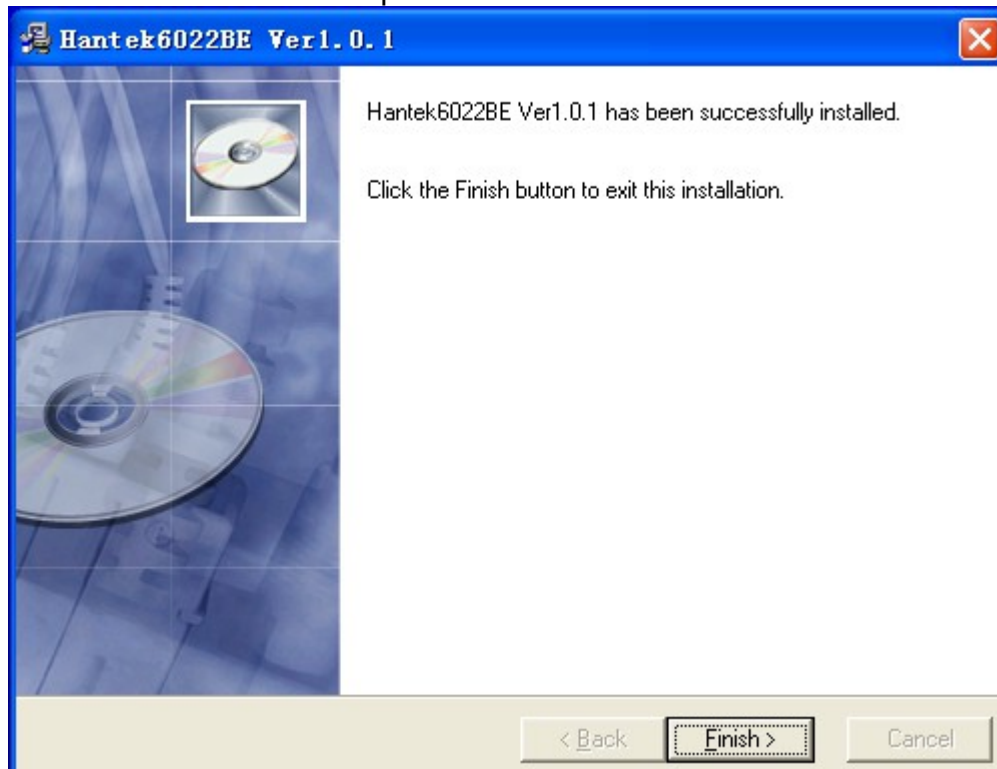




## 7. Updating Your System Configuration.



## 8. The installation is complete.



## Install Driver

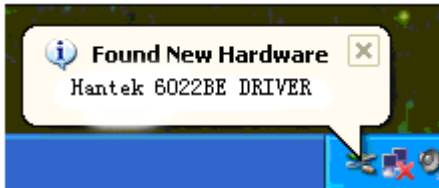
1. Connect the A-Type Plug of USB cable to your PC'S USB port.



2. Connect the B-Type Plug of USB cable to Hantek 6022BE'S USB port.



3. New hardware is found.



4. New hardware search wizard starts.



5. New hardware search wizard starts to search the driver.



6. New hardware wizard installs "Hantek 6022BE DRIVER".



7.The wizard has finished installing for “Hantek 6022BE DRIVER”.



## General Features

### Product features:

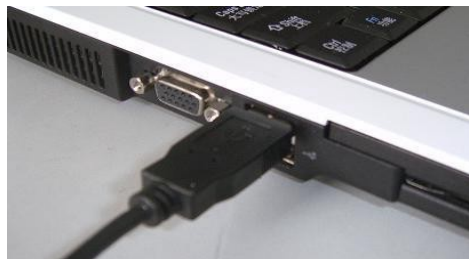
- ◆ **Dual Channel, Bandwidth: 48MSa/s**
- ◆ **Maximum real-time sample rate: 1Mbyte/channel**
- ◆ **Automatic setup for ease of use (AUTOSET);**
- ◆ **20 Automatic measurements;**
- ◆ **Automatic cursor tracking measurements;**
- ◆ **waveform storage;**
- ◆ **User selectable fast offset calibration;**
- ◆ **Add, Subtract , Multiply and Division Mathematic Functions;**
- ◆ **Adjustable waveform intensity, more effective waveform view;**
- ◆ **User interface in several user-selectable languages;**

## Function Check

Perform this functional check to verify that your oscilloscope is operating correctly.

### ◆ **Connect the oscilloscope**

You should connect the A-Type Plug of USB cable to your PC USB port and connect the B-Type Plug of USB cable to oscilloscope USB port.

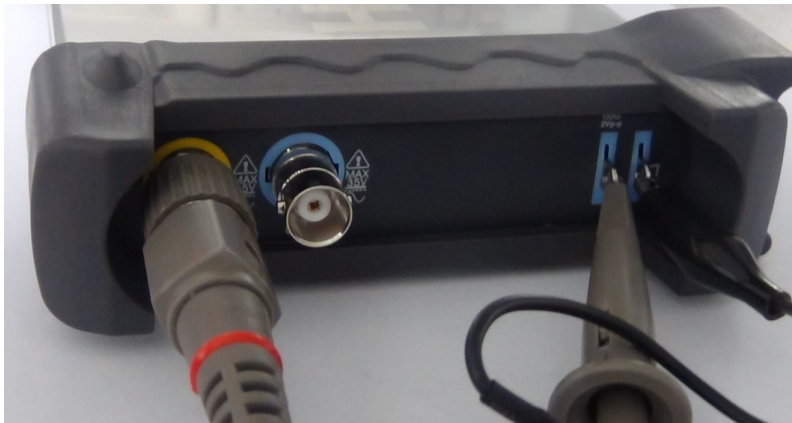


### ◆ Input a signal to a channel of the oscilloscope

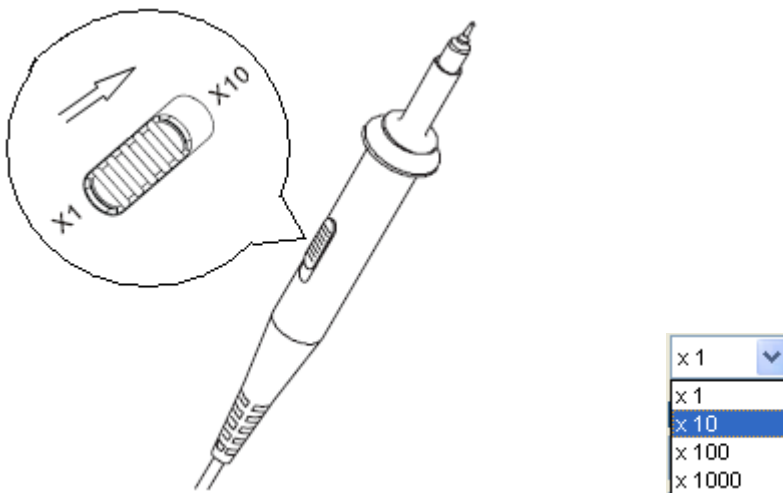
The oscilloscope is equipped with dual channels plus external trigger.

#### Please input signal in the following steps:

1. Set the attenuation switch on the probe as 10X and connect the probe on the oscilloscope with CH1. Aim the slot in the probe connector at the faucet on BNC of CH1 and insert, then, turn right to lock the probe. Finally, attach the tip of probe and ground nip to the Connector of Probe compensator.



2. Set the CH1 probe attenuation of the oscilloscope to X10. (The default is X1).

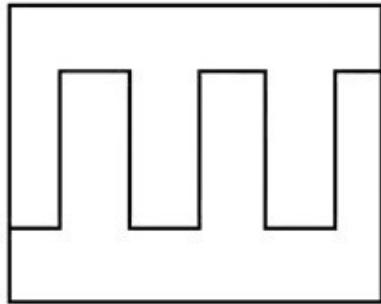


3. Attach the tip of probe and ground nip to the Connector of Probe compensator. Click the **AUTO** button. A square wave will be displayed within a several seconds. (Approximately 1 kHz, 2V, peak- to- peak). Inspect CH2 with the same method.
4. Repeat steps 2 and 3

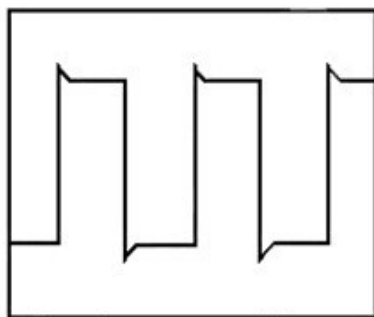
## Probe Compensation

Perform this function to match the characteristics of the probe and the channel input. This should be performed whenever attaching a probe to any input channel at the first time.

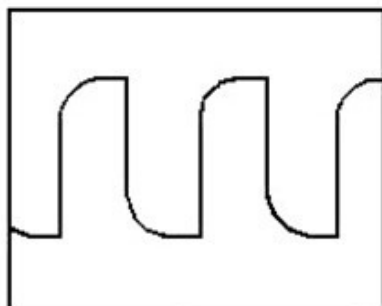
- From the “Probe” menu, select attenuation to 1:10. Set the switch to “X10” on the probe and connect it to CH1 of the oscilloscope. When using the probe hook-tip, insert the tip onto the probe firmly to ensure a proper connection.
- Attach the probe tip to the Probe Compensator and the reference lead to the ground connector, select CH1, and then press the “AUTOSET” button into the menu or the toolbar.
- Check the shape of the displayed waveform.



Correctly Compensated

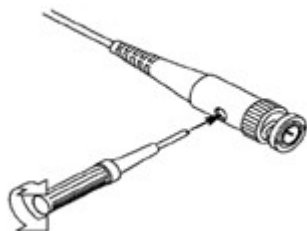


Over compensated



### Under Compensated

- If necessary, use a non-metallic tool to adjust the trimmer capacitor of the probe for the fattest square wave being displayed on the oscilloscope.



- Repeat if necessary.

**WARNING:** To avoid electric shock while using the probe, be sure the perfection of the insulated cable, and do not touch the metallic portions of the probe head while it is connected with a voltage source.

## Self Calibration

The self calibration routine lets you optimize the oscilloscope signal path for maximum measurement accuracy. You can run the routine at any time but you should always run the routine if the ambient temperature changes by 5°C or more. For accurate calibration, power on the oscilloscope and wait twenty minutes to ensure it is warmed up. To compensate the signal path, disconnect any probes or cables from the input connectors. Then, access the “**Menu -> Utility -> Calibration**” option and follow the directions on the screen. The self calibration routine takes about several minutes.

## Accessories

All the accessories listed below are standard accessories for the oscilloscope:

- ◆ Probex2 (1.5m), 1:1, (10:1) Passive Probes
- ◆ A User's Guide
- ◆ An USB Cable
- ◆ A PC software of the oscilloscope

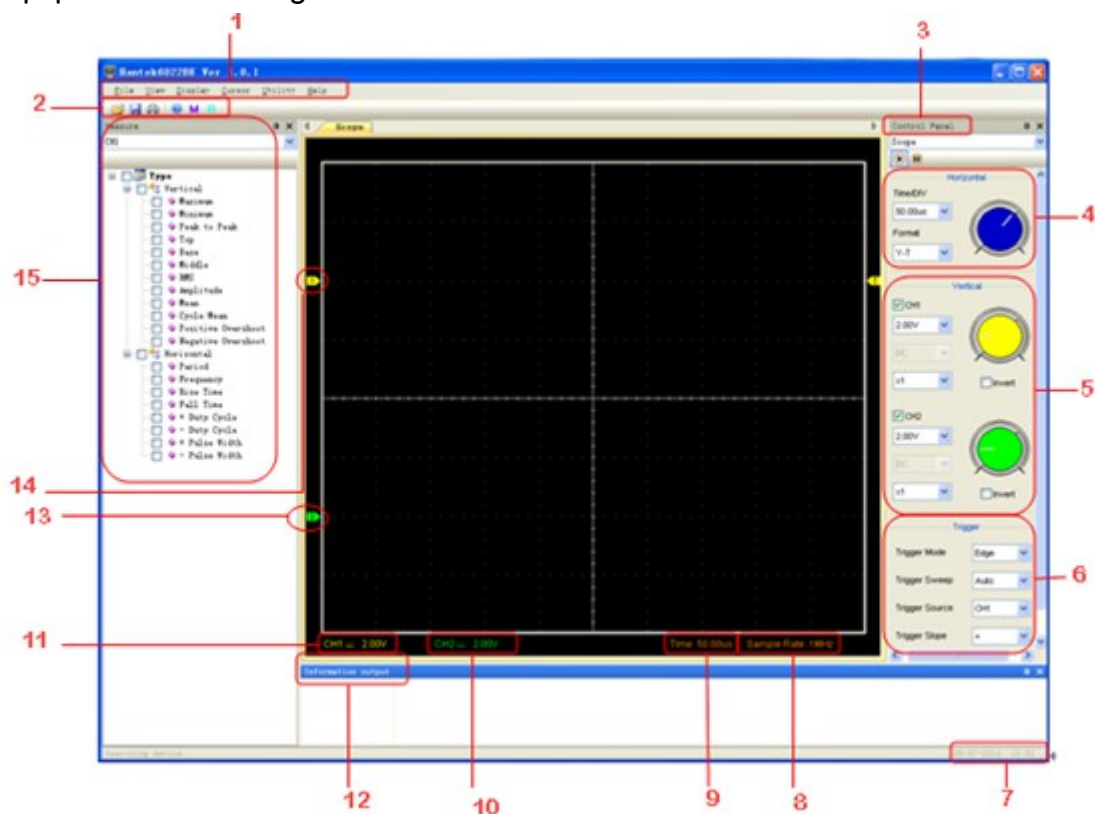


## **Chapter 2 Operating Basics**

- ◆ **The User's Interface**
- ◆ **The Menu System**
- ◆ **The Vertical System**
- ◆ **The Horizontal System**
- ◆ **The Trigger System**

## The User's Interface

Click the software icon on the desk after you finished the software setting and equipment connecting. Then a user interface will be showed as follows:



In addition to displaying waveforms, the display area is filled with many details about the waveform and the oscilloscope control settings.

1. **The Main Menu**  
All settings can be found in the main menu.
2. **The Toolbar**

**3. Control Panel****4. The Horizontal Panel**

The user can change Time/Div, format in the panel.

**5. The Vertical Panel**

The user can turn on/off the CH1/CH2. Also the user can change the CH1/CH2 volt/div, coupling and probe attenuation.

**6. The Trigger Panel**

In this panel, the user can change the trigger mode, sweep, source and slope.

**7. It shows the system time.****8. Sample Rate****9. It shows the main time base setting.****10. It shows the CH2 information**

Readouts show the coupling of the channels.

Readouts show the vertical scale factors of the channels.

A “B” icon indicates that the channel is bandwidth limited.

**11. It shows the CH1 information**

Readouts show the coupling of the channels.

Readouts show the vertical scale factors of the channels.

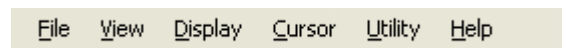
**12. Output Window****13. The markers show the reference points of the displayed waveforms.**

**If there is no marker, the channel is not displayed.**

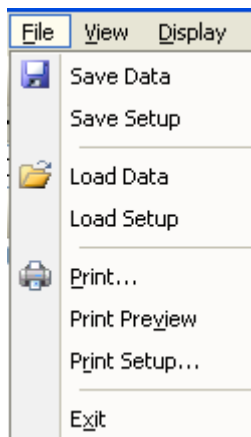
**14. The same as 13.****15. Measure Window.**

## The Menu System

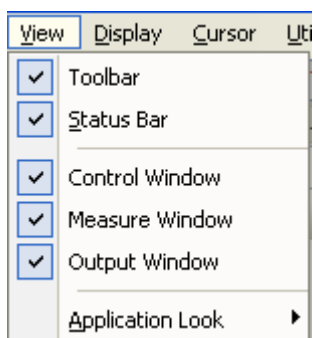
### The Main Menu



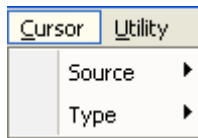
1. **File:** Load or Save data, setup



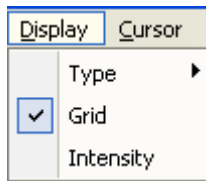
2. **View:** Change the user interface



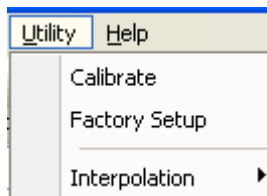
3. **Cursor:** Cursor measure setup



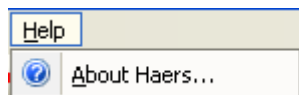
4. **Display:** The waveform display setup



5. **Utility:** Utility setting

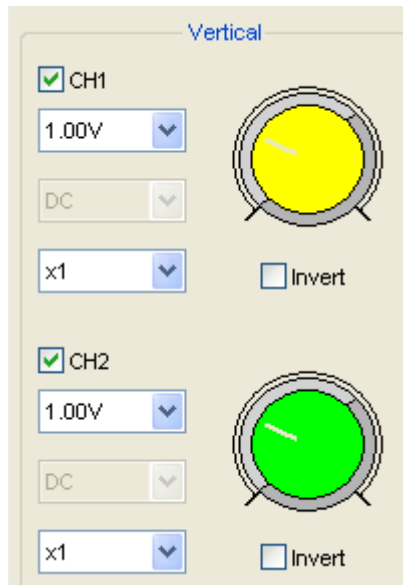


6. **Help:** Turn on help file



## The Vertical System

The following figure shows the vertical system menu. It shows the vertical parameters setting.



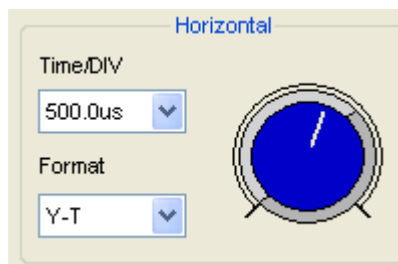
1. **CH1**: Leads to the setting of the **CH1** parameters
2. **CH2**: Leads to the setting of the **CH2** parameters

Use the left mouse button to dragging the channel icon to set the vertical position offset precisely.

**Invert**: The invert function turns the displayed waveform 180 degrees.

## The Horizontal System

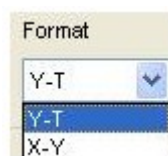
The following figure shows the Horizontal System window. It shows the horizontal parameters settings.



1. **Time/DIV**: leads the setting of the time base parameters
2. **Format**: leads the setting of the horizontal format parameters

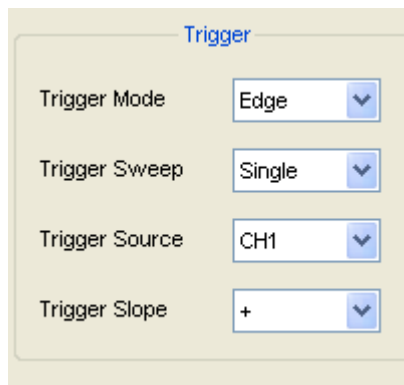
The time base ranges of the oscilloscope is listed as follows. The horizontal scan speed is from 4ns/div to 1hour/div.

In the "**Format**" menu of the "**Horizontal**" menu, select the display mode to **Y-T**, **X-Y**.



## The Trigger System

The following figure shows the trigger system control.



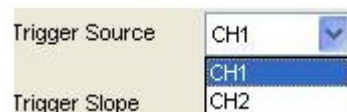
**Mode:** Sets the trigger mode to **Edge** trigger



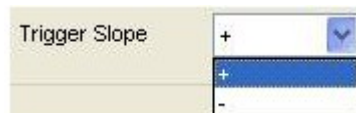
**Sweep:** Selects the trigger sweep mode to **AUTO**, **NORMAL** or **SINGLE**



**Source:** Selects the trigger source to **CH1**, **CH2**, **ALT**, **EXT** or **EXT/10**



**Slope:** Selects the edge trigger slope to **Positive** or **Negative** slope



The user can drag the trigger icon to adjust the trigger level and the trigger level will be displayed on the top right corner.

## Input Connectors



**CH 1/CH 2:** Input connectors for waveform display.

**EXT.:** Input connector for an external trigger source. Use the Trigger Menu to select the Ext. or Ext./10 trigger source.

**Other Connector:**



**GND.:** a ground terminal

**USB PORT:** Connect the B-Type Plug of USB cable to this port.

**CAL.:** Probe compensation output.



## **Chapter 3 Understanding Function**

- ◆ **Set Oscilloscope**
- ◆ **Set Vertical System**
- ◆ **Set Horizontal System**
- ◆ **Set Trigger System**
- ◆ **Utility Function**
- ◆ **Measure Signal**
- ◆ **Utility Function**
- ◆ **Save and Load**
- ◆ **Print**

## Set Oscilloscope

### Save Setup

The oscilloscope software saves the current setup before you close the oscilloscope software. The oscilloscope recalls this setup the next time you run the software. You can use the “**Save Setup**” menu to permanently save up to several different setups.

### Load Setup

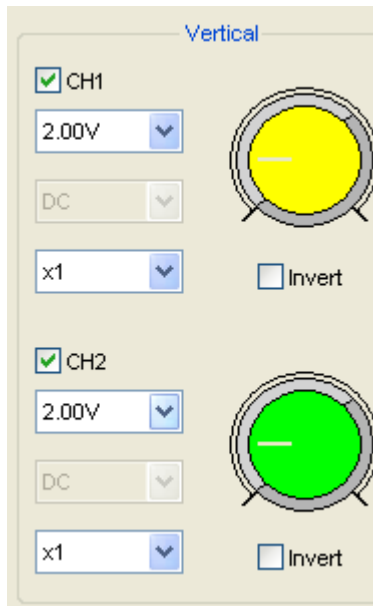
The oscilloscope can recall the last setup before the oscilloscope software was running, any saved setups, or the factory setup. You can use the “**Load Setup**” menu to permanently recall a setup.

### Factory Setup

The oscilloscope software is set up for normal operation when it is shipped from the factory. This is the factory setup. To recall this setup, push the “**Factory Setup**” menu.

## Set Vertical Systems

The CH1/CH2 control panel in sidebar



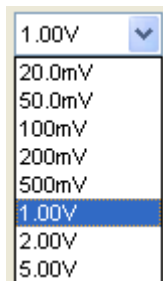
### The Vertical Menu function:

- ◆ **Turn ON/Off:** Turn on/off the channel
- ◆ **Volt/DIV:** Select the channel voltage/div
- ◆ **Coupling:** Select the channel coupling
- ◆ **Probe:** Select the channel probe attenuation

#### ➤ Change Volt/DIV

You can click **"Volt/Div"** in **"CH1/CH2"** Menu to select the voltage

You can also change **"CH1/CH2"** voltage in sidebar

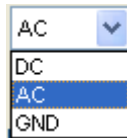


You can left click and drag the mouse on the green knob or the yellow knob to change the voltage.

## ➤ Set Channel Coupling

Click “**Coupling**” in “**Channel**” menu

In the sidebar, you can change the channel coupling too.



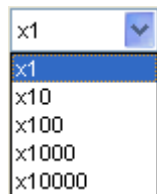
You can set the coupling to **DC**, **AC** or **GND**. If you set the coupling to **DC**, it blocks the **AC** component of the input signal.

## ➤ Probe Attenuation Setting

Select the attenuation factor for the probe. To check the probe attenuation setting, toggle the probe menu to match the attenuation factor of the probe. This setting remains in effect before you changed again.

Click “**Probe**” in Channel menu to select the probe attenuation

The probe setting window in the sidebar

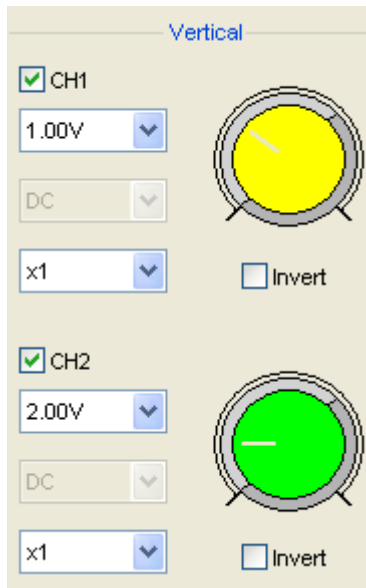


**Note:** The attenuation factor changes the vertical scale of the oscilloscope so that the measurement results reflect the actual voltage levels at the probe tip.

## ➤ Invert

The invert function turns the displayed waveform 180 degrees, with respect to the ground level. When the oscilloscope is triggered on the inverted signal, the trigger is also inverted.

Click “**Invert**”



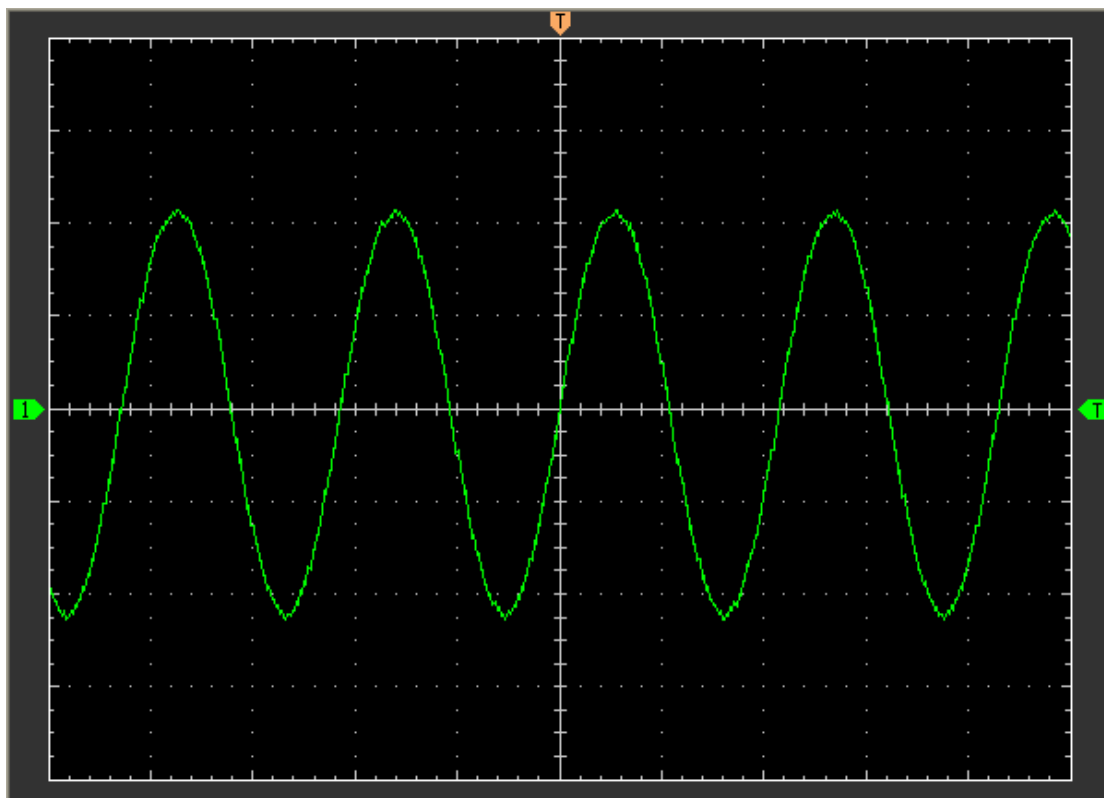
Turn off invert

☐ Invert

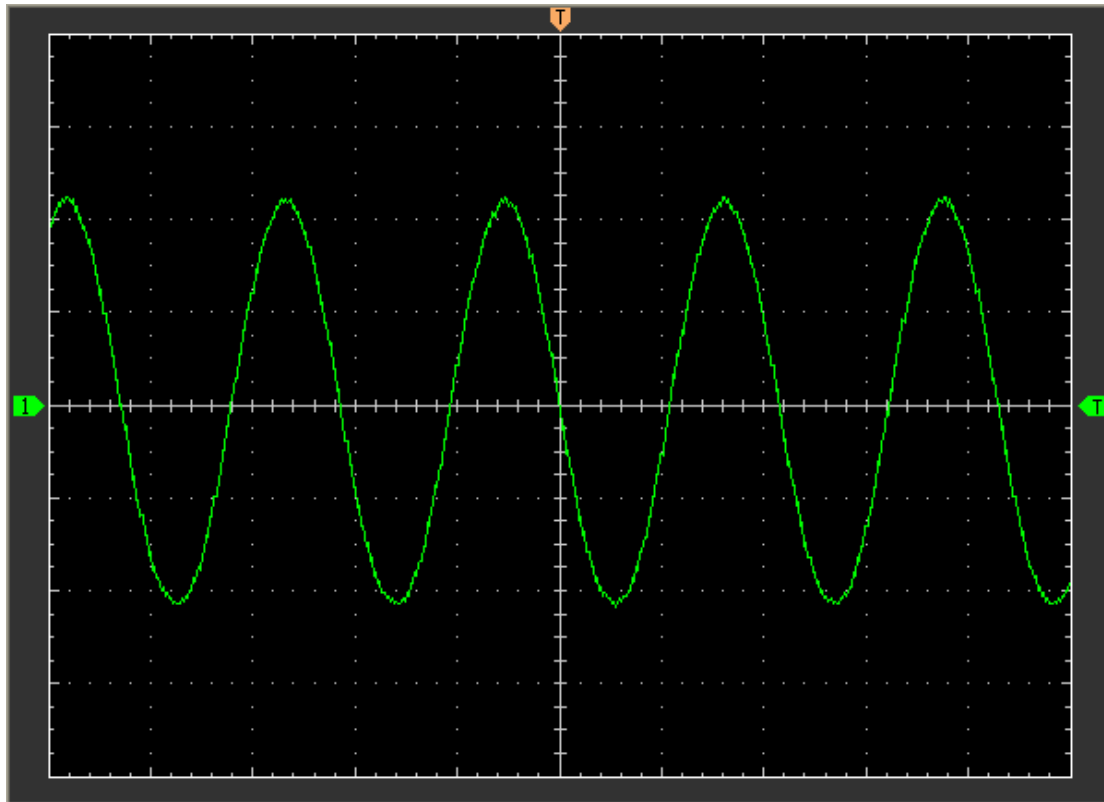
Turn on invert

☒ Invert

The following picture shows the waveform before inversion:



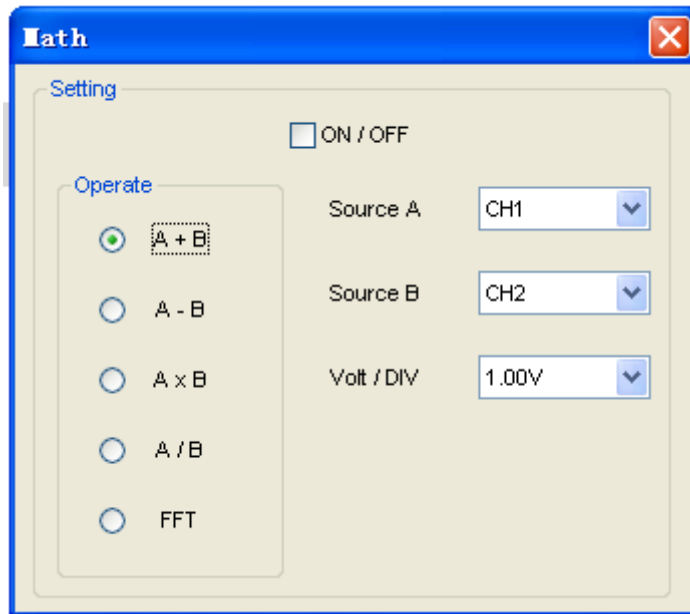
The following picture shows the waveform of inversion:



## Set Math

Click **M** in **Toolbar**.

The **MATH** Menu:



◆ **Turn On/Off:** Turn On/Off the MATH Channel.

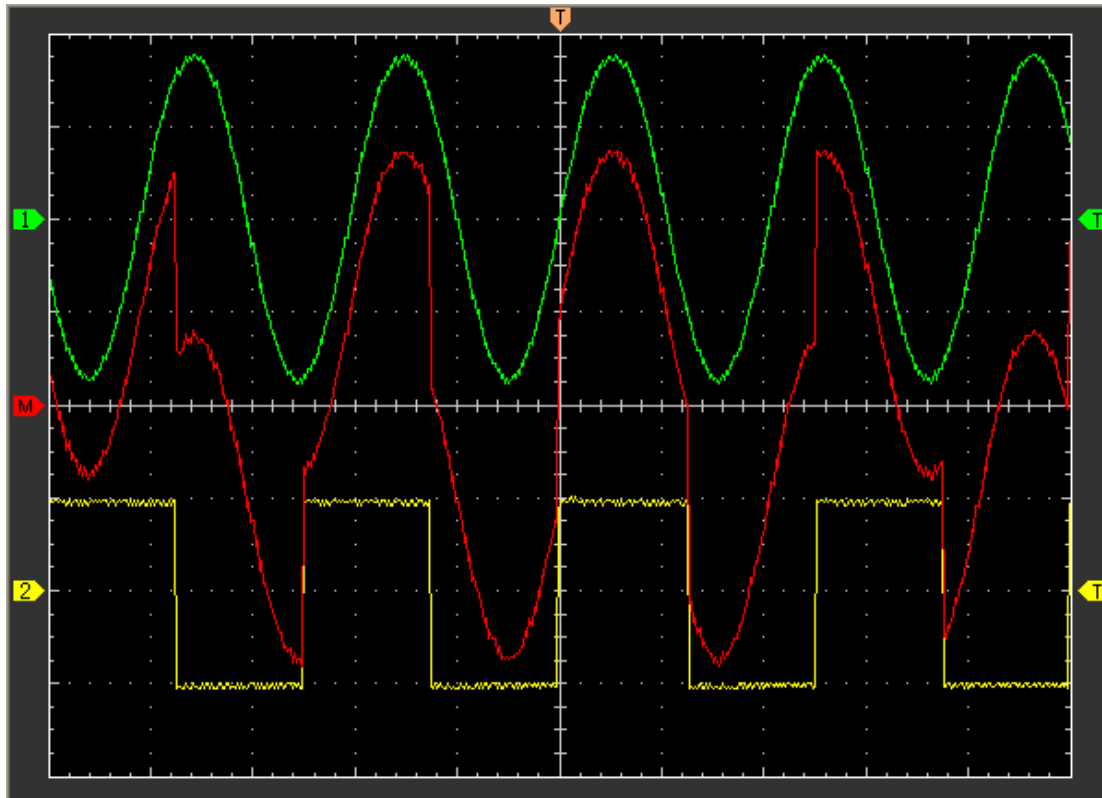
◆ **Source A/B:** Set the sources of the math channel.

The mathematic functions include addition, subtract, multiply and division for CH1 and CH2.

In this function, use the addition, subtraction, multiplication, division function and FFT to operate and analyze the waveform.

Select source A and B. Then adjust the vertical scale and offset to view the math channel clearly. The mathematic result can be measured by the measure and the cursor.

### ➤ **The Math Function Display**



## Fast Fourier Transform Function

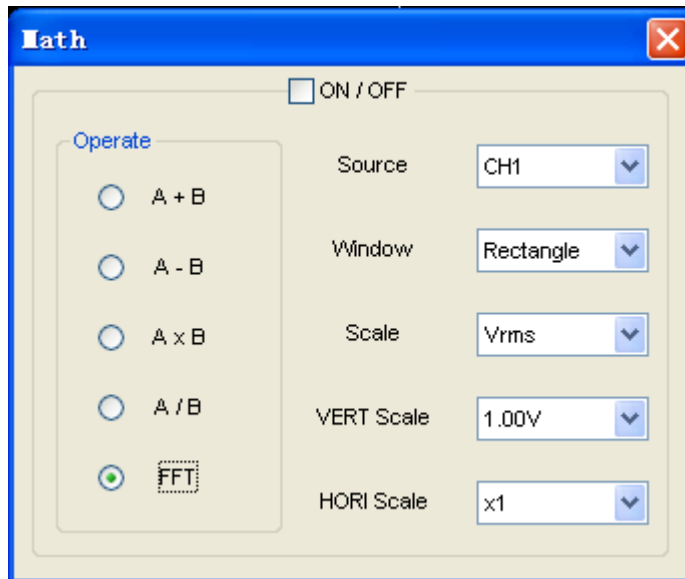
You can use the FFT mode to convert a time-domain signal into its frequency components (spectrum). You can use the FFT mode for the following types of analysis:

- ◆ Measure harmonic content and distortion in systems
- ◆ Characterize noise in DC power supplies
- ◆ Analyze harmonics in power lines
- ◆ Analyze vibration

To use the FFT mode, you need to click  in Toolbar to open the FFT setup window.

**The FFT setup window:**





You can select the Source channel, Window algorithm, FFT number, and FFT Zoom factor. It displays only one FFT spectrum at a time.

**Source:** Source CH1

Selects the channel used as the FFT source

**Window:** Window Rectangle

Selects the FFT window type

**Scale:** Vrms

Selects the vertical scale units

**Vert Scale:** 1.00V

Selects the vertical scale

**HORI Scale:** x1

Selects the FFT zoom factor

Sets horizontal scale, If the information is more than the quantity displayed to the display window, more information is displayed by using scroll bar.

You can click the ☐ ON / OFF button to start FFT math, also you can click this button to stop FFT math.

Click "Save" button if you want to save FFT math result. You can save the data into Word file, Excel file or Text file.

**Harmonic** information window shows the information of Harmonics.

Harmonics Information		
1st	50.0kHz	1.20V
2nd	100kHz	707mV
3rd	150kHz	58.8mV
4th	200kHz	235mV
5th	250kHz	308mV
6th	300kHz	57.0mV

**Measurement** information window shows the information about measurement of FFT.

Measurement Information	
SNR	-0.144dB
THD	-3.391dB
ENOB	-0.316bits
SFDR	4.562dB
SINAD	-1.678dB
TotalPower	5.505dB

### Measurement Parameters:

$\sum V_k^2$  : Amplitude of the fundamental frequency

$\sum H_k^2$  : Sum of Amplitude of Harmonic (excluding fundamental frequency)

$\sum N_k^2$  : Sum of Noise (excluding fundamental frequency, Harmonics, DC and Nyquist bins)

$F$  : Total Number of bins

$F_h$  : Total Number of bins of Harmonic

$F_n$  : Total Number of bins of Noise.

**SNR** (Signal to Noise Ratio): The ratio of the amplitude of the fundamental frequency to the Noise.

$$SNR = 10 \log_{10} \left[ \frac{\sum V_i^2}{\frac{F}{F_n} \sum N_i^2} \right] dB$$

**ENOB** (Effective Number of Bits) : The number of bits in an ideal converter that would be required to give the same SNR performance.

$$ENOB = \frac{SNR - 1.76}{6.02} bits$$

**SINAD** (Signal to Noise and Distortion): The ratio of the amplitude of fundamental frequency to the Noise, but Noise include Harmonics.

$$SINAD = 10 \log_{10} \left[ \frac{\sum V_i^2}{\frac{F - F_h}{F_n} \sum N_i^2 + \sum H_i^2} \right]$$

**THD** (Total Harmonic Distortion): The ratio of the RMS sum of the harmonics to

the RMS value of the fundamental.

$$THD = 10 \log_{10} \left[ \frac{\sum H_i^2}{\sum V_i^2} \right] dB$$

**SFDR** (Spurious Free Dynamic Range): The ratio of the RMS signal amplitude to the RMS value of the peak spurious spectral component. The peak spurious component may or may not be a harmonic.

$\sum S_i^2$  : The RMS value of the peak spurious spectral component.

$$SFDR = 10 \log_{10} \left[ \frac{\sum V_i^2}{\sum S_i^2} \right] dB$$

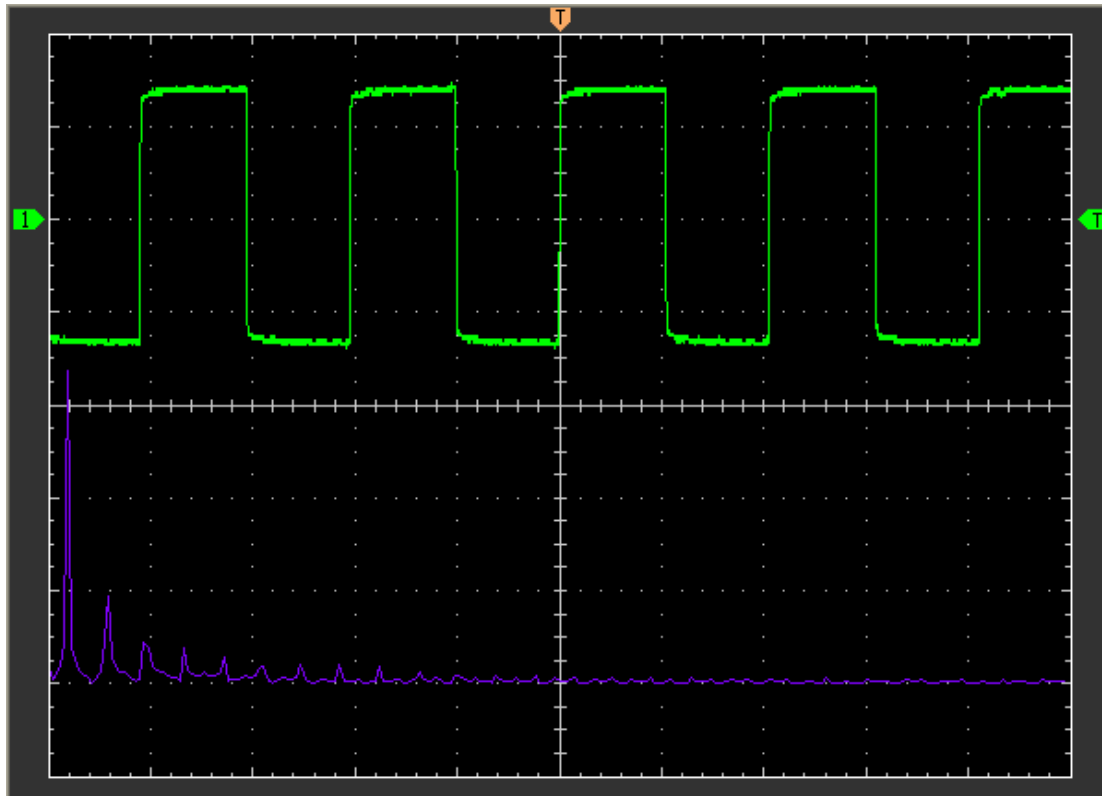
**Total Power**: The RMS value of the sum of all spectral components.

$\sum A_i^2$  : Sum of Noise excluding DC and Nyquist.


$$TotalPower = 10 \log_{10} \left[ \sum A_i^2 \right] dB$$

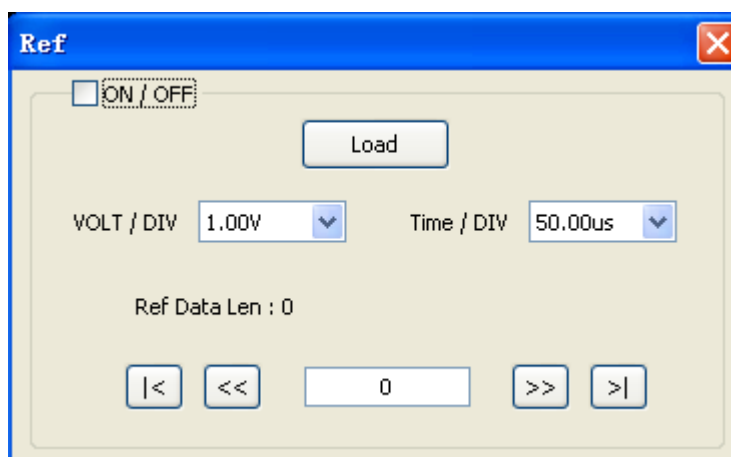
$$THD = 20 \log_{10} \frac{\sqrt{V_2^2 + V_3^2 + V_4^2 + V_5^2 + V_6^2}}{V_1}$$

### The FFT display Windows:



### Set reference

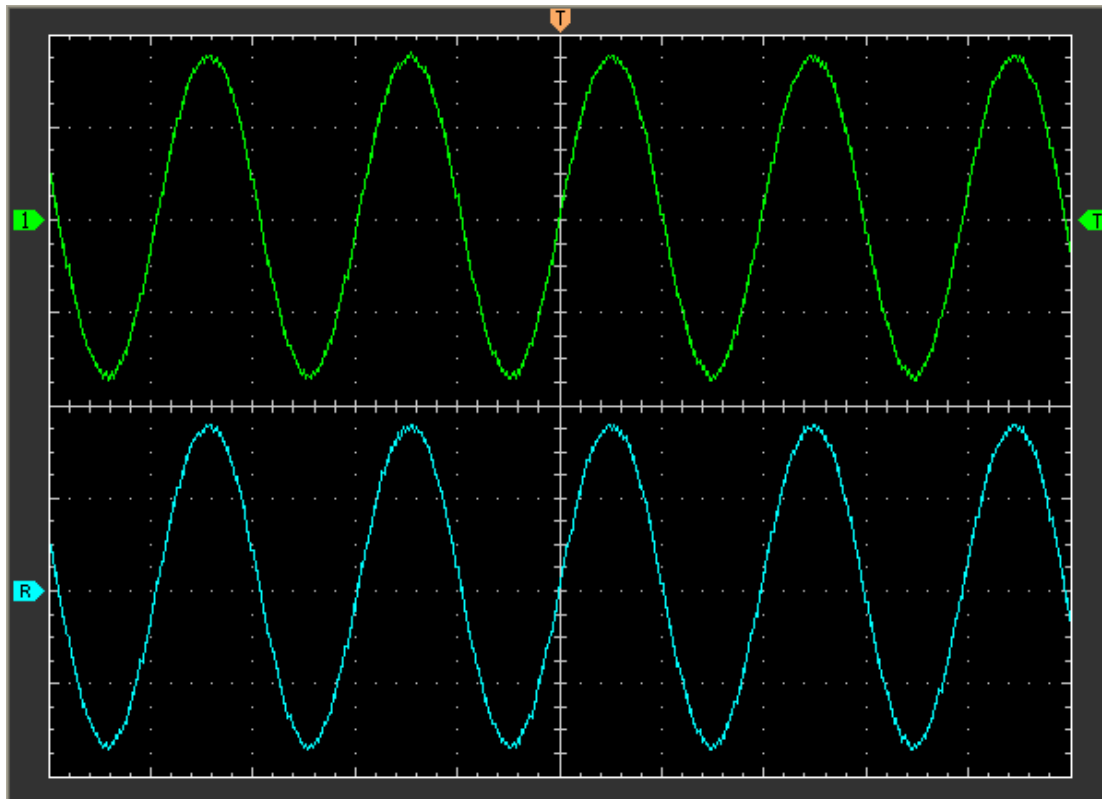
Click  in Toolbar to set REF channel.



The Reference Channel Function:

- ◆ **Turn On/Off:** Turn on/off the reference channel.
- ◆ **Volt/DIV:** Channel the resolution of the reference channel.
- ◆ **Reset:** Reset the reference channel vertical position to zero.

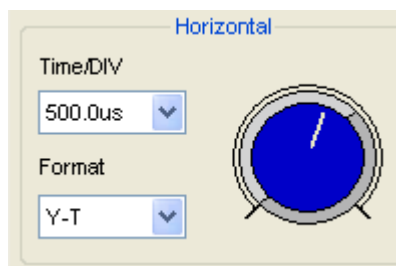
The Reference Waveform Display Window:



Note: If you turn on the “**Reference**” channel, the load file window will appear.

## Set Horizontal System

The following figure shows the Horizontal System window. It shows the horizontal parameters settings.



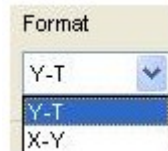
1. **Time/DIV:** leads the setting of the time base parameters



2. **Format:** leads the setting of the horizontal format parameters

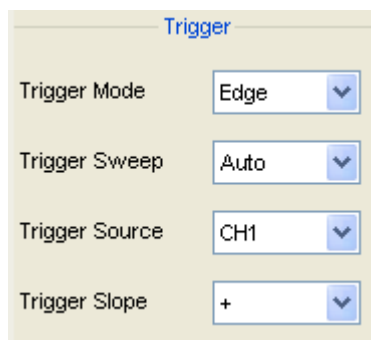
The time base ranges of the oscilloscope is listed as follows. The horizontal scan speed is from 4ns/div to 1hour/div.

In the **"Format"** menu of the **"Horizontal"** menu, select the display mode to **Y-T, X-Y**.



## Set Trigger System

Click **"Trigger"** in main menu



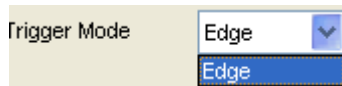
The trigger determines when the oscilloscope starts to acquire data and display a waveform. When a trigger is set up properly, it can convert unstable displays or blank screens into meaningful waveforms.

If the oscilloscope wants to acquire a waveform, it collects enough data so that it can draw the waveform to the left of the trigger point. The oscilloscope continues to acquire data while waiting for the trigger condition to occur. The oscilloscope continues to acquire enough data so that it can draw the waveform to the right of the trigger point after it detects a trigger,.

The **Edge** trigger determines whether the oscilloscope finds the trigger point

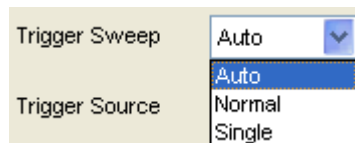
on the rising or the falling edge of a signal. Select **Edge** trigger mode to trigger on **Rising** edge or **Falling** edge.

**Mode:** Select the trigger mode.



The oscilloscope only provides edge trigger mode.

**Sweep:** Set the sweep mode to **Auto**, **Normal** or **Single**.

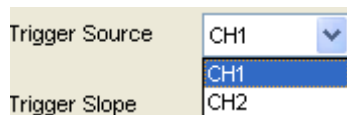


**Auto:** Acquire waveform even no trigger occurred

**Normal:** Acquire waveform when trigger occurred.

**Single:** Acquire waveform when trigger occurred then stop

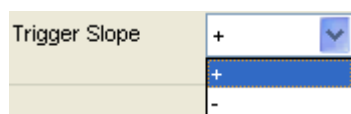
**Source:** You can use the trigger source options to select the signal that the oscilloscope uses as a trigger. The source can be any signal connected to a channel BNC, or to the EXT. BNC.



**CH1:** Select CH1 as trigger signal

**CH2:** Select CH2 as trigger signal

**Slope:** Set the slope to **Rising (+)** or **Falling (-)**.



**Rising:** Trigger on rising edge

**Falling:** Trigger on falling edge

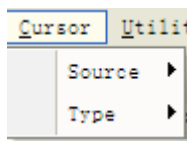
# Measure Signal

## ◆ Cursor

## ◆ Measure

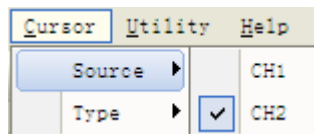
### Cursor Menu

Click “**Cursor**” in main menu



This method allows you to take measurements by moving the cursors

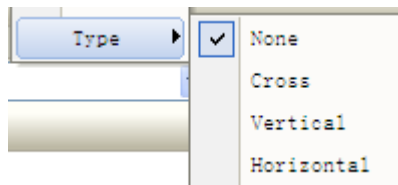
#### 1. Source



The user can set the source to **CH1**, **CH2**, **FFT** and **MATH**. But the **FFT** source can only use **Trace** type.

When you use cursors, be sure to set the **Source** to the waveform on the display that you want to measure.

#### 2. Type



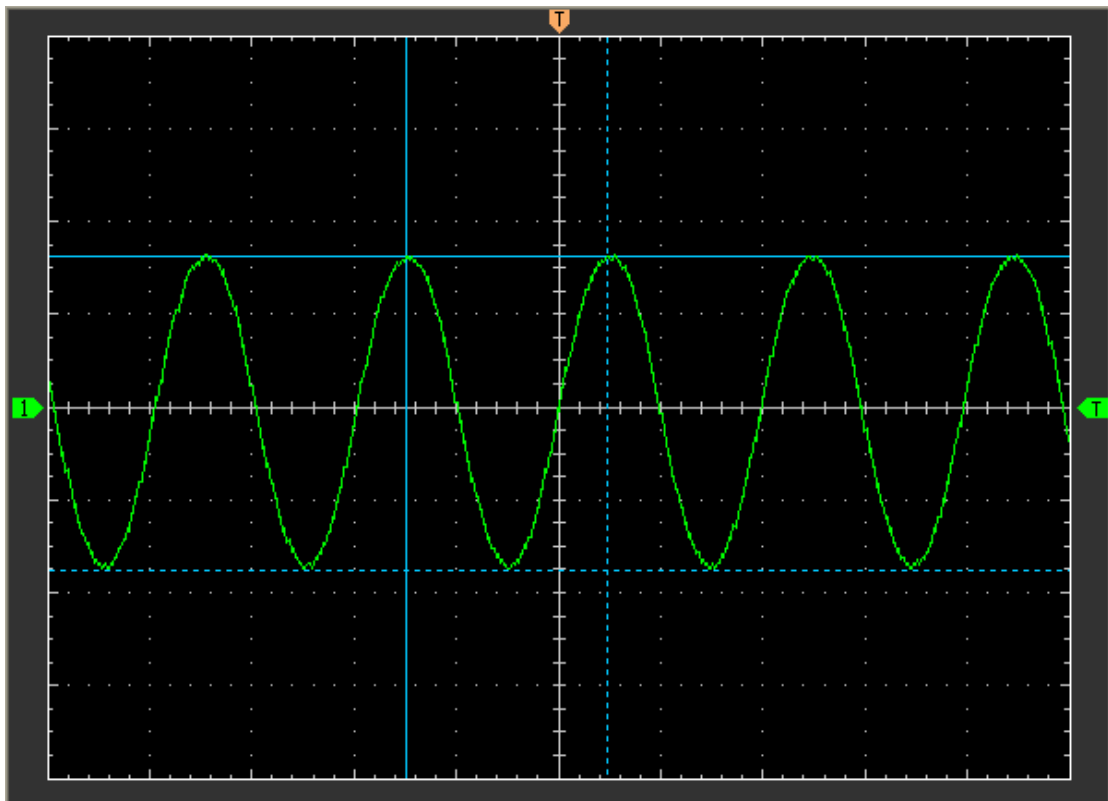
There are four types of cursors: **Cross**, **Vertical** and **Horizontal**

##### 1) Cross

The **Cross** cursors appear as cross lines on the display and measure the vertical and horizontal parameters.



The **Cross** cursor display window



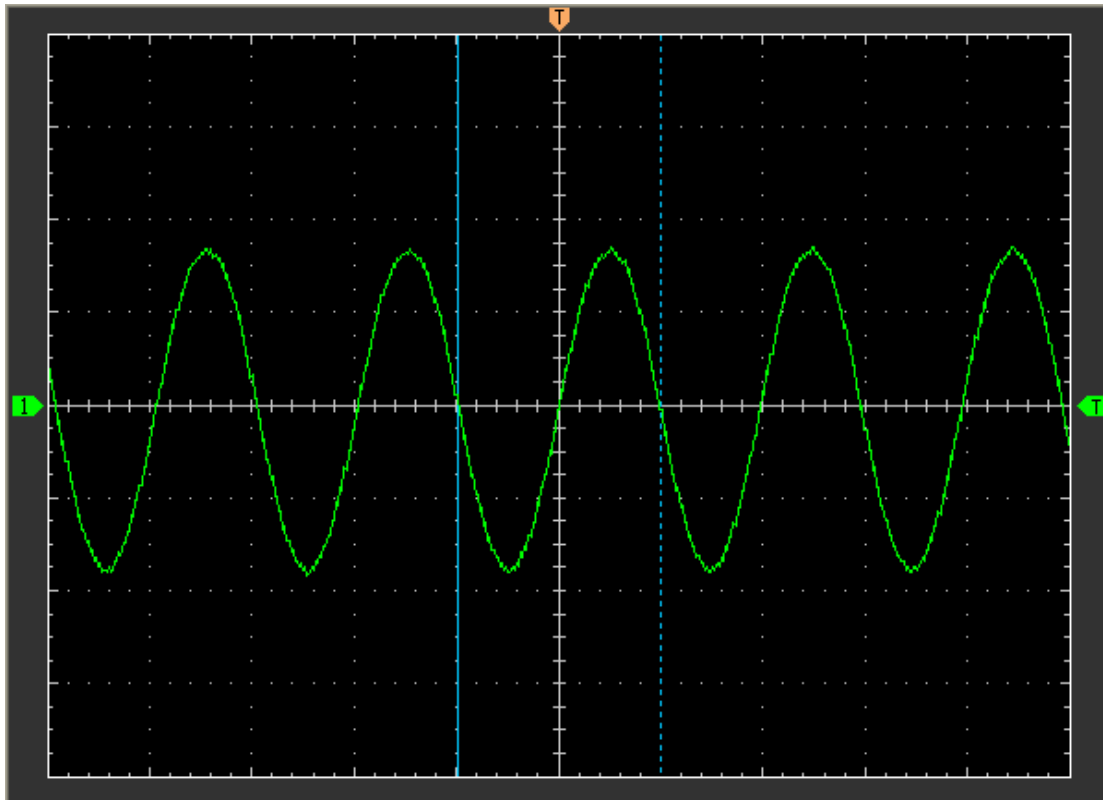
The **Cross** measure result displays on status bar

Freq = 12.683 KHz    Time = 78.843  $\mu$ S    Volt = 3.403 V

## 2) **Vertical**

The **Vertical** cursors appear as vertical lines on the display and measure the vertical parameters.

The **Vertical** cursor display window



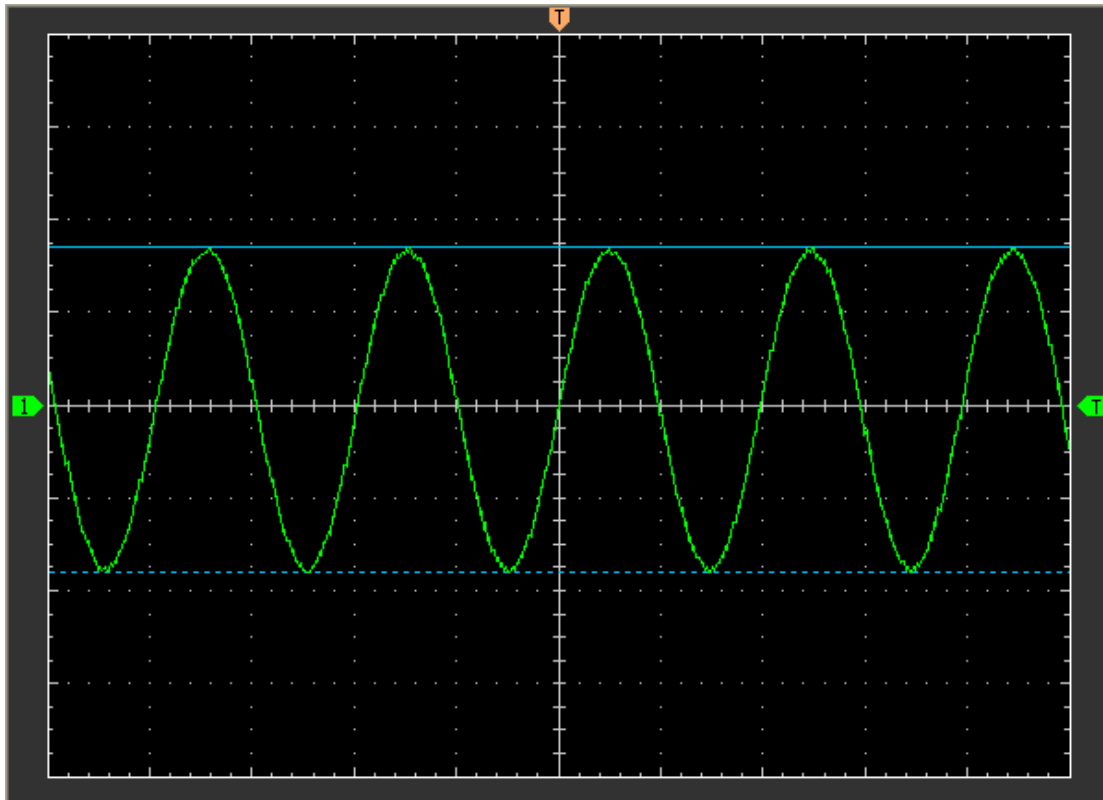
The **Vertical** cursor measure result display on status bar

Freq = 12.568 KHz    Time = 79.566 uS

### 3) **Horizontal**

The **Horizontal** cursors appear as horizontal lines on the display and measure the horizontal parameters.

The **Horizontal** cursor display window



The **Horizontal** cursor measure result display on status bar

Volt = 3.502 V

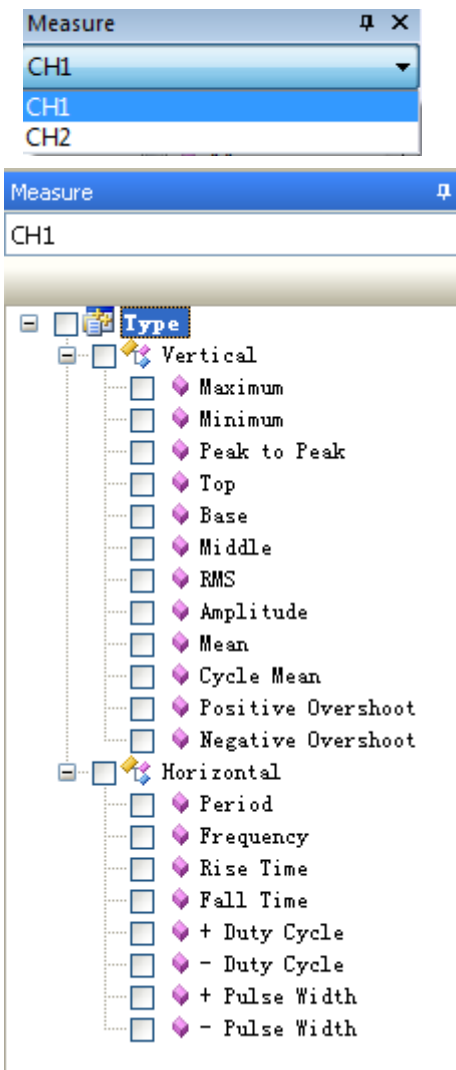
To acquire and display a signal, please do the steps as follows:

Connect signal to **CH1** by using probe

The DSO set the vertical, horizontal, and triggers controls at the best status automatically. Also, you can adjust the controls to meet your measurement to optimize the waveform display.

## Measure

Select Channel



**Maximum:** Voltage of the absolute maximum level, Measured over the entire waveform

**Minimum:** Voltage of the absolute minimum level, Measured over the entire waveform

**Peak To Peak:** Peak-to-peak = Max – Min, Measured over the entire waveform

**Top:** Voltage of the statistical maximum level, Measured over the entire waveform

**Base:** Voltage of the statistical minimum level, Measured over the entire waveform

**Middle:** Voltage of the 50% level from base to top

**RMS:** The Root Mean Square voltage over the entire waveform

**Amplitude:** Amp = Base – Top, Measured over the entire waveform

**Mean:** The arithmetic mean over the entire waveform

**Cycle Mean:** The arithmetic mean over the first cycle in the waveform

**Preshoot:** Positive Overshoot =  $(\text{Max} - \text{Top}) / \text{Amp} \times 100 \%$ , Measured over the entire waveform

**Overshoot:** Negative Overshoot =  $(\text{Base} - \text{Min}) / \text{Amp} \times 100 \%$ , Measured over the entire waveform

**Period:** Time to take for the first signal cycle to complete in the waveform

**Frequency:** Reciprocal of the period of the first cycle in the waveform

**Rise Time:** Time taken from lower threshold to upper threshold




**Fall Time:** Time taken from upper threshold to lower threshold

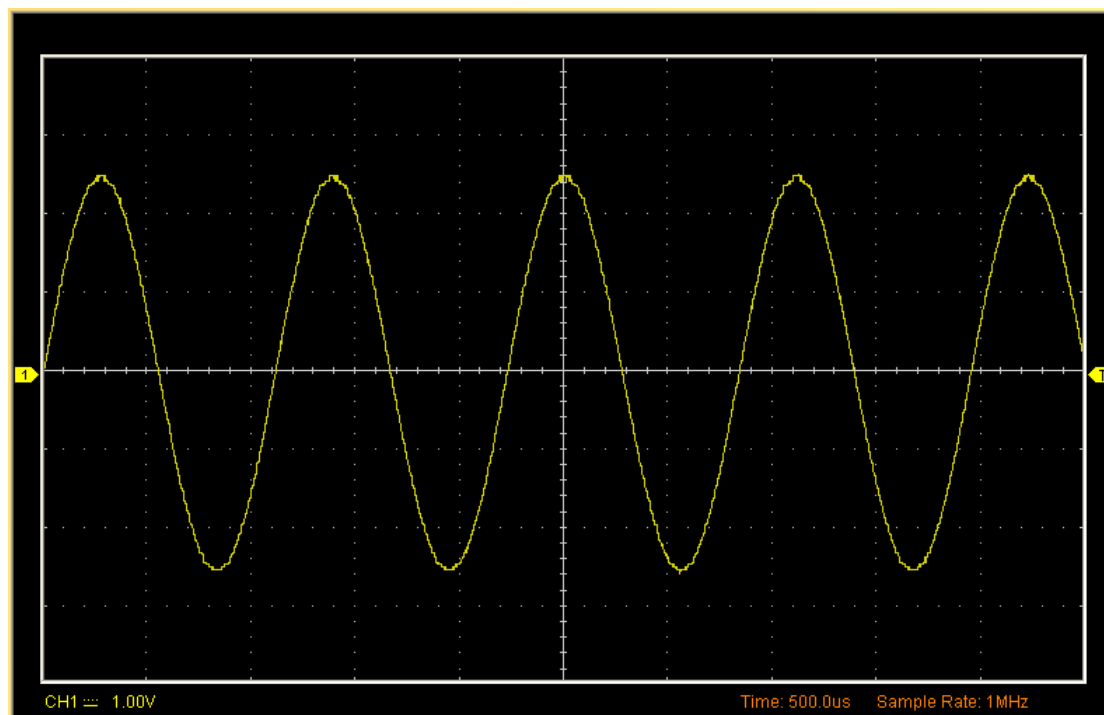
**+Duty Cycle:** Positive Duty Cycle =  $(\text{Positive Pulse Width}) / \text{Period} \times 100\%$ ,  
Measured of the first cycle in waveform

**-Duty Cycle:** Negative Duty Cycle =  $(\text{Negative Pulse Width}) / \text{Period} \times 100\%$ ,  
Measured of the first cycle in waveform

**+Pulse Width:** Measured of the first positive pulse in the waveform. The time between the 50% amplitude points

**-Pulse Width:** Measured of the first negative pulse in the waveform. The time between the 50% amplitude points

1. To measure the frequency and “**Vpp**”, you can do these steps as follows:
2. Click the  **Frequency** button, the frequency of the signal display on the bottom of the waveform interface.
3. Click the  **Peak to Peak** button, the “**Vpp**” of the signal will also display on the bottom of the waveform interface.
4. To clear the measurement on the waveform interface, click the  button.

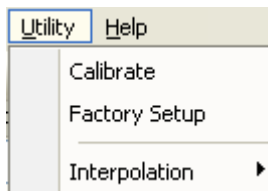


The results of measure display in Information output.

Information output	
CH1	
Peak to Peak	5.11V
- Pulse Width	554uS

## The Utility Function

Click the “**Menu -> Utility**” to get into the “**Utility**” menu.

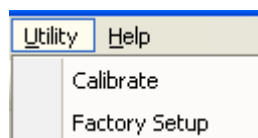


The “**Utility**” Functions:

- ◆ **Calibrate**
- ◆ **Factory Setup**
- ◆ **Interpolation**

### Factory Setup

Click “**Factory Setup**” in “**Utility**” menu to load default setups



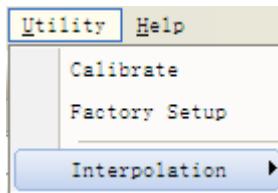
When you click the **Factory Setup** in **Utility** menu, the oscilloscope displays the CH1 and CH2 waveforms and removes all other waveforms.

The oscilloscope set up for normal operation when it is shipped from the factory and can be recalled at anytime by user.

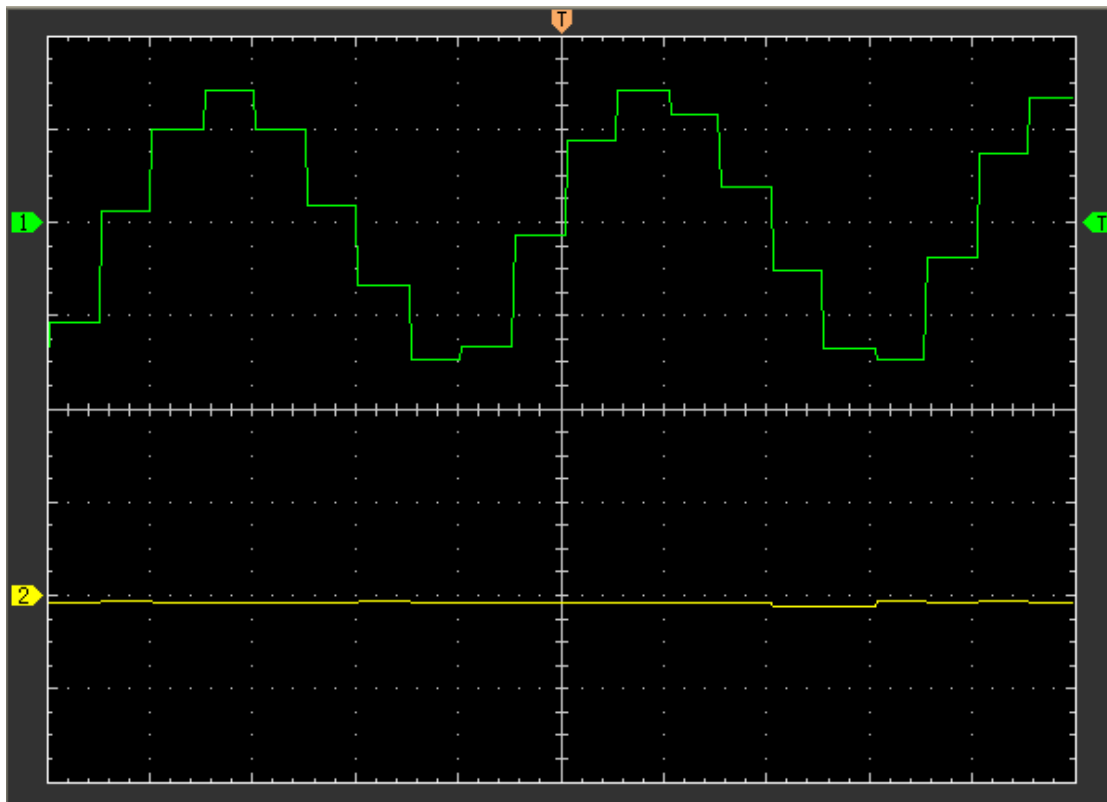
The Factory Setup function does not reset **Date and time**.

## Interpolation

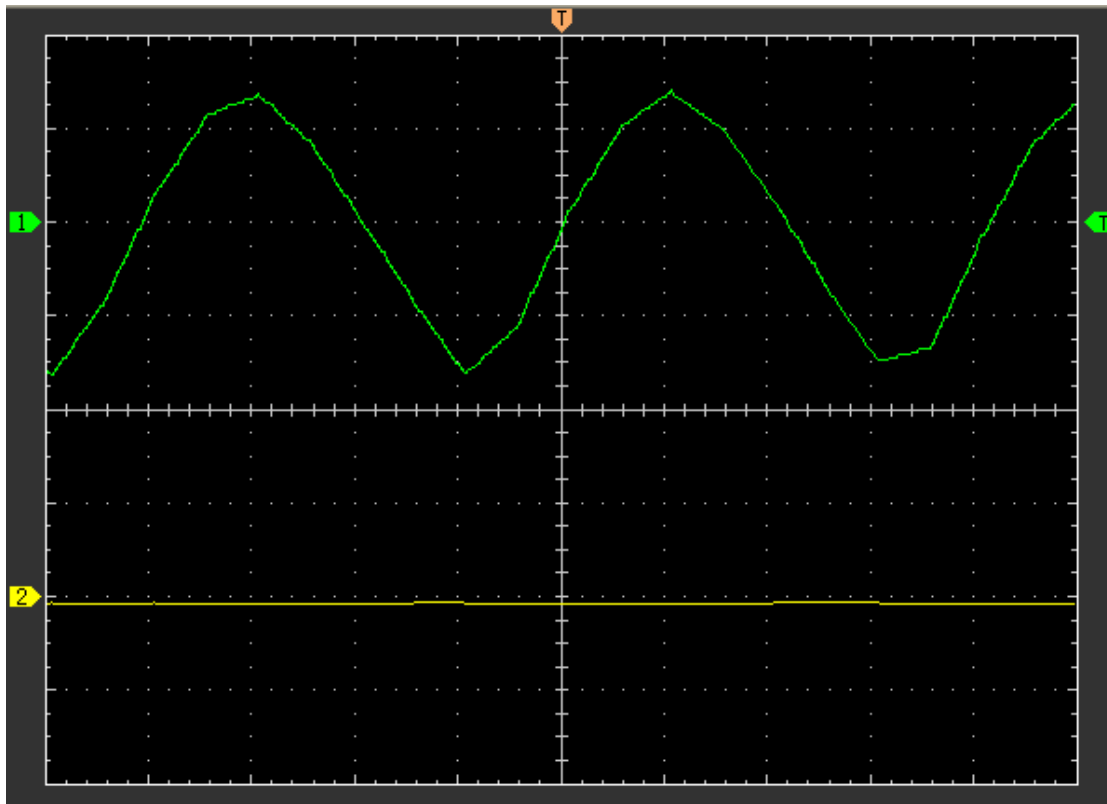
Click “Utility->Interpolation”



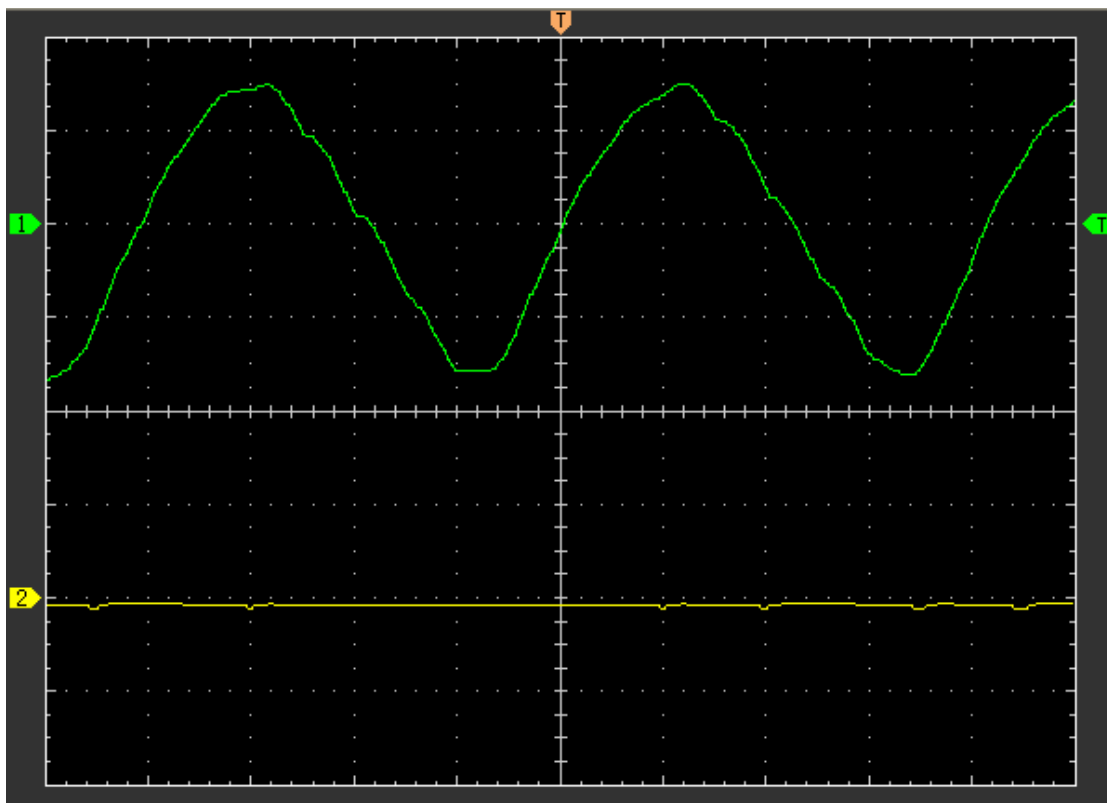
The **Step** Interpolation



The **Linear** Interpolation



The **Sin(x)/x** Interpolation



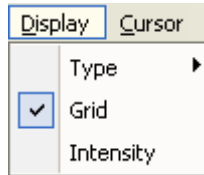
**Note:** The default interpolation mode is Sin(x)/x.



## The display System

Click “**Display**” in main menu

The following figure shows the display system menu. It shows the display parameters setting.

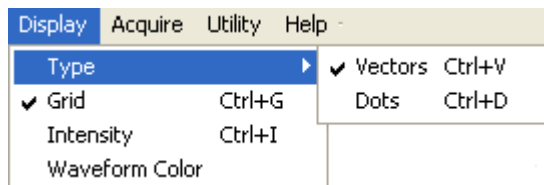


- ◆ **Type**
- ◆ **Grid**
- ◆ **Intensity**

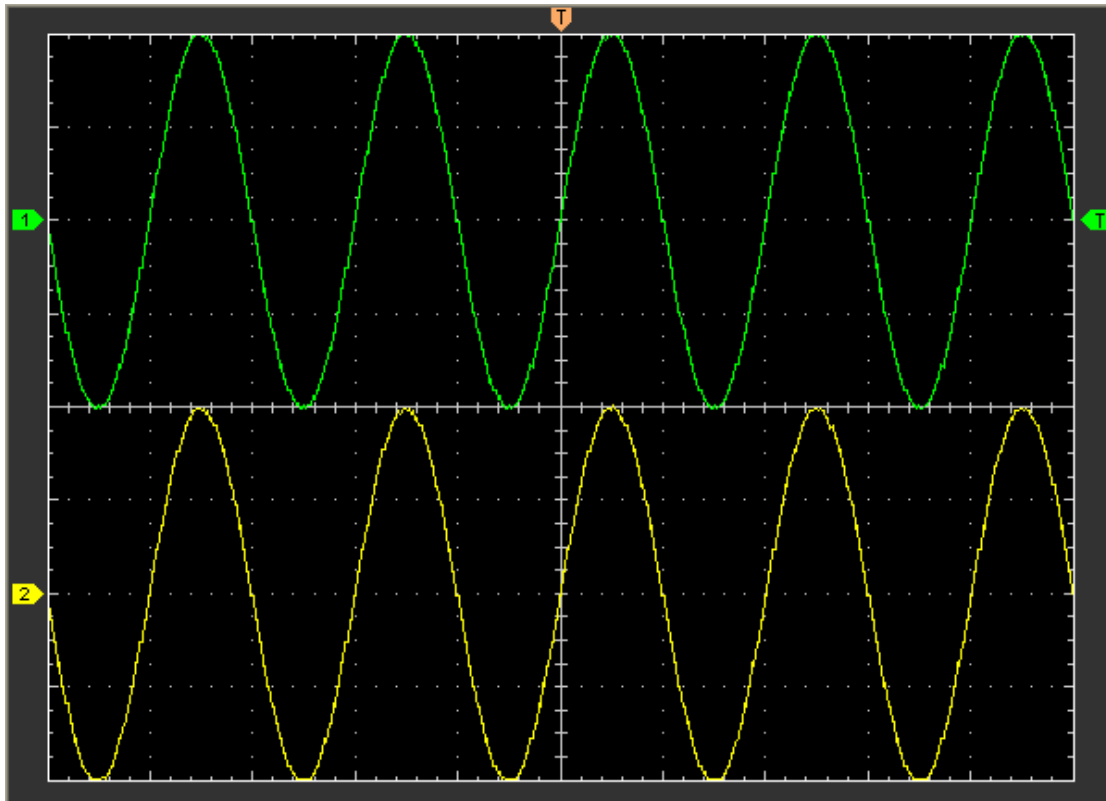
### Display type

Click “**Type**” in “**Display**” menu.

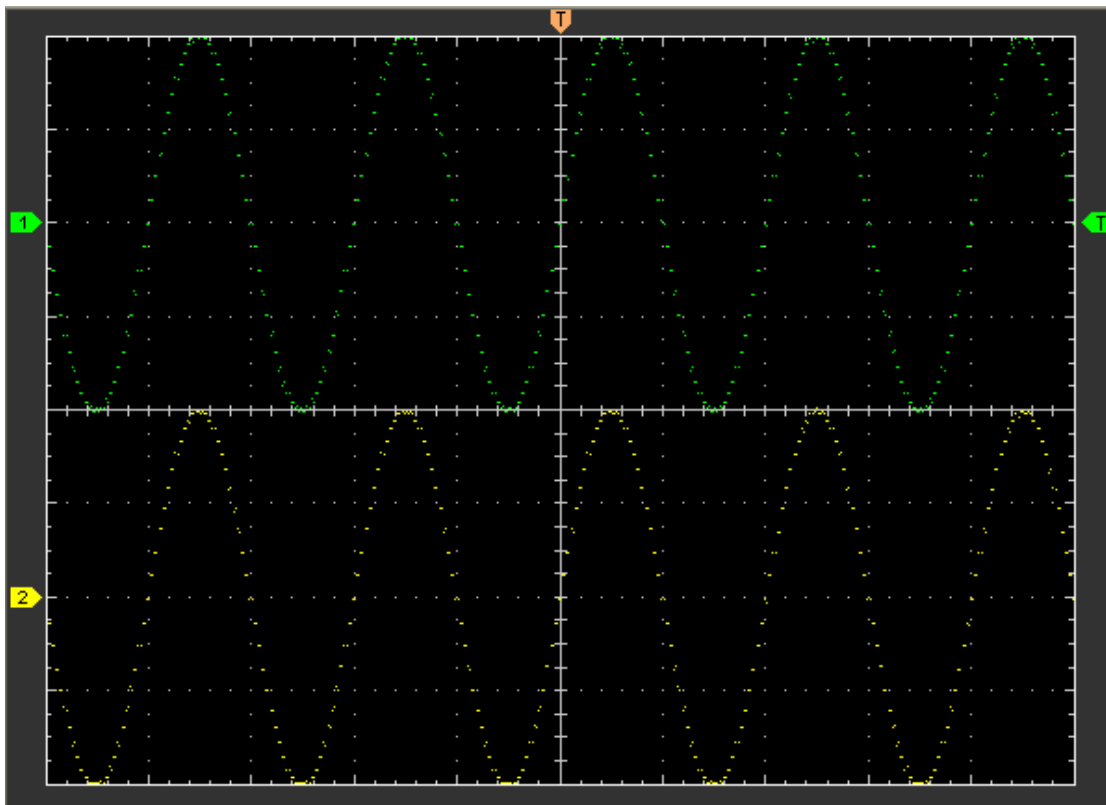
The following figure shows the type parameters setting.



If the **Vectors** type mode is selected, the waveform will be displayed as following figure.



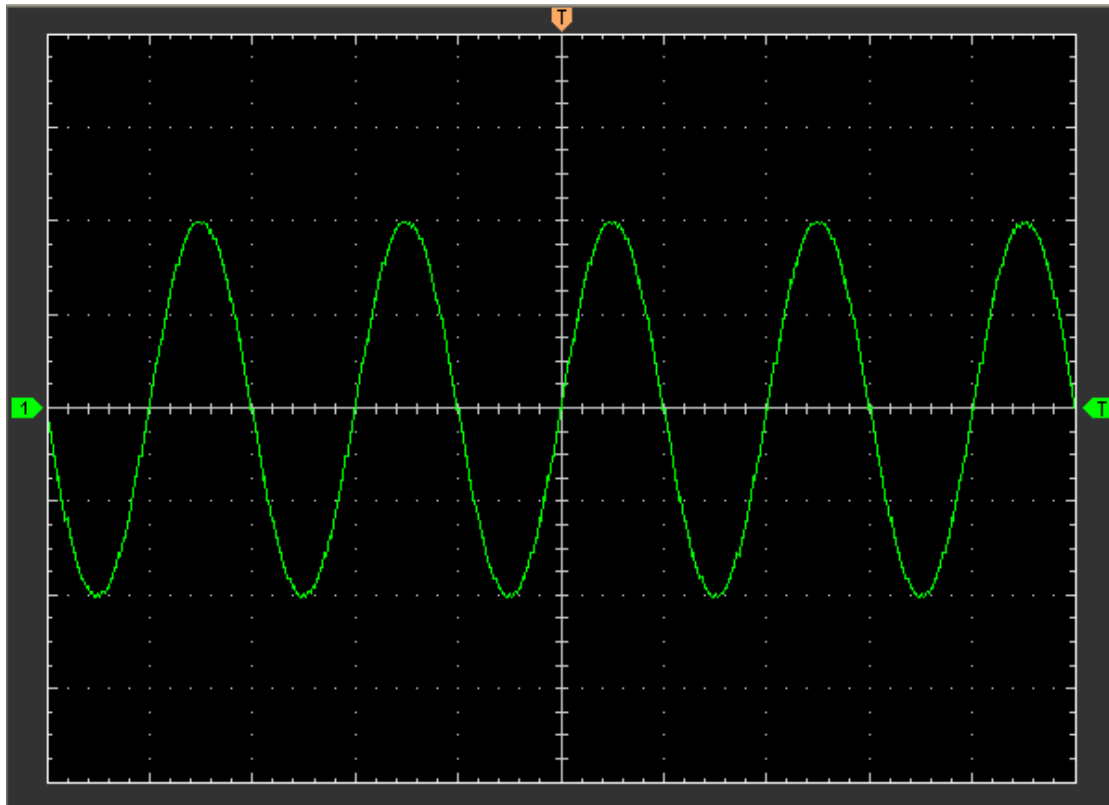
If the **Dots** type mode is selected, the waveform will be displayed as following figure.



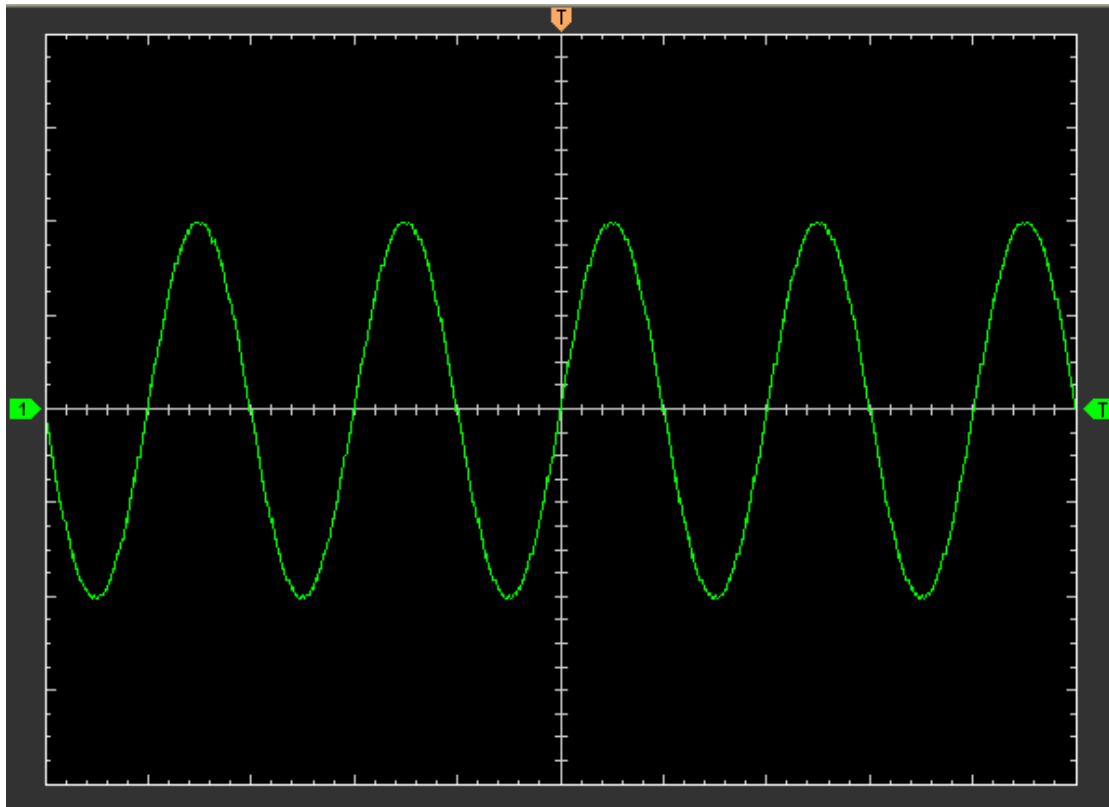
## Display Grid

Click “**Display**” in main menu

The grid shows:



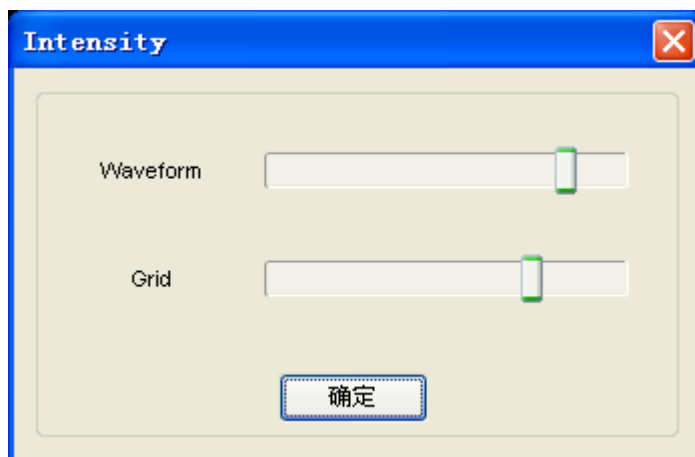
The grid not shows:



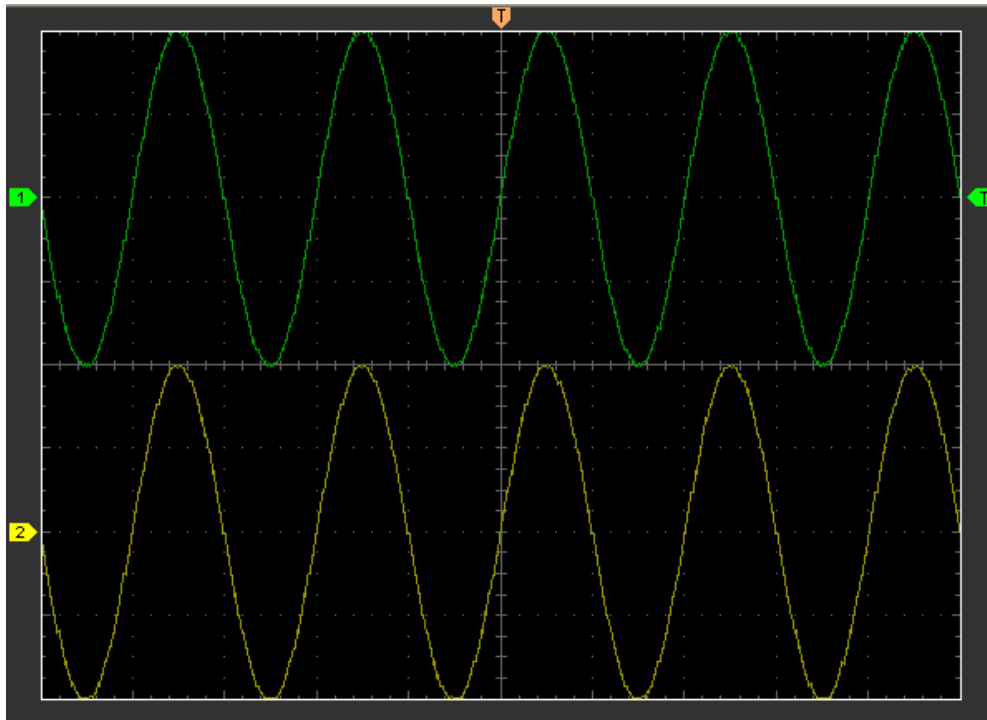
## Display Intensity

Click “**Display->Intensity**” in main menu

The following figure shows the intensity dialog. It shows the display parameters setting.

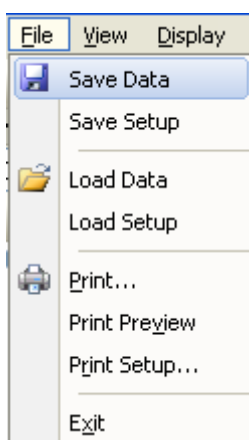


You can change the grid and waveform color intensity in this dialog.



## Save and Load

Click **“File”** in main menu to save waveform, setups and screen



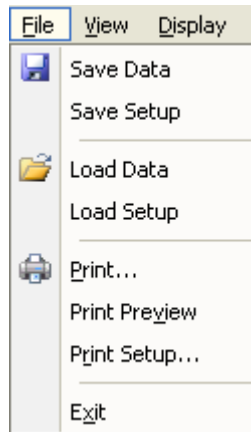
### 1. Save Data

Save waveform data

## 2. Save Setups

Save the current oscilloscope setups to file

Click **"File"** in main menu to recall saved waveform, setup



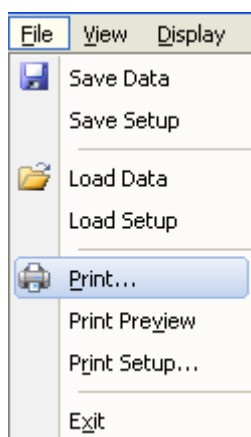
### 1. Load Data

Load the waveform


### 2. Load Setup

Load the instrument that had saved

## Print



1. Click **"Print"** in **"File"** menu to set the printer to print the current waveform.
2. Click the **"PrintPreview"** in **"File"** menu to get into the Preview window.

In "**PrintPreview**" window, use the  button to change the size of the waveform graph. Click the "**Close**" button to turn this window off and click the "**Print**" button to print the report.

## Chapter 4 Application Example

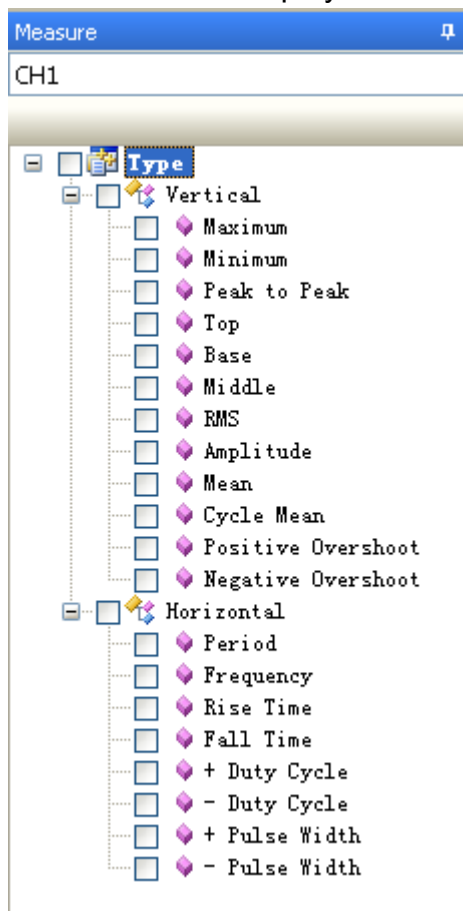
- ◆ **Simple Measurement**
- ◆ **Capturing a Single-Shot Signal**
- ◆ **The Application of the X-Y**
- ◆ **Taking Cursor Measurement**




## Simple Measurement

To acquire and display a signal, please do the steps as follows:

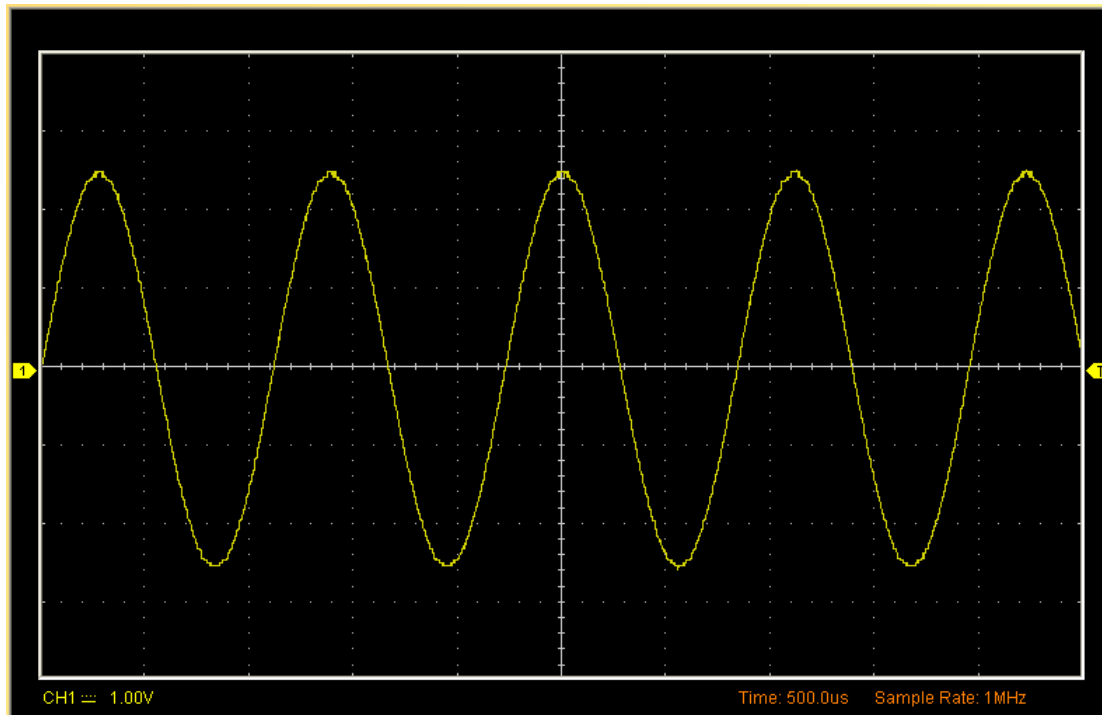
Connect signal to **CH1** by using probe

The DSO set the vertical, horizontal, and triggers controls at the best status automatically. Also, you can adjust the controls to meet your measurement to optimize the waveform display.



1. To measure the frequency and “**Vpp**”, you can do these steps as follows:
2. Click the  **Frequency** button, the frequency of the signal display on the bottom of the waveform interface.
3. Click the  **Peak to Peak** button, the “**Vpp**” of the signal will also display on the bottom of the waveform interface.
4. To clear the measurement on the waveform interface, click the  button.





The results of measure display in Information output.


Information output	
CH1	
Peak to Peak	5.11V
- Pulse Width	554uS

## Capturing a Single-Shot Signal

To capture a single event, it needs to gather some pre-test knowledge of the signal in order to set up the trigger level and slope correctly. For example, if the event is derived from 3.3V COMS logic, a trigger level of 1.2 or higher Volts should work on a rising edge.

Do these steps as follows:

1. Set the probe and the channel attenuations to X 10.
2. Set up the trigger in the Trigger Menu, or in the Trigger Setting window.
  - 1) Adjust the Trigger Mode to Edge.

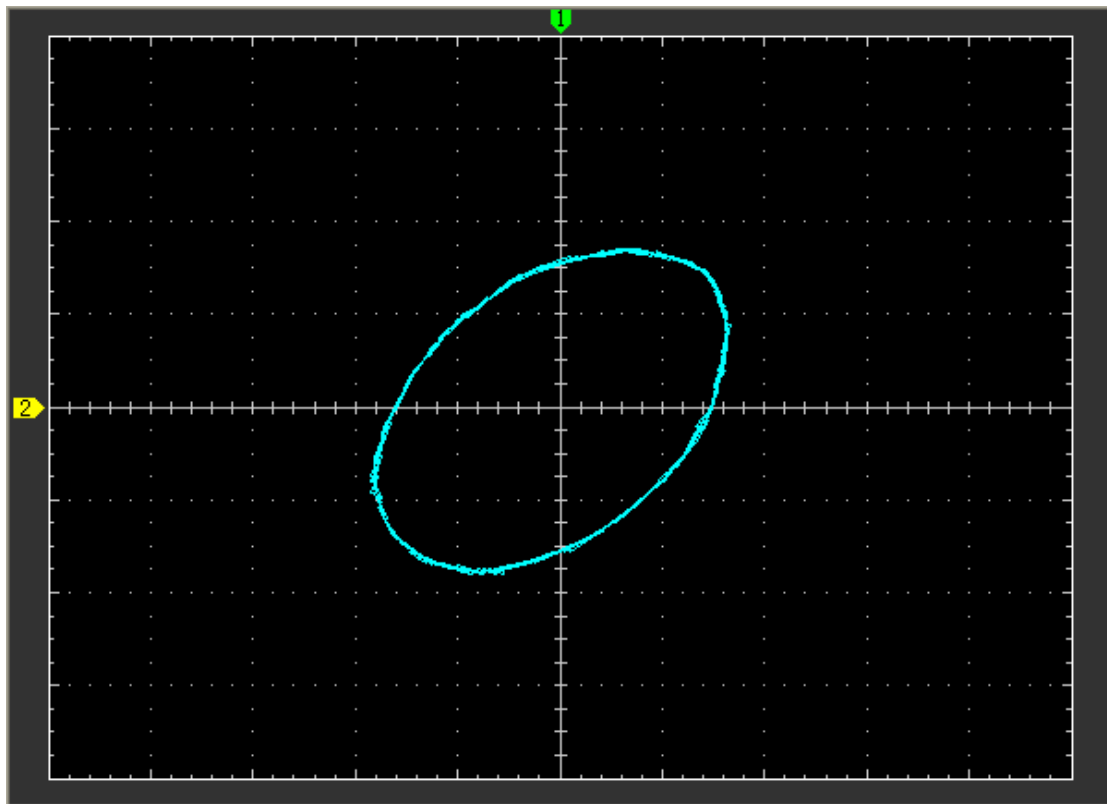
- 2) Set the Trigger Sweep to Single.
- 3) Set the Trigger Source to CH1.
- 4) Set the Trigger Slope to “+” which means you select the rising edge.
- 5) Adjust the Volts/Div and the time base in a proper range for the signal.
- 6) Drag the trigger level sign on the waveform display screen to proper position. It's usually higher a little above the normal level.
- 7) Click  to start capturing. When the trigger conditions are met, data appears on the display representing the data points that the oscilloscope obtained with one acquisition.

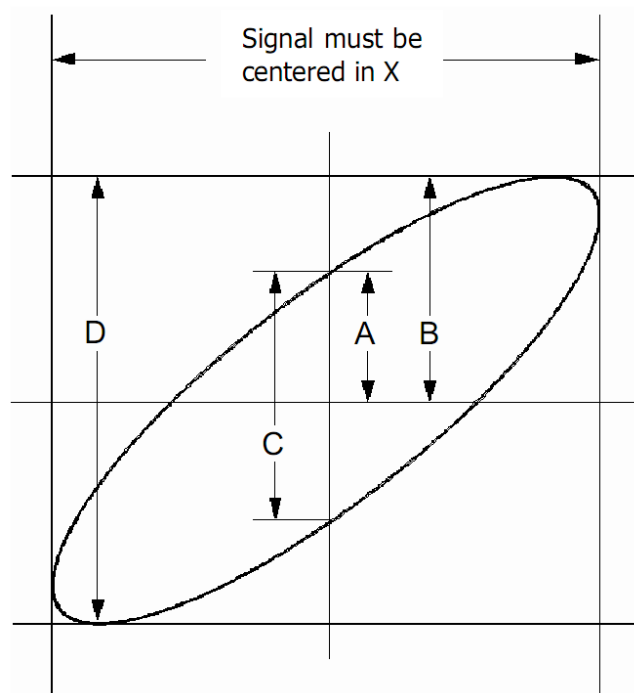
## The Application of the X-Y Operation

**X-Y** Plot acts to analyze correlation of data of two channels. Lissajous diagram is displayed in the screen when you use **X-Y** Plot, which enables to compare frequencies, amplitudes and phases of counterpart waveform against the reference waveform. This makes it possible to compare and analyze frequency, amplitude and phase between input and output.

Do these steps as follows:

1. Set the probe attenuation to “**x10**”. Set the switch to “**x10**” on the probes.
2. Connect the CH1 probe to the input of the circuit, and connect the CH2 probe to the output of the circuit.
3. Click “Autoset” button.
4. Adjust the vertical scale and offset to display approximately the same amplitude signals on each channel.
5. Select X-Y format at Horizontal window. The oscilloscope will displays a Lissajous pattern representing the input and the output characteristics of the circuit.
6. Adjust the scale and offset of the horizontal and vertical to a desirable waveform display. The following picture shows a typical example.
7. Apply the Ellipse Method to observe the phase difference between the two channels.

**Signal in X-Y Format:****Instruction of the Ellipse Method**



$\sin\theta = A/B$  or  $C/D$ , where  $\theta$  = phase shift (in degrees) between the two signals.

From the formula above:

$$\theta = \pm \arcsine (A/B) \text{ or } \pm \arcsine (C/D)$$

$\theta$  must be in the range of  $(0 \sim \pi/2)$  or  $(3\pi/2 \sim 2\pi)$  if the main axis of the ellipse is between I and III quadrant, . If the main axis is at II and IV quadrant,  $\theta$  must be in the range of  $(\pi/2 \sim \pi)$  or  $(\pi \sim 3\pi/2)$ .

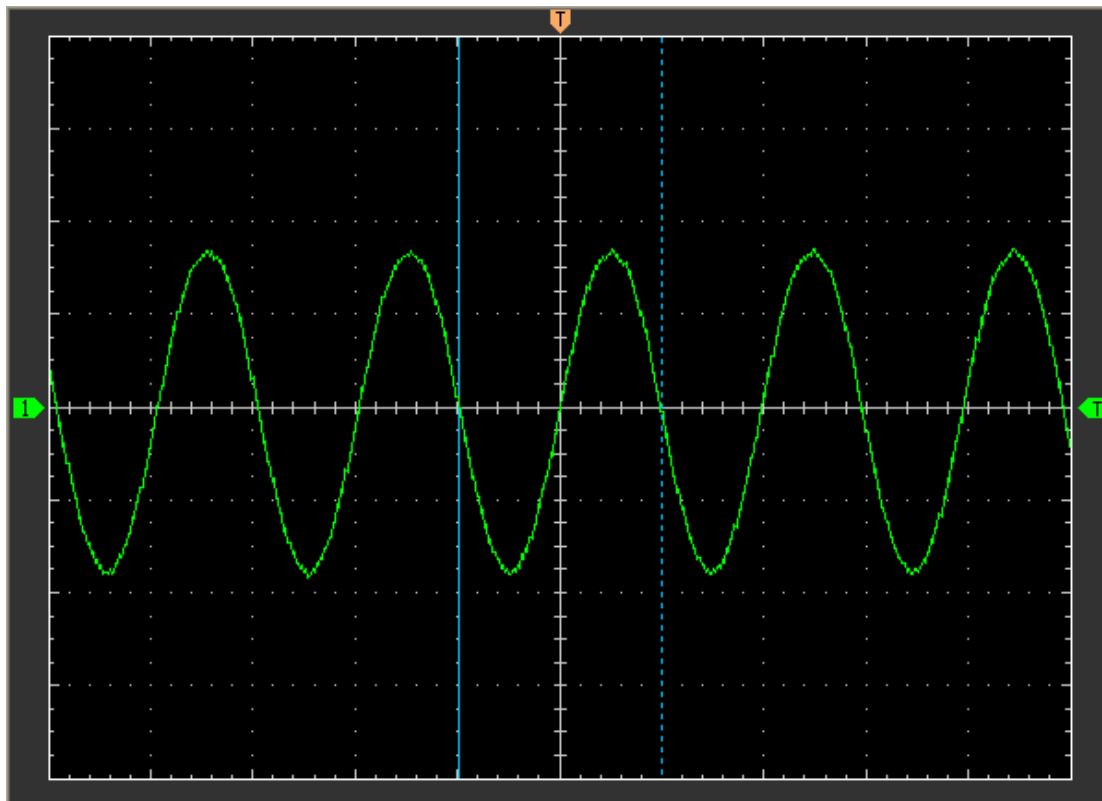
## Taking Cursor Measurements

Use cursors to make time and amplitude measurements on a waveform quickly.

### Measure the Peak Frequency or Time of the First Sine Waveform

Do these steps:

1. Click "**Cursor->Source**", select CH1 (select CH2 if you want measure CH2).
2. Click "**Cursor->Type**", select Vertical.
3. Push left mouse button, and the vertical lines appear.
4. Drag the mouse button to the point you want to measure.
5. Release the left mouse button, the frequency difference and time difference will be shown at the status bar.

**Measure the Frequency and Time:**

Read the details showing in the status bar.

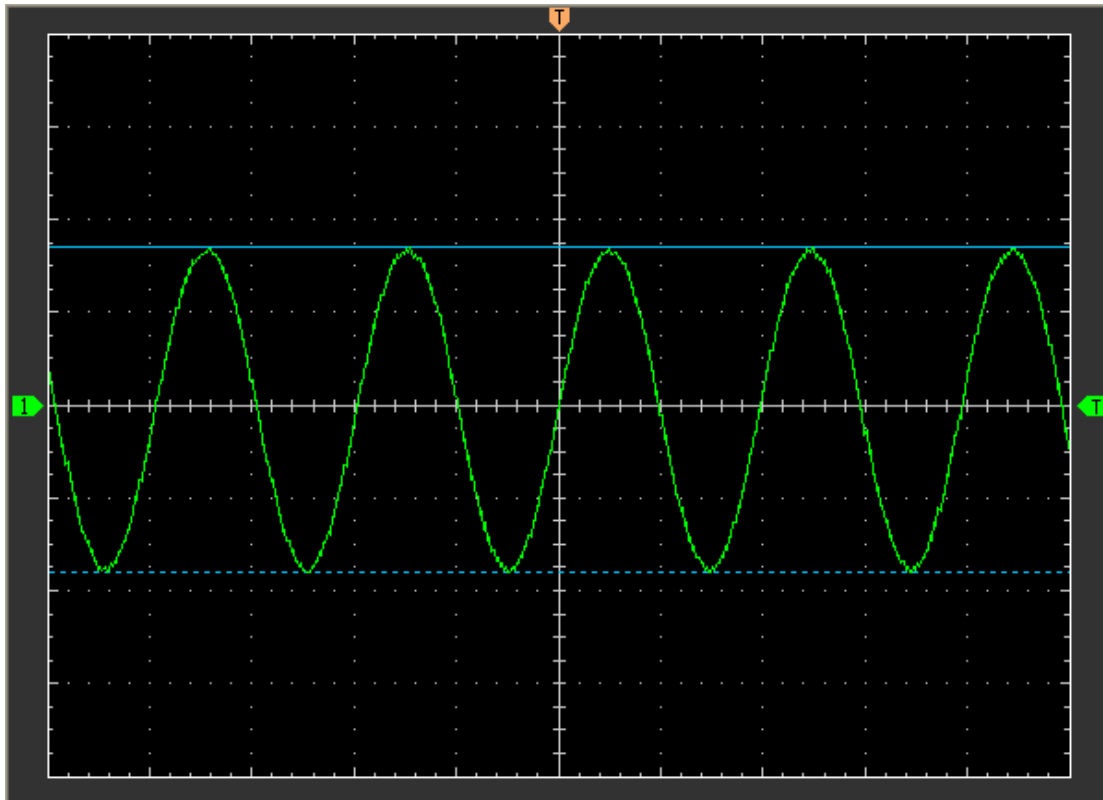
Freq = 12.568 KHz    Time = 79.566 uS

**Measure the Amplitude of the First Waveform Peak of the Waveform**

Do these steps:

1. Click "**Cursor->Source**", select CH1 (select CH2 if you want measure CH2).
2. Click "**Cursor->Type**", select Horizontal.
3. Push left mouse button, and the Horizontal lines appear.
4. Drag the mouse button to the point you want to measure.
5. Release the left mouse button, the voltage difference will be shown at the status bar.

**Measure the Amplitude:**



Read the details showing in the status bar.

V<sub>olt</sub> = 3.502 V

**Note:** Click “**Cursor->Type**”, select “**Cross**”, you can measure time and amplitude at one time.

# Appendix

- ◆ **Appendix A: Specification**
- ◆ **Appendix B: General Maintenance**
- ◆ **Appendix C: Services and Support**

## Appendix A: Specifications

Specifications Table:

Input	
Real	Real-time sampling:48MS/s
Channels	2 Channels
Bandwidth	20MHz (-3dB)
Vertical resolution	8 bits/channel
Gain range	10mV ~ 5V/div @ x1 probe(10mV, 20mV, 50mV, 100mV, 200mV, 500mV, 1V, 2V, 5V/div1,2,5 sequence) 100mV ~ 50V/div @ x10 probe 1V ~ 500V/div @ x100 probe 10V ~ 5KV/div @ x1000 probe
Range	8 divisions
Offset level	+/-4 divisions
Coupling	DC
Offset increments	0.02 div
Impedance	1M ohm
DC accuracy	+/-3%
Input protection	35Vpk (DC + peak AC < 10 kHz, without external attenuation)
Display Mode	Y-T, X-Y
Timebase	
Timebase range	4ns/div ~ 1h/div(4ns, 10ns, 20ns, 40ns, 100ns, 200ns, 400ns, 1us, 2us, 4us, 10us, 20us, 40us, 100us, 200us, 400us, 1ms, 2ms, 4ms, 10ms, 20ms, 40ms, 100ms, 200ms, 400ms, 1s,2s, 4s, 10s,20s,40s,10m,20m,40m,1h /div 1-2-4 sequence)
Range	10 divisions
Buffer Size	Max. 1M samples/channel
Trigger	
Type	Edge trigger
Mode	Auto, Normal and Single
Autoset	Yes
Range	10 divisions
Trigger level	+/-4 divisions
Settability	0.02 div increments



Math	
Measurements	Vp-p, Vmax, Vmin, Vmean, Vrms, Vamp, Vtop, Vbase, Vmid, positive overshoot, negative overshoot, cycle mean, cycle RMS, period, frequency, positive pulse width, negative pulse width, rise time (10%~90%), fall time (10%~90%), positive duty cycle, negative duty cycle
Math	Addition, Subtraction, Multiplication, Division
FFT	Rectangular, Hanning, Hamming, Blackman Window
Physical	
Interface	USB2.0 (USB1.1 compatible)
Power	No external power source required. Bus-powered from USB
Dimensions	187 x100 x 33(mm)

## Appendix B: General Maintenance

### General Care

Do not store or leave the oscilloscope where the device will be exposed to direct sunlight for long periods of time.

### Caution

To avoid damages to the device or probes, do not expose them to sprays, liquids or solvents.

### Cleaning

Inspect the device and probes as often as operating conditions require.  
Make sure the device disconnect from all power sources.

To clean the exterior surface, perform the following steps:

1. Remove loose dust on the outside of the oscilloscope and probes with a lint-free cloth. Use care to avoid scratching the clear glass display filter.
2. Use a soft cloth dampened with water to clean the device.

### Caution

To avoid damages to the surface of the device or probes not use any

abrasive or chemical cleaning agents.

## **Appendix C: Services and Support**

Thank you for choosing HANTEK. Please contact us through the following ways should you have any inquiry regarding our products. We shall do our best to help you.

1. Contact your local HANTEK distributor;
2. Contact your local HANTEK field office;
3. Contact HANTEK headquarters in China.

### **Headquarters**

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