



USER'S MANUAL

Hantek 6000EU

V1.0.1

<http://www.Hantek.com>

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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, 12V 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**
- ◆ **Function Check**
- ◆ **Self Calibration**
- ◆ **Accessories**

1.1 System Requirement

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

Minimum System Requirements

Operating System

Window Vista/Win7/Win8/Win10

Processor

Upwards of 1.00G processor

Memory

2G byte

Disk Space

500M disk free space

Screen resolution

1280 x 800 resolution

Recommended Configuration

Operating System

Windows Vista/Win7/Win8/Win10

Processor

2.4G Processor

Memory

4G Byte Memory

Disk Space

80G Disk Space

Screen resolution

1920 x 1080 resolution

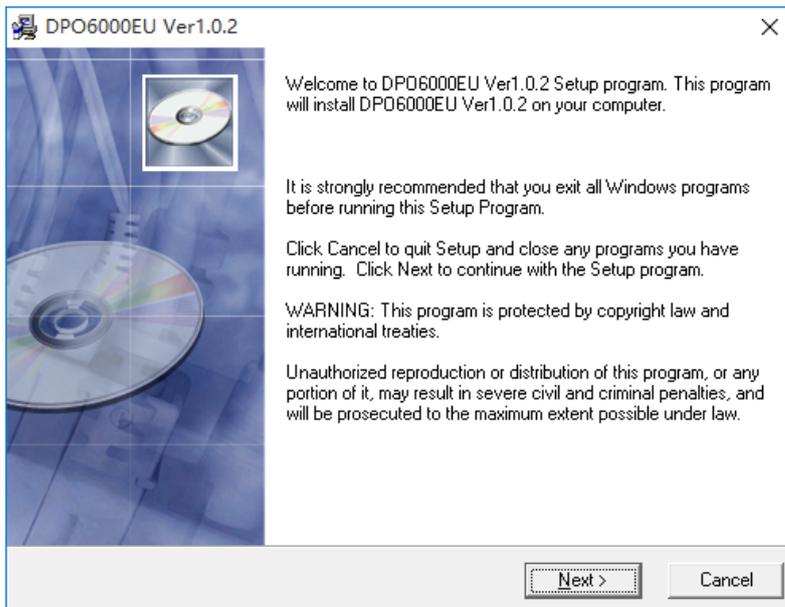
DPI Setting

Normal Size (96DPI)

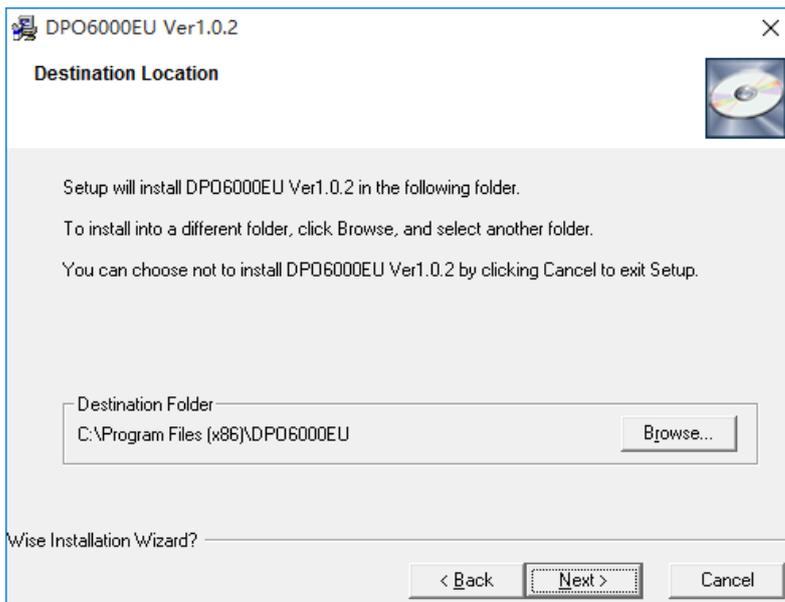
1.2 Install Software And Driver

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

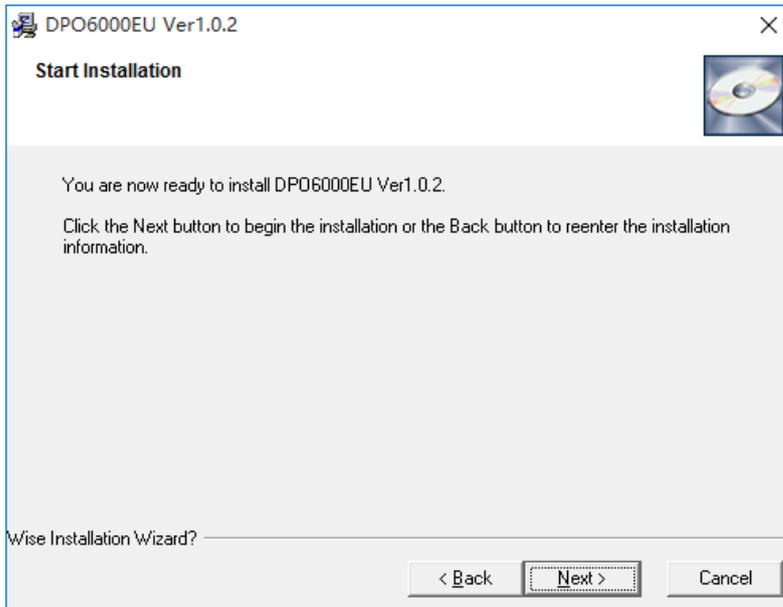
1. While in Windows, insert the installation CD into the CD-ROM drive.
2. The installation should start up automatically. Otherwise in Windows Explorer, switch to the CD-ROM drive and run Setup.exe.
3. The software Installation is started. Click 'Next' to continue.



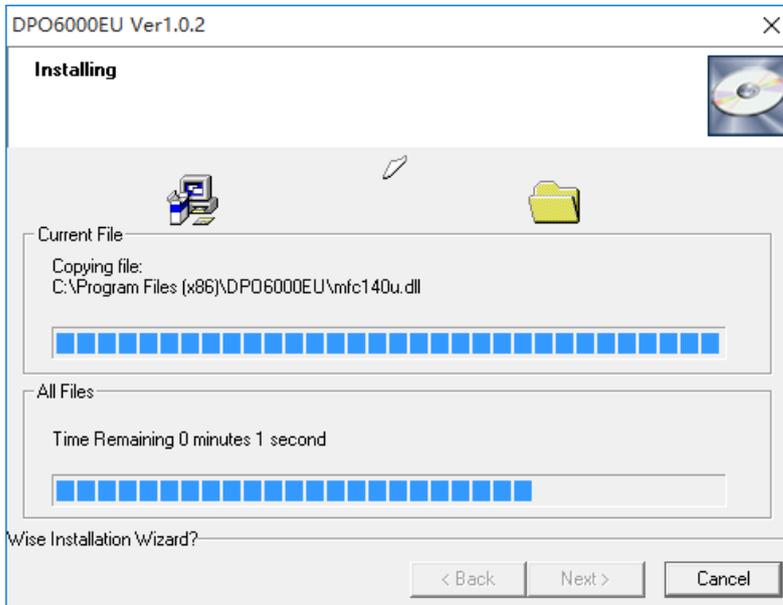
4. Choose a destination directory. Click 'Next' to continue.



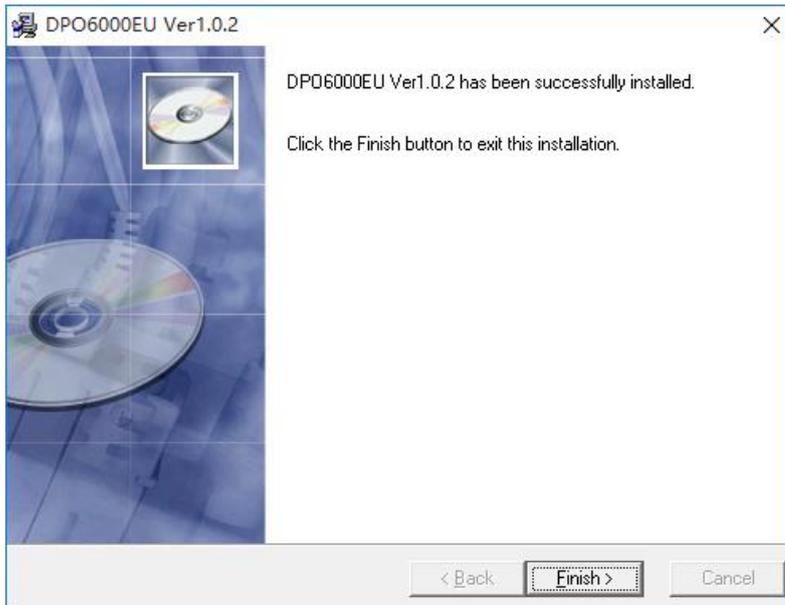
5. Check the setup information. Click Next to start copying of files.



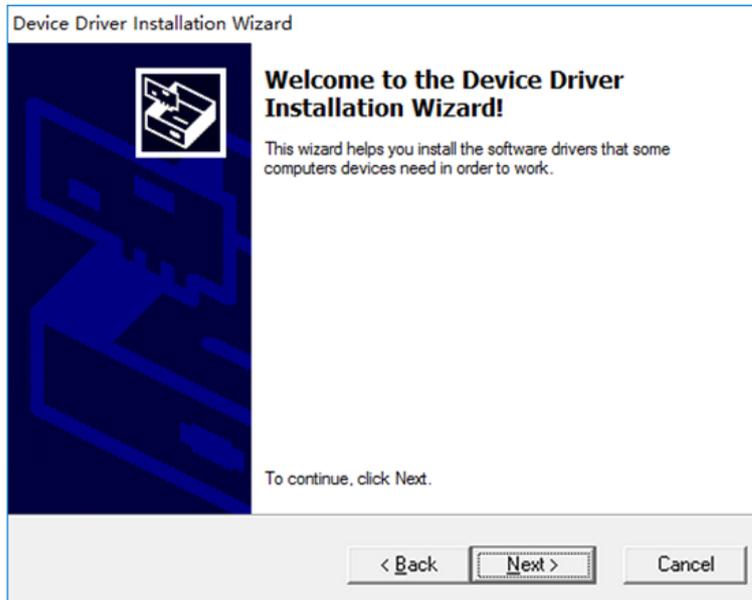
6. This Status dialog is displayed during copying of files.



7. The installation is complete.



8. After software Installation it can be start the Device Driver Installation. Click Next to start the Device Driver Installation.



9. Complete the Device Driver Installation.



1.3 General Features

Product Features:

- **Four Channels, Max Bandwidth:**
250MHz/200MHz/100MHz/70MHz
- **Maximum real-time sample rate:**
1GSa/s
- **Memory depth:**
128M /CH
- **Automatic setup for ease of use (AUTOSSET);**
- **Built-in Fast Fourier Transform function(FFT);**
- **20 Automatic measurements;**
- **Automatic cursor tracking measurements;**
- **Waveform storage, record and replay dynamic waveforms;**
- **User selectable fast offset calibration;**

- **Add, Subtract and Multiply Mathematic Functions;**
- **Selectable 20 MHz bandwidth limit;**
- **Waveform average;**
- **Adjustable waveform intensity, more effective waveform view;**
- **User interface in several user-selectable languages;**
- **Waveform capture rate to 60,000 wfm/s,400,000wfm/s(FastAcq mode)**
- **Intensity graded color display**
- **SATA Interface communication**

1.4 General Check

Please check the instrument as following steps after receiving an oscilloscope:

Check the shipping container for damage:

Keep the damaged shipping container or cushioning material until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically.

Check the accessories:

Accessories supplied with the instrument are listed in "Accessories" in this guide. If the contents are incomplete or damaged, please notify the franchiser.

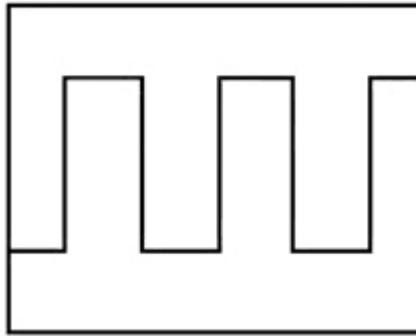
Check the instrument:

In case there is any mechanical damage or defect, or the instrument does not operate properly or fails performance tests, please notify the franchiser.

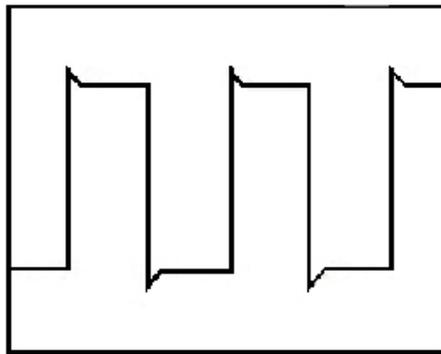
Probe Compensation

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.

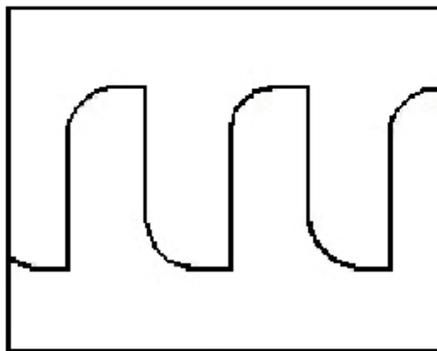
- From the “Probe” menu, select attenuation to 1:10. Set the switch to “X10” on the probe and connect it to CH1 of the oscilloscope. When using the probe hook-tip, insert the tip onto the probe firmly to ensure a proper connection.
- Attach the probe tip to the Probe Compensator and the reference lead 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

1. 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.
2. 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.

1.5 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 other A-Type Plug of USB cable to oscilloscope USB port.



■ Input a signal to a channel of the oscilloscope

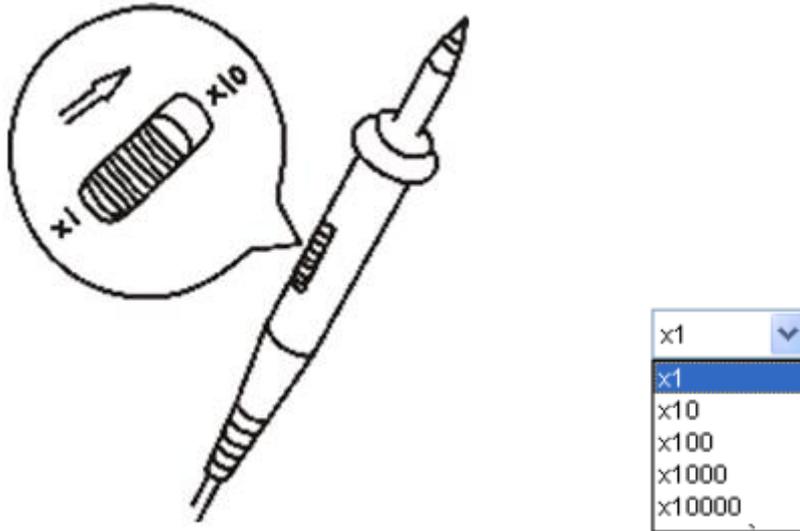
The oscilloscope is equipped with two channels plus external trigger.

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  button. A square wave will be displayed within a several seconds. (Approximately 1 kHz, 2V, peak- to- peak).
4. Inspect CH2 with the same method. Repeat steps 2 and 3.

1.6 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 “**Utility -> Calibration**” option and follow the directions on the screen. The self calibration routine takes about several minutes.

1.7 Accessories

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

Hantek 6000EU:

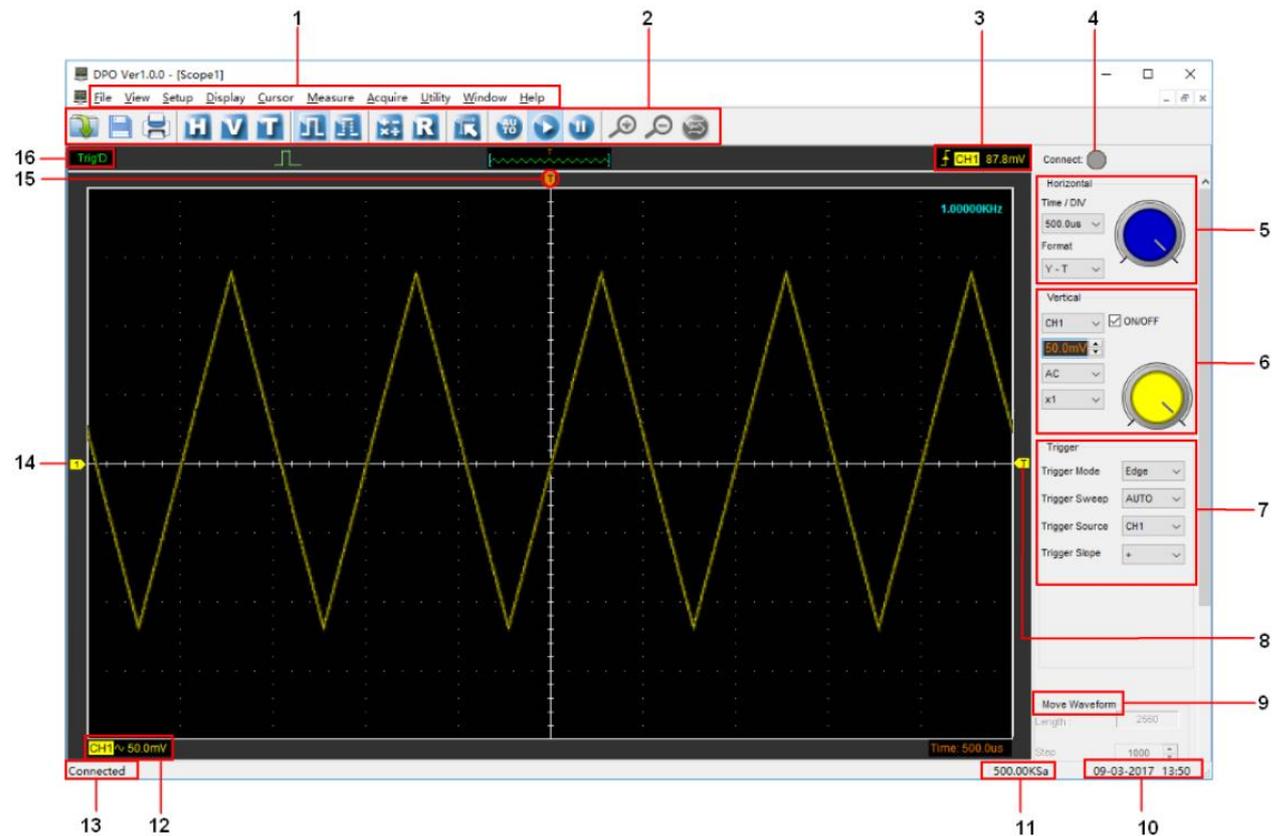
- ◆ Probe x 2 (1.5m), 1:1(10:1), Passive Probes
- ◆ A USB cable
- ◆ Alligator clip wire x 2
- ◆ QuickGuide
- ◆ A software installation CD

Chapter 2 Operating Basics

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

2.1 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. **Displays the trigger information:** Displays the edge trigger slope, source and level.
4. **The Connect Panel**
5. **The Horizontal Panel:** The user can change Time/Div, format in the panel.
6. **The Vertical Panel:** The user can turn on/off the CH1/CH2/CH3/CH4. Also the user can change the CH1/ CH2/CH3/CH4 volt/div, coupling and probe attenuation.
7. **The Trigger Panel:** In this panel, the user can change the trigger mode, sweep, source and slope.
8. **Marker shows Edge trigger level**

9. Move Waveform

10. Displays the system time.

11. Sample rate

12. The markers show the CH1/CH2/CH3/CH4 reference points of the displayed waveforms. If there is no marker, the channel is not displayed.

13. Connect

14. Displays the CH1/CH2/CH3/CH4 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

15. Marker shows horizontal trigger position.

16. Trigger status indicates the following:

AUTO: The oscilloscope is in auto mode and is acquiring waveforms in the absence of triggers.

Trig'D: The oscilloscope has seen a trigger and is acquiring the post trigger data.

STOP: The oscilloscope has stopped acquiring waveform data.

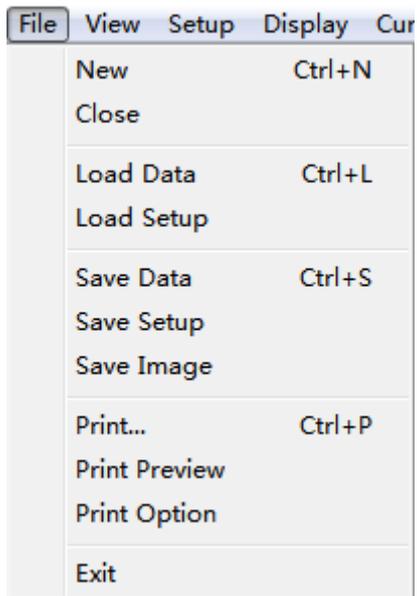
RUN: The oscilloscope is running.

2.2 The Menu System

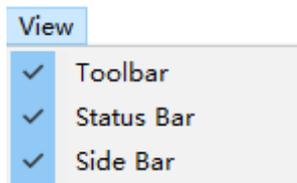
The Main Menu:

File View Setup Display Cursor Measure Acquire Utility Window Help

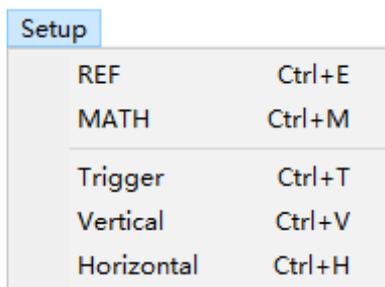
1. **File:** Load or Save data, setup



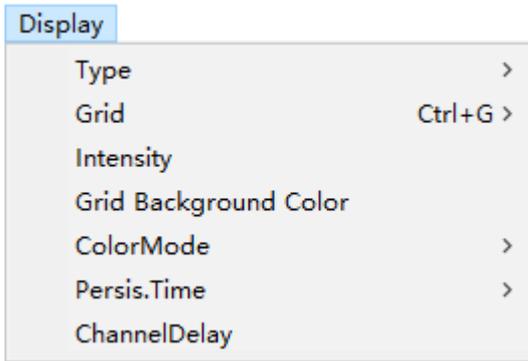
2. **View:** Change the user interface



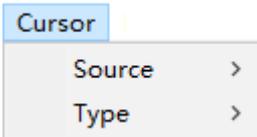
3. **Setup:** Setup setting



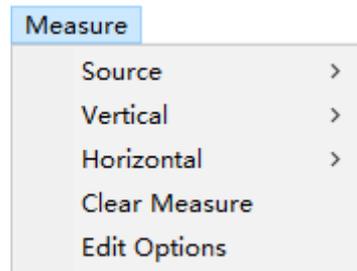
4. **Display:** Change wave display type



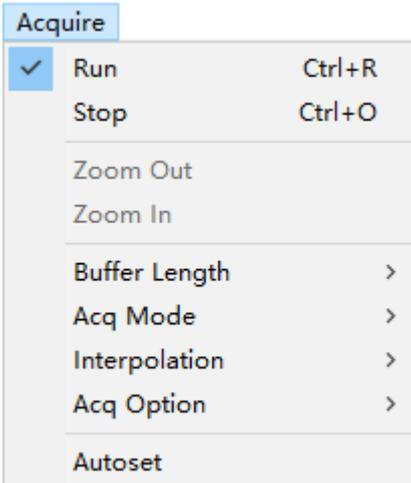
5. **Cursor:** Set Cursor measure type



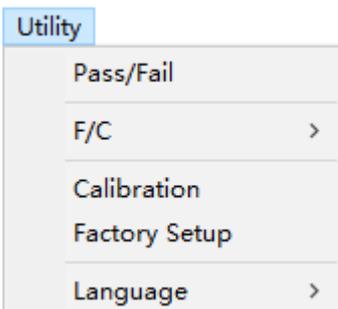
6. **Measure:** Set measurement parameters



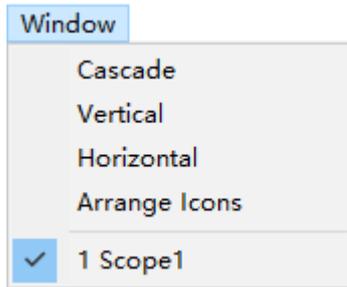
7. **Acquire:** Run ,Stop or other operation setting



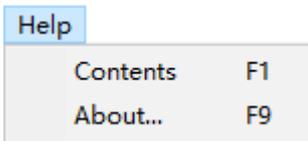
8. **Utility:** Utility setting



9. **Window:** Window setting



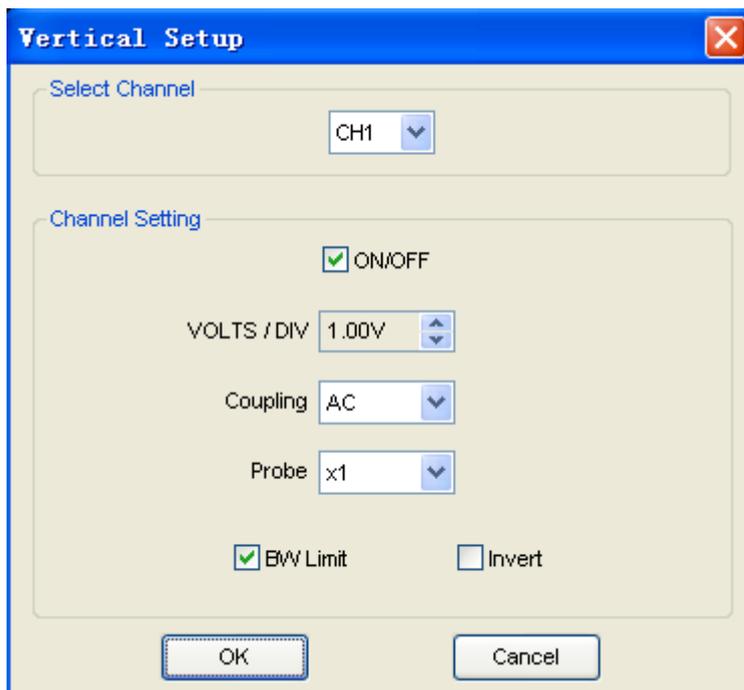
10.Help: Turn on help file



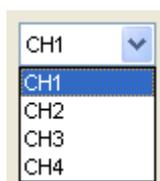
2.3 The Vertical System

Click “Setup->Vertical”

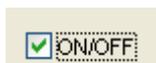
The following figure shows the vertical Setup window. It shows the vertical parameters setting.



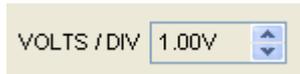
1.Select channel: User can select the channel by clicking the Combo box.



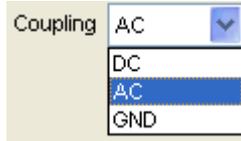
2.Select channel: User can select the channel by clicking the Combo box.



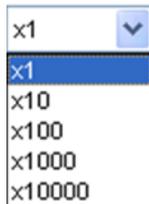
3.VOLTS/DIV: Set the selected channel voltage range.



4.Coupling: Set the selected channel to DC/AC.



5.Probe: Set the Select one according to the probe attenuation factor to ensure correct vertical scale reading



6.BW Limit: Reject the frequency component higher than 20MHz.



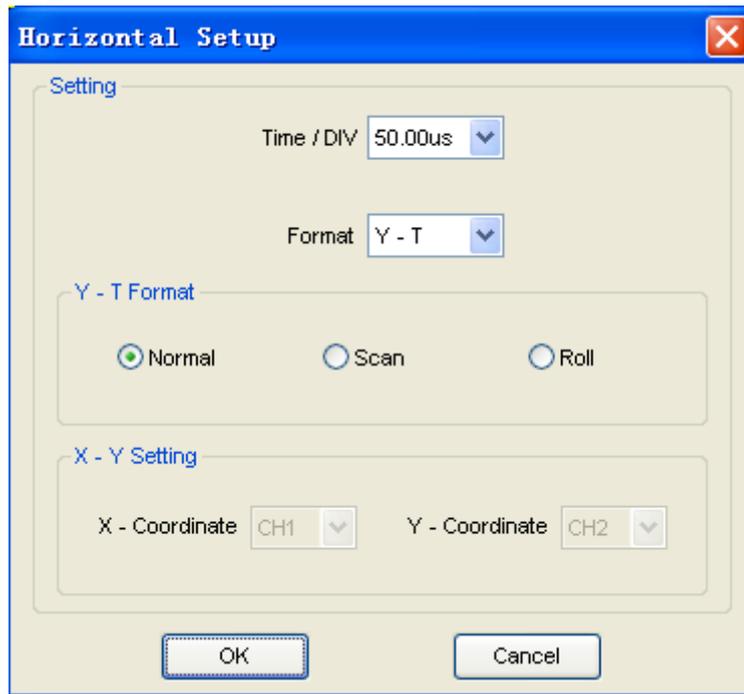
7.Invert: Invert the selected wave.



2.4 The Horizontal System

Click “**Setup->Horizontal**”

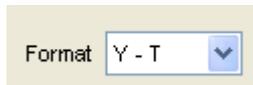
The following figure shows the Horizontal System window. It shows the horizontal parameters settings.



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



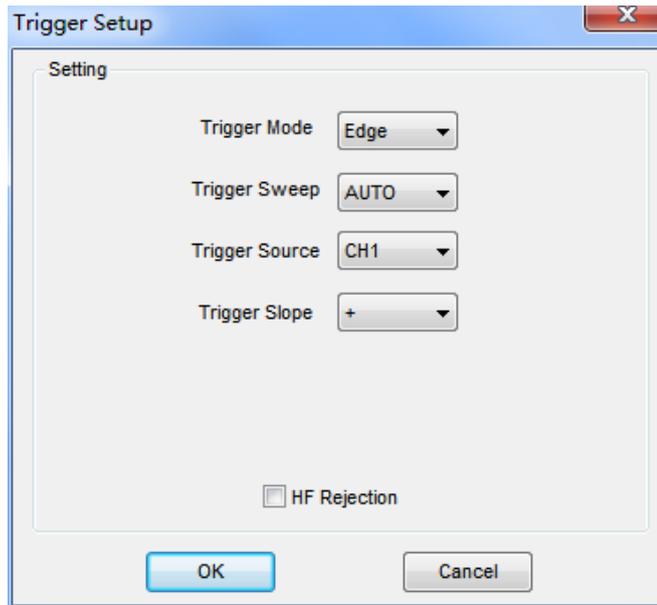
2. **Format**: leads the setting of the horizontal format parameters



2.5 The Trigger System

Click **“Setup-> Trigger”**

The following figure shows the trigger system control.



Trigger:

1. **Trigger Mode:** Sets the trigger mode
2. **Trigger Sweep:** Selects the trigger sweep mode to AUTO, NORMAL or SINGLE
3. **Trigger Source:** Selects the trigger source to CH1, CH2, CH3, CH4
4. **Trigger Slope:** Selects the edge trigger slope to Positive or Negative slope

2.6 Input Connector

- **CH1/CH2/CH3/CH4:** Input connectors for waveform display.



- **Other Connector:**



GND.: A ground terminal

USB PORT: Connect the USB cable to this port.

CAL.: Probe compensation output.

■ SATA Interface communication

The SATA interface is the communication interface that connects the instrument combination.

The SATA data interface is defined as follows:



1 GND Ground

2 D- : Data transmission negative signal interface

3 D+ : Data transmission positive signal interface

4 GND Ground

5 +5V Power

6 +5V Power

7 GND Ground

8 GND Ground

9 SYNC_OUT

10 SYNC_IN

11 GND Ground

12 CLK_IN

13 CLK_OUT

14 GND Ground

Chapter 3 Oscilloscope Functions

- ◆Set Oscilloscope
- ◆Set Vertical System
- ◆Set Horizontal System
- ◆Set Trigger System
- ◆Save/Load
- ◆Utility Function
- ◆Measure Signal
- ◆Zoom In/Out Waveforms
- ◆Acquire Signal
- ◆Print

3.1 Setup the Oscilloscope

Using “**AUTOSET**” to display a signal automatically.

Auto setup functions one time each time you push the “**AUTOSET**” button. The function obtains a stable waveform display for you. It automatically adjusts the vertical scale, horizontal scale and trigger settings. Auto setup also displays several automatic measurements in the graticule area, depending on the signal type.

Connect a signal to the CH1 input:

1. Connect a signal to the oscilloscope as described above.
2. Click the “**Acquire -> Autoset**” button.

The oscilloscope will change the current settings to display this signal.

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

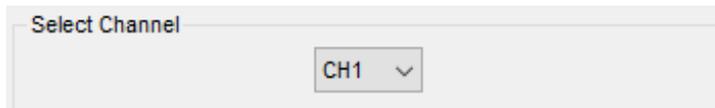
The oscilloscope software is set up for normal operation when it is shipped from the factory. This is the factory setup. To recall this setup, push the “**Factory Setup**” menu.

3.2 Set Vertical System

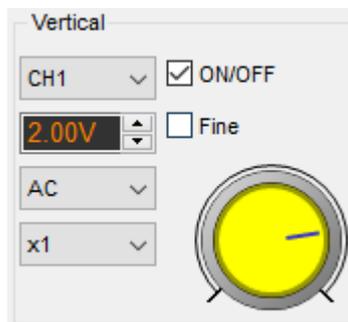
Set Channel

Click “Vertical” in “Setup” menu.

The Channel Selection



The Channel Control Panel in sidebar



The Vertical 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

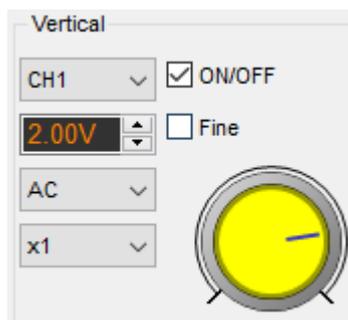
Invert: Turn on/off the invert function.

Change Volt/DIV

You can click “volt/Div” in “vertical Setup” window to select the voltage



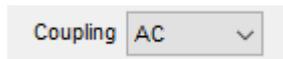
You can also change the selected channel voltage in sidebar



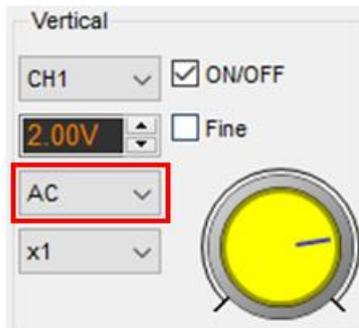
You can left click and drag the mouse on the knob to change the voltage.

Set Channel Coupling

Click “**Coupling**” in “**Vertical Setup**” window



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

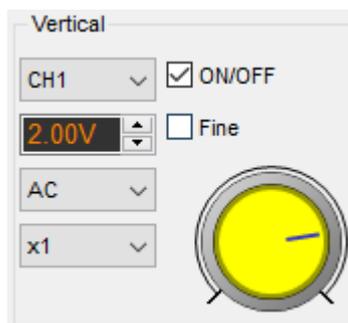
Select the attenuation factor for the probe. To check the probe attenuation setting, toggle the probe menu to match the attenuation factor of the probe.

This setting remains in effect before you changed again.

Click “**Probe**” in Vertical Setup window to select the probe attenuation



The probe setting window in the sidebar

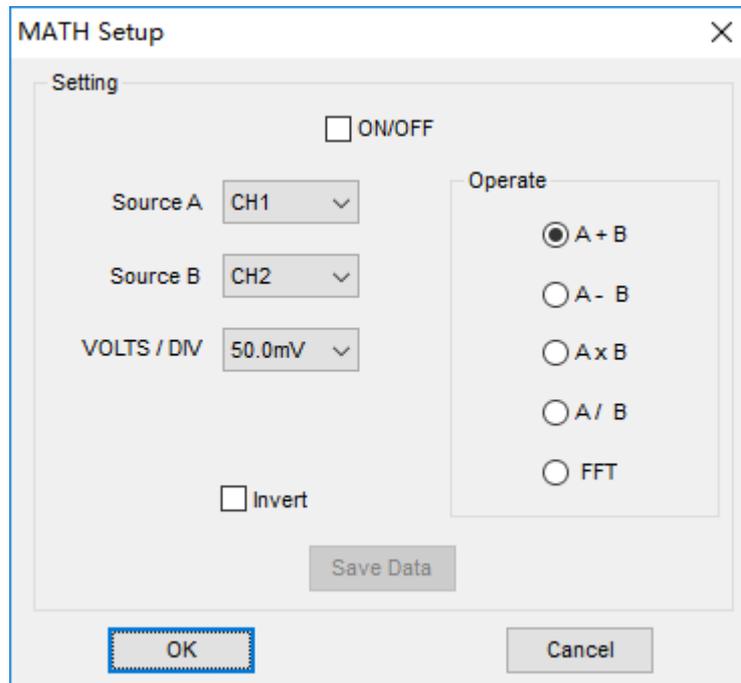


Note: The attenuation factor changes the vertical scale of the oscilloscope so that the measurement results reflect the actual voltage levels at the probe tip.

Set Math

Click “**MATH**” in **Channel** menu to set **MATH** channel.

The **MATH Setup** window:



ON/OFF: Turn On/Off the MATH Channel.

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

Operate: Set operates type of the math channel.

Volt/DIV: Set the resolution of the math channel.

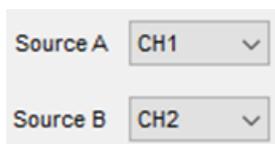
Probe: Set the math channel probe attenuation.

Invert: Turn on/off the invert function

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

Source A/B

Source A and Source B Menu



Operate

Four Types:

A + B Add source A and source B

A - B Subtract source B from source A

A x B Multiply source A by source B

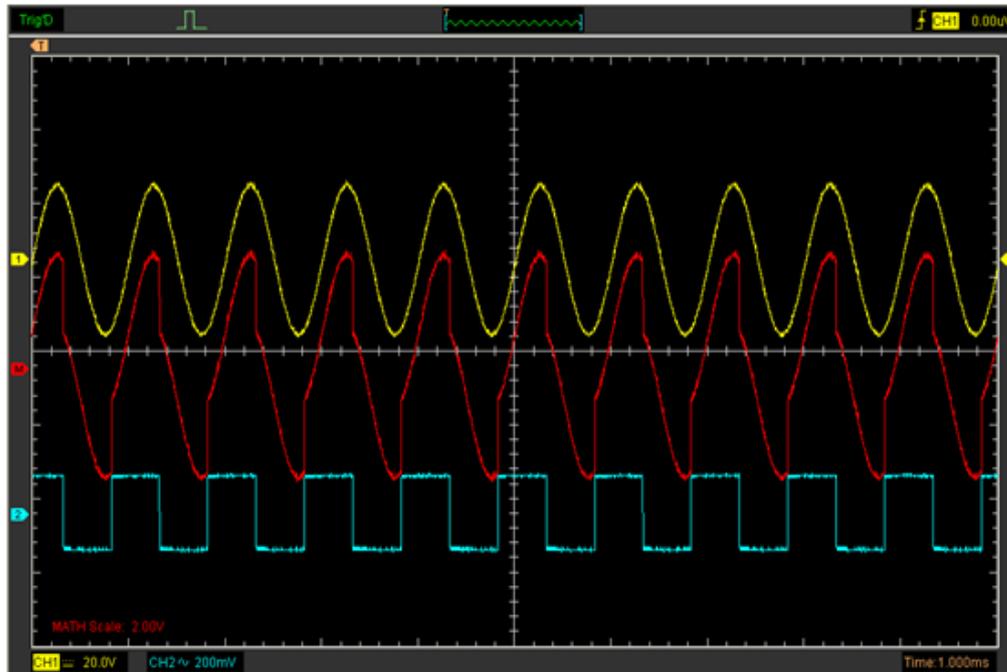
A / B Divide source A by source B

FFT Convert a time-domain signal into its frequency components (spectrum).

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

Select the operate type in the **Operate** menu. 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



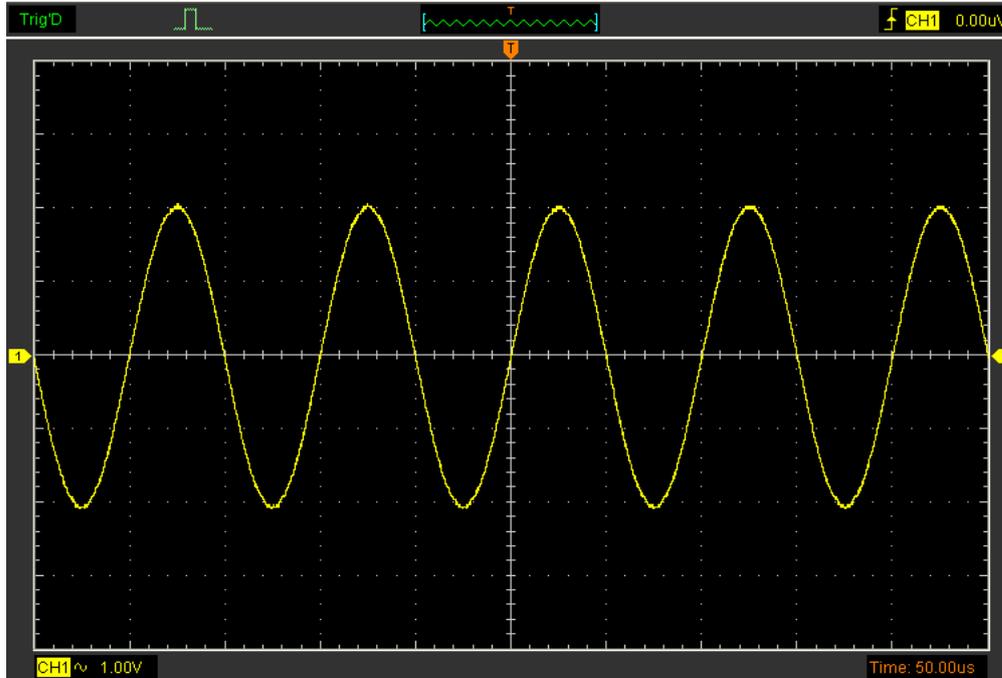
Invert

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.

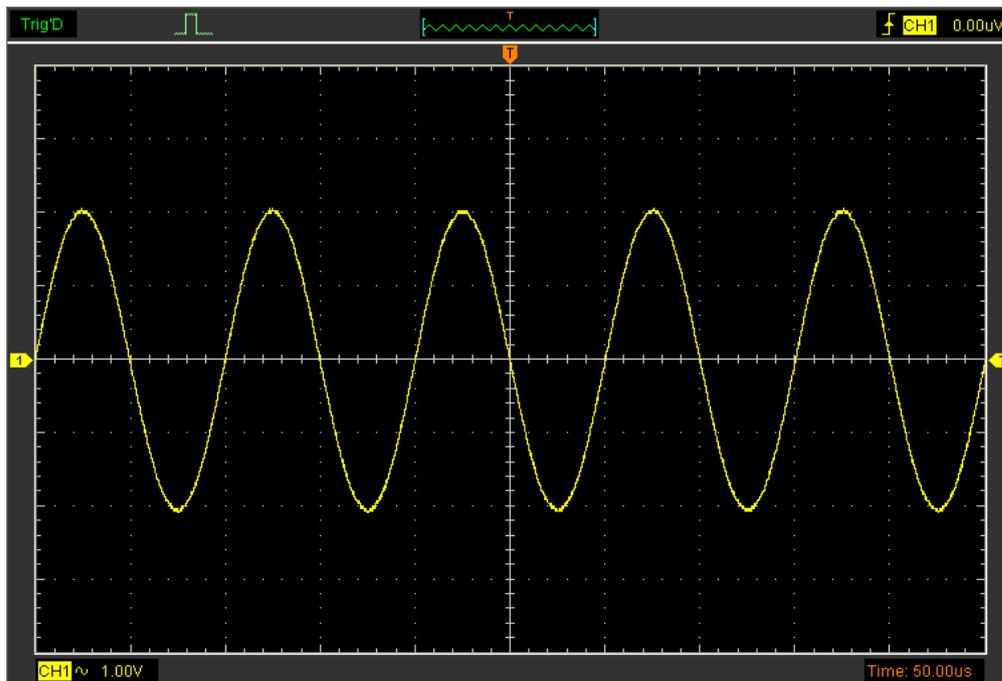
Click **“Invert”** in MATH.



The following picture shows the waveform before inversion:

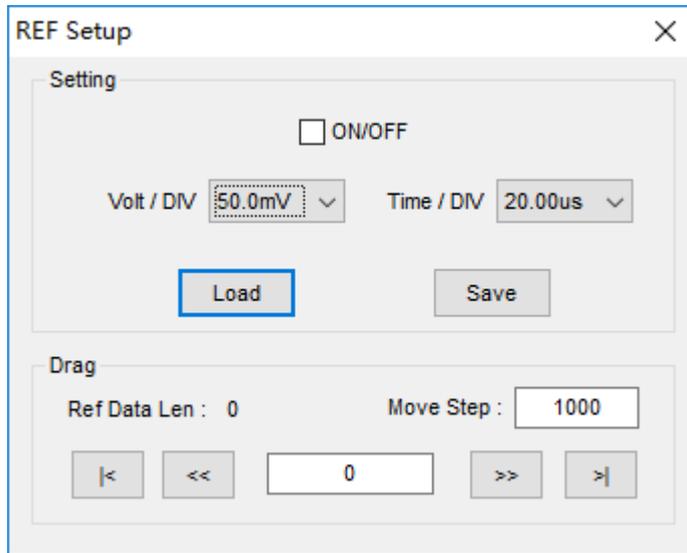


The following picture shows the waveform of inversion:



Set Reference

Click “REF” in “Setup” menu to set REF channel.



The Reference Channel Function:

On/Off: Turn on/off the reference channel.

Volt/DIV: Channel the resolution of the reference channel.

Load: Load the reference waveform from the “.rfc” file from your computer.

Save: Save the current reference waveform to your computer as “.rfc” format.

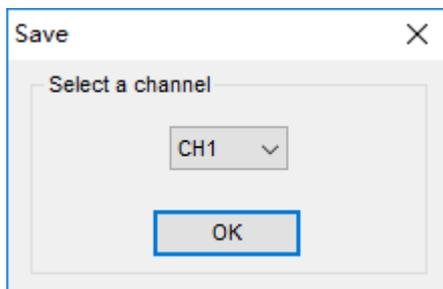
Save Reference: Save the current reference waveform to your computer as “.rfc” format. You can change the vertical scale of a waveform. The waveform display will contract or expand relative to the reference level.

Load

Click “**Load**” to load the “.rfc” file that was selected. The load file window will appear.

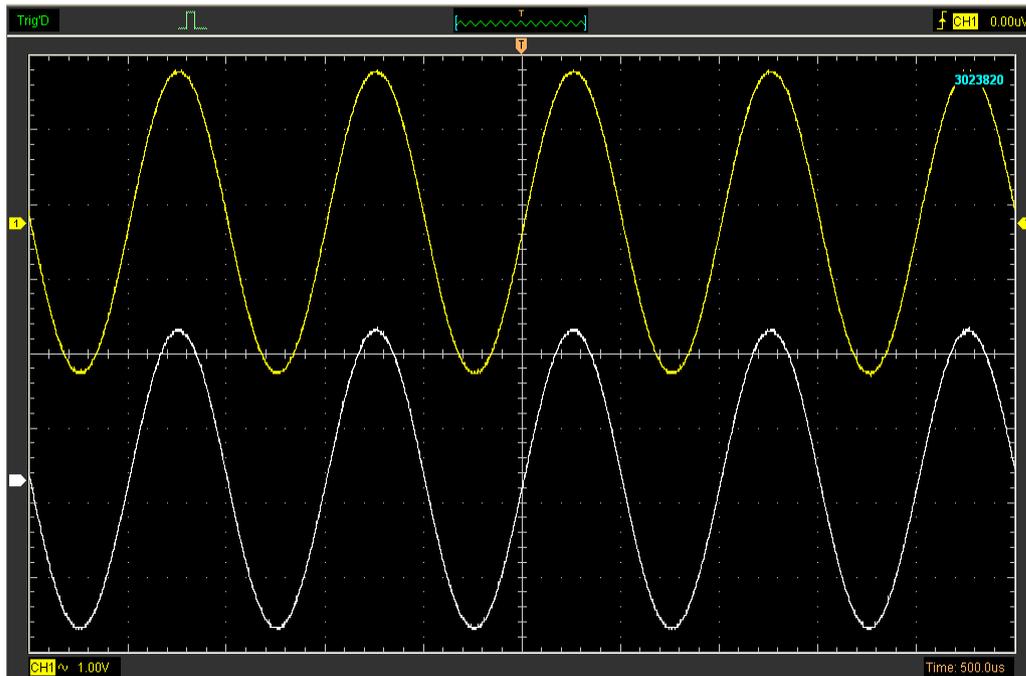
Save

Click “**Save**” to save the waveform to *.rfc file. The saved source window appears.



The save file window will appear after you selected the saved source.

The Reference Waveform Display Window:



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

3.3 Setup Horizontal System

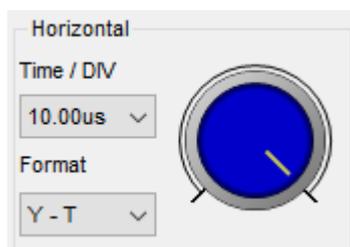
Change Time/Div

The “Time/Div”



Selects the horizontal **Time/DIV** (scale factor) for the main or the window time base

The Horizontal Panel

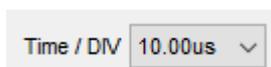


Click the blue knob can change **Time/Div**.

If the waveform acquisition is stopped, **Time/Div** control expands or compresses the waveform.

Change Format

Click “Time/Div” you can set the Time base in Horizontal Setup window.



In the “**Format**” item, set the waveform display format (**Y-T, X-Y**).

Y -T: Show the relative relation between vertical voltage and horizontal time

X -Y: Show CH1 value at X axis; CH2 value at Y axis

Change Horizontal Position

Double click the channel button to set the trigger point to the horizontal center of the screen.

Horizontal position changes the displayed waveform position, relative to the trigger point.

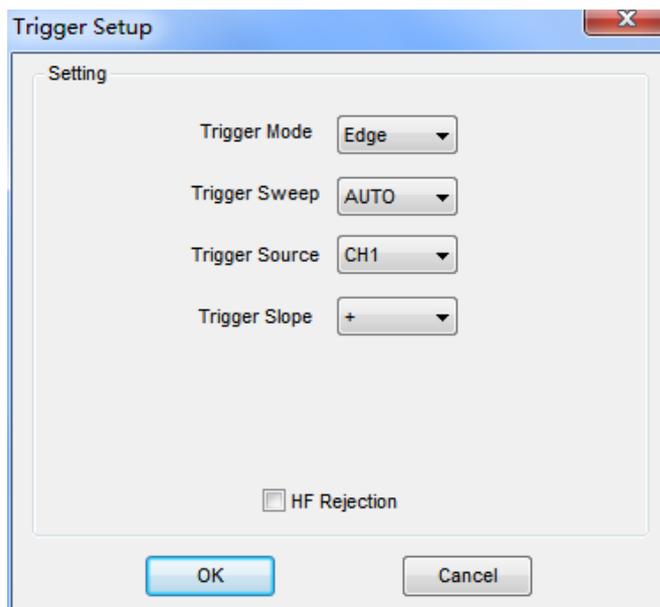
The user can drag  on screen to change the horizontal position.

3.4 Set Trigger System

Click “**Setup->Trigger**”, you can configure the trigger.

The user can also click  in the toolbar to set Trigger.

1. Set Trigger



Edge Trigger

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.



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

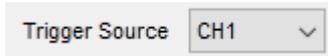


Auto: Acquire waveform even no trigger occurred

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.



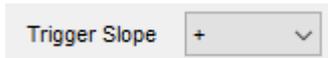
CH1: Select CH1 as trigger signal

CH2: Select CH2 as trigger signal

CH3: Select CH2 as trigger signal

CH4: Select CH2 as trigger signal

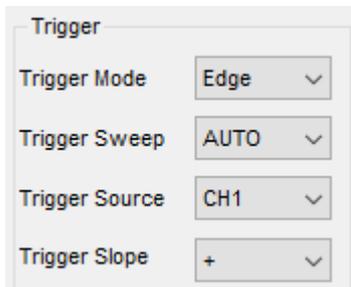
Slope: Set the slope to **Rising (+)** or **Falling (-)**.



Rising: Trigger on rising edge

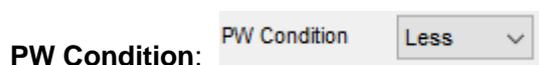
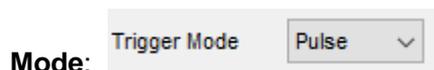
Falling: Trigger on falling edge

The user can also change the trigger setting on trigger panel in sidebar.

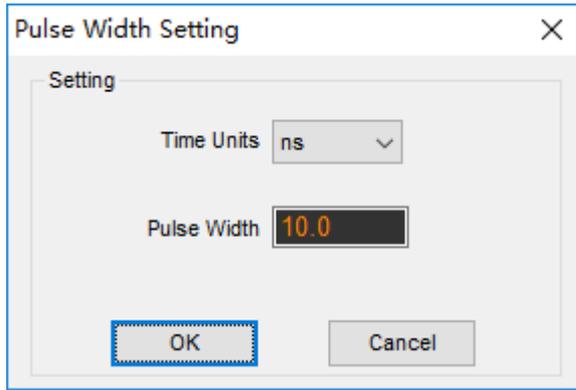


Set Pulse Trigger

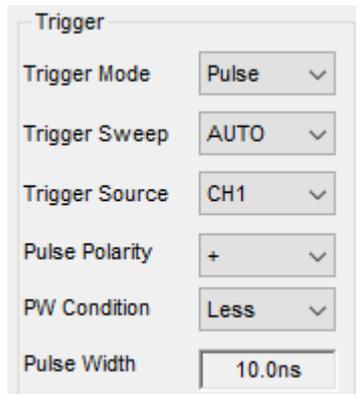
Pulse trigger occurs according to the width of pulse. The abnormal signals can be detected through setting up the pulse width condition.



Pulse Width: The Pulse Width adjust range is 10ns~10s. When the condition is met, it will trigger and acquire the waveform.



The user can also change the trigger setting on trigger panel in sidebar.



When alternative trigger is on, the trigger sources come from two vertical channels. This mode can be used to observe two non-related signals. You can choose two different trigger modes for the four vertical channels.

| Options | Settings | Comments |
|--------------|--|--|
| Pulse | | With Pulse highlighted, the trigger occurs on pulses that meet the trigger condition (defined by the Source, When and Set Pulse Width options). |
| Sweep | Auto, Normal, Single | Auto: Acquire waveform even no trigger occurred Normal: Acquire waveform when trigger occurred Single: Acquire waveform when trigger occurred then stop. |
| Source | CH1 CH2 CH3 CH4 | Select the input source as the trigger signal. |
| PW Condition | +Less, +Equal, +More -Less -Equal -More | +Less: +Pulse width less than selecting pulse condition. +Equal: +Pulse width equal than selecting pulse condition. +More: +Pulse width more than selecting pulse condition. -Less: -Pulse width less than selecting pulse condition. -Equal: -Pulse width equal than selecting pulse condition. -More: -Pulse width more than selecting pulse condition. |
| Pulse Width | | Set Pulse Width highlighted, including Time Unit and Pulse Width |

Video Trigger:

Mode: Select the trigger mode.



Sweep:

Trigger Sweep ▾

Source: Set the Trigger Channel to **CH1,CH2,CH3,CH4**.

Trigger Source ▾

Trigger Sync:

Trigger Sync ▾

Trigger Standard:

Standard ▾

| Options | Settings | Comments |
|----------|---|--|
| Video | | With Video highlighted, an NTSC, PAL or SECAM standard video signal will be triggered. The trigger coupling is preset to AC. |
| Sweep | Auto, Normal Single | Auto: Acquire waveform even no trigger occurred Normal: Acquire waveform when trigger occurred Single: Acquire waveform when trigger occurred then stop. |
| Source | CH1 CH2 CH3 CH4 | Select the input source as the trigger signal. |
| Sync | All Lines Line Number Odd Field Even Field All Fields | Choose a proper video sync. When selecting Line Number for the Sync option, you may use the User Select knob to specify a line number. |
| Standard | NTSC PAL/SECAM | Choose a video standard for sync and line number count. |

Set ALT System

Mode: Select the trigger mode.

Trigger Mode ▾

Trigger Channel: Set the Trigger Channel to **CH1,CH2,CH3,CH4**.

Trigger Channel ▾

Trigger Type: Set the Trigger Type to **Edge** or **Pulse**.

Trigger Type ▾

PW Condition: Set the PW Condition to the following condition.

+More: +Pulse width more than selecting pulse condition.

+Less: +Pulse width less than selecting pulse condition.

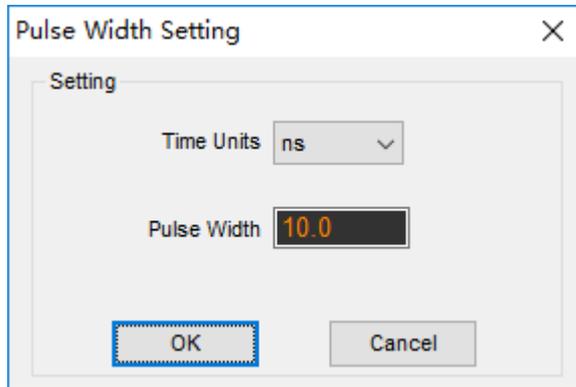
+Equal: +Pulse width equal to selecting pulse condition.

-More: -Pulse width more than selecting pulse condition.

-Less: -Pulse width less than selecting pulse condition.

-Equal: -Pulse width equal to selecting pulse condition.

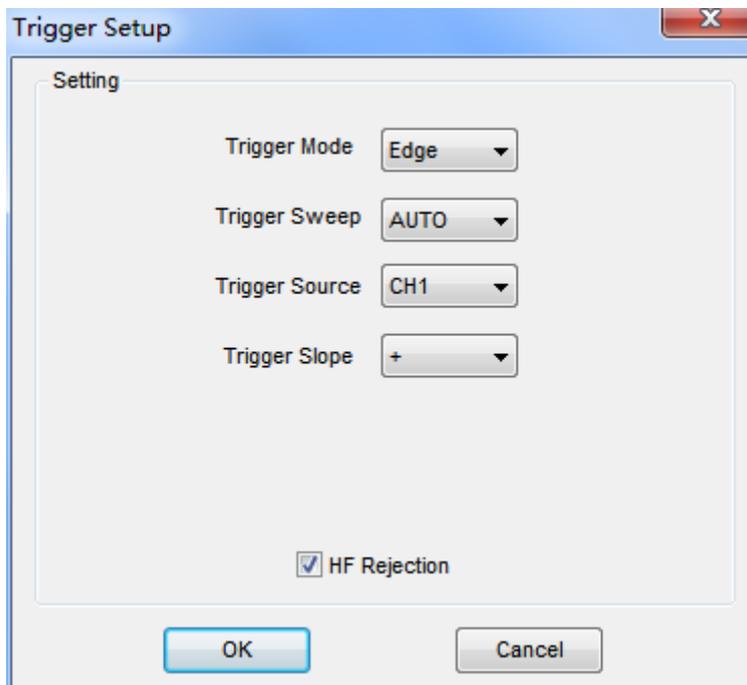
Pulse Width: The Pulse Width adjust range is 10ns~10s. When the condition is met, it will trigger and acquire the waveform.



The user can also change the trigger setting on trigger panel in sidebar.

High Frequency Rejection

Select "HF Rejection" in "Trigger Setup" window

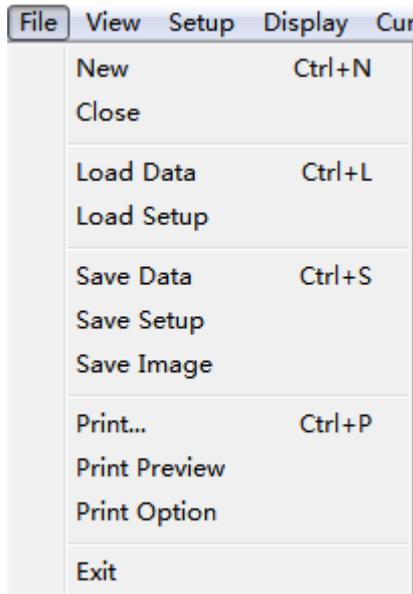


The user can turn on "HF Rejection" to eliminate trigger higher-frequency (20M above)

3.5 Save/Load

Save

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



1. Save Data

Save waveform data as a type file

2. Save Setup

Save the current oscilloscope setup to file

3. Save Image

Save the software display window as a .bmp or .jpg file

Load

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

1. Load Data

Load the waveform that had saved as a type file

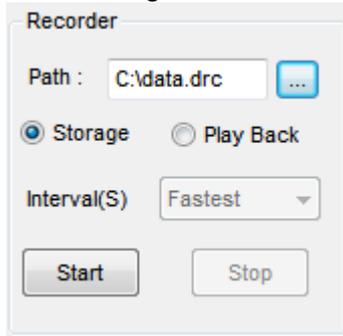
2. Load Setup

Load the instrument that had saved

3.6 Recorder

The following picture shows the **Recorder** Interface. The dialog box of record is shown on

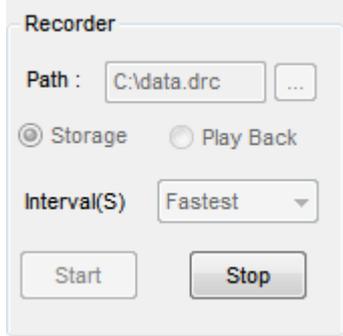
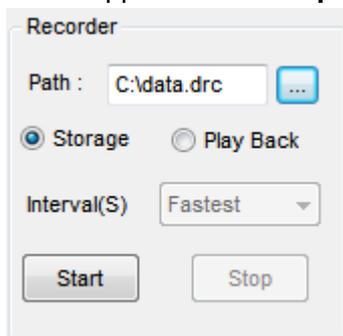
the lower right corner of the screen.



This function can record input waveform form CH1, CH2, CH3, CH4.

Storage: Record waveform and save it as “.drc” file. **“Play Back”** button: Click this button to start playing back waveform.

“Start” button: Start to record waveforms. After you start to record waveforms, this window will disappear. Click **“Stop”** to stop recording waveforms.



File Information:

Writing: Recording data.

Reading: Playing back data.

data.0.drc: the name of the recorded file. The Max. length of this file is about 0.5GB.

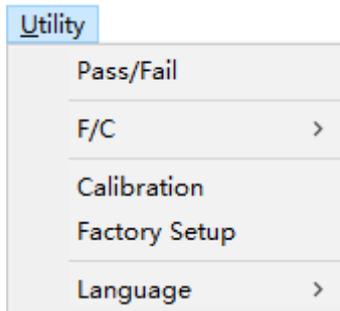
When recording data length is more than 0.5GB, it will create next file named data.1.drc, and so on.

When click **play back** button, it will play back data from the first file (data.0.drc) to the last file. If you want to read an arbitrary file, please delete the other data.drc, and then play back.

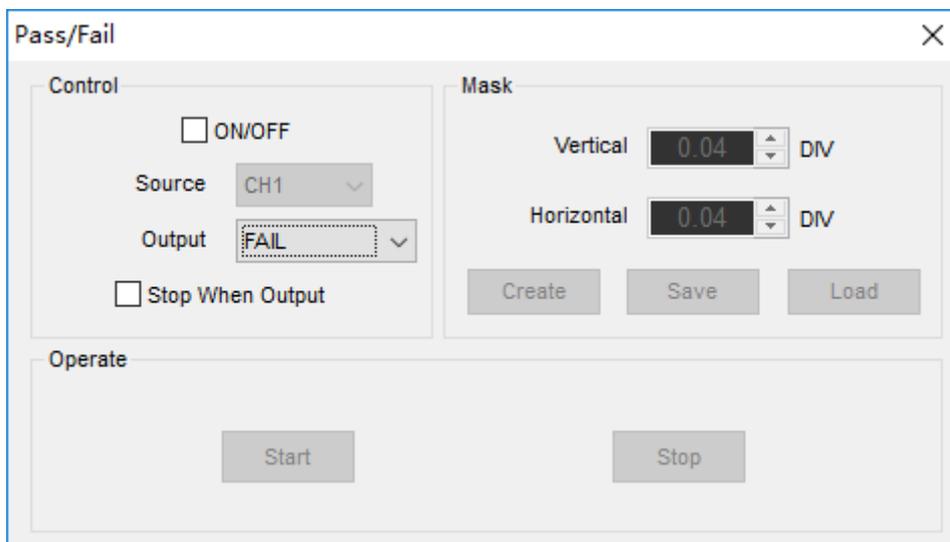
3.7 Utility Function

3.7.1 Pass/Fail

Click “**Pass/Fail**” in “**Utility**” menu.



The **Pass/Fail** window appears:

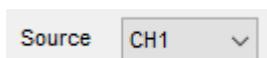


The **Pass/Fail** function monitors changes of signals and outputs pass or fail signals by comparing the input signal with the pre-created mask.

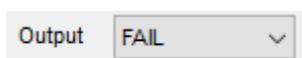
Control Setting



Source: Select the **Pass/Fail** channel



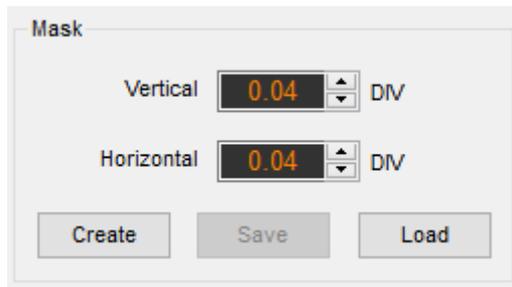
Output: Select the **Pass/Fail** output condition.



Stop When Output: If it was checked, the Pass/Fail will stop when output.

Stop When Output

Mask Setting



Mask

Vertical DIV

Horizontal DIV

Create Save Load

Vertical: Set the vertical limit range



Vertical DIV

Horizontal: Set the horizontal limit range



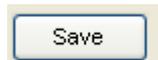
Horizontal DIV

“Create” button: Click this button to create Pass/Fail area according to the mask



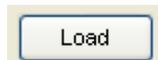
Create

“Save” button: Click this button to save the setups to file



Save

“Load” button: Click this button to load the saved setups file



Load

Information Display

```

Pass: 81 wfs
Fail: 1 wfs
Total: 82 wfs

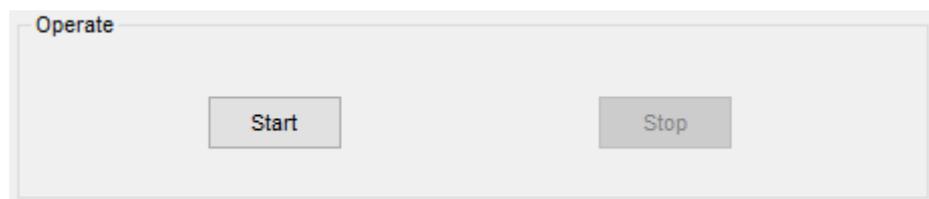
```

Fail: It shows the fail waveform number

Pass: It shows the pass waveform number

Total: It shows the total **Pass/Fail** waveform number

Operation



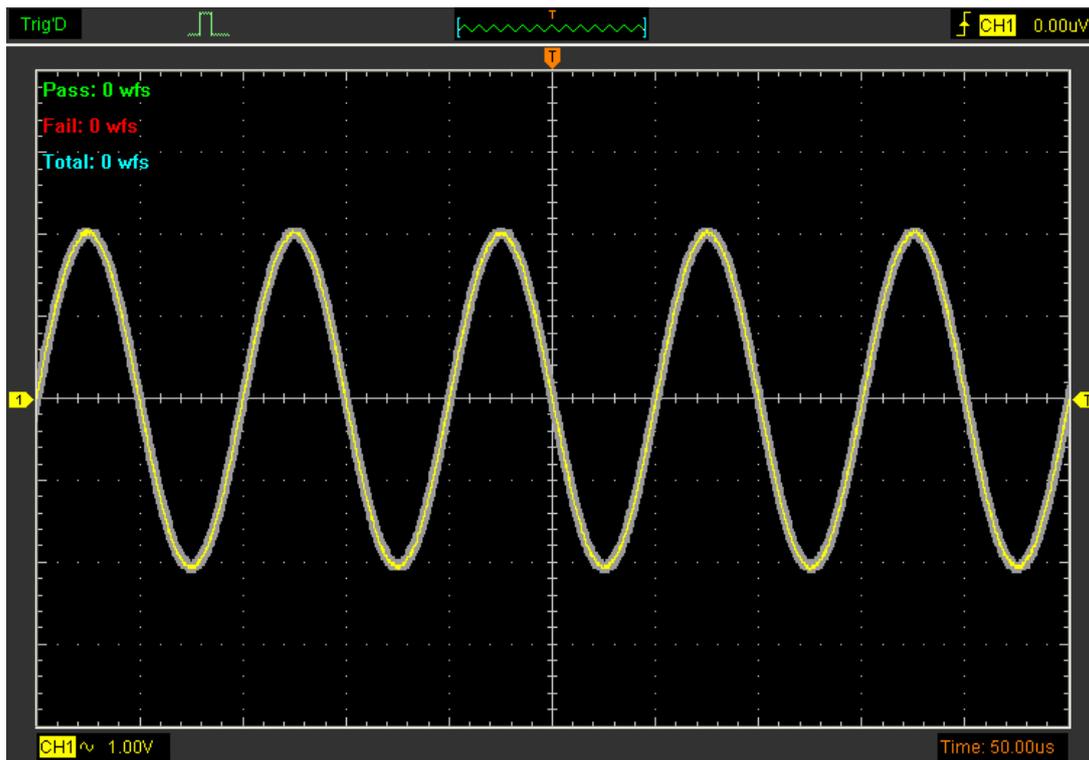
Operate

Start Stop

Click **“Start”** button to start the **Pass/Fail** test.

Click **“Stop”** button to stop the **Pass/Fail** test.

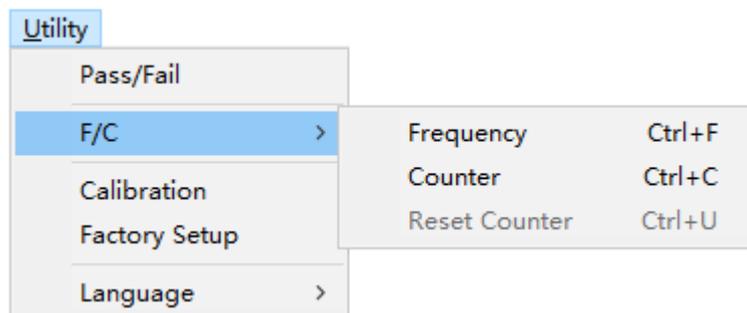
The Pass/Fail function display



NOTE: Pass/Fail function is unavailable in X-Y mode.

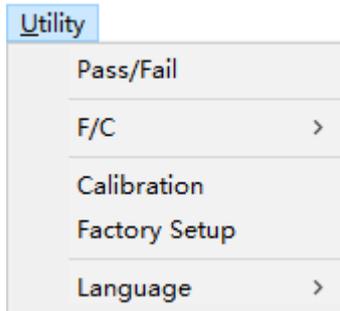
3.7.2 F/C

Click “F/C” in “Utility” menu to display the frequency value of the trigger channel.



3.7.3 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 waveforms and removes all other waveforms.

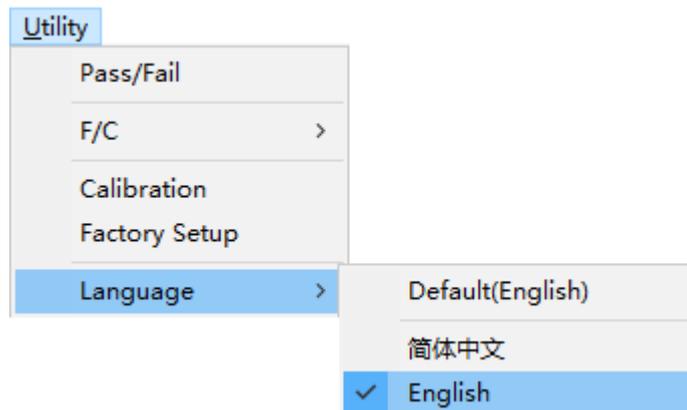
The oscilloscope set up for normal operation when it is shipped from the factory and can be recalled at anytime by user.

The Factory Setup function does not reset the following settings:

- Language option
- Date and time

3.7.4 Language

Click “**Language**” in “**Utility**” menu

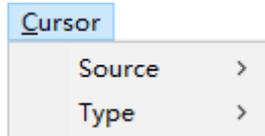


There are four languages in “**Language**” menu. The default language is English.

3.8 Measure Signal

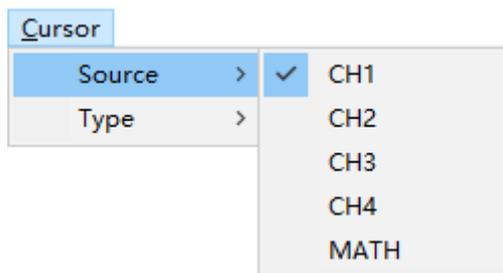
3.7.1 Cursor Menu

Click “**Cursor**” in main menu.



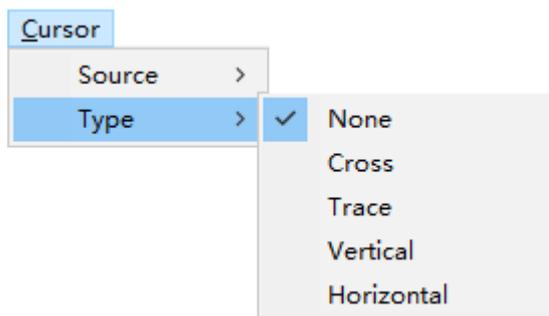
This method allows you to take measurements by moving the cursors

1. Source



The user can set the source to **CH1**, **CH2**, **CH3**, **CH4** and **MATH**.
When you use cursors, be sure to set the **Source** to the waveform on the display that you want to measure.

2. Type

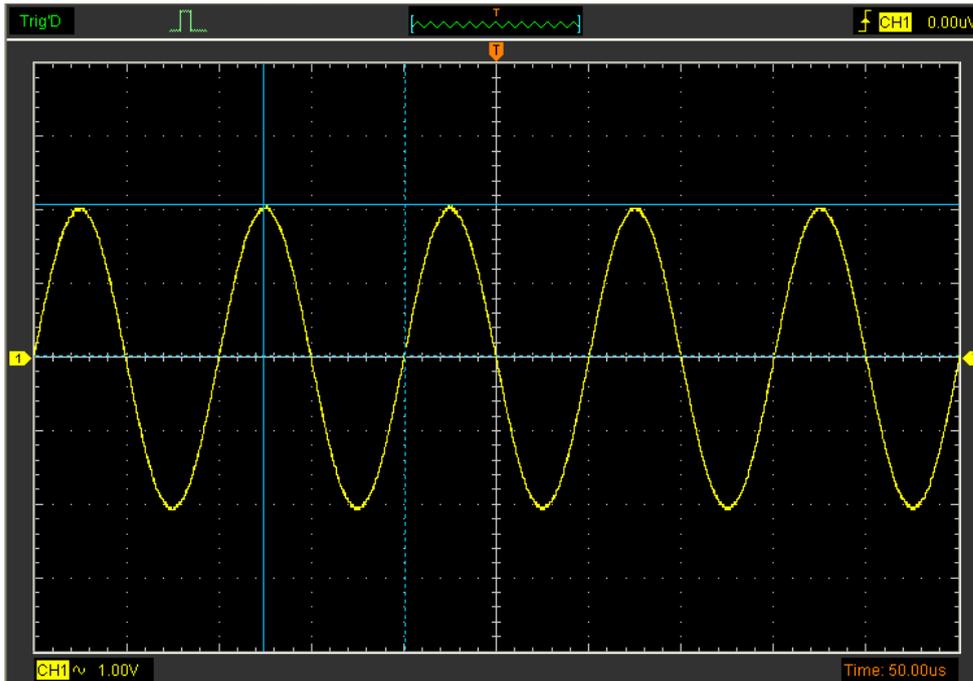


There are four types of cursors: **Cross**, **Trace**, **Vertical** and **Horizontal**

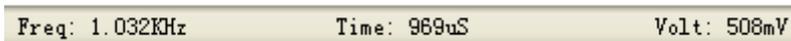
1) Cross

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

The **Cross** cursor display window:



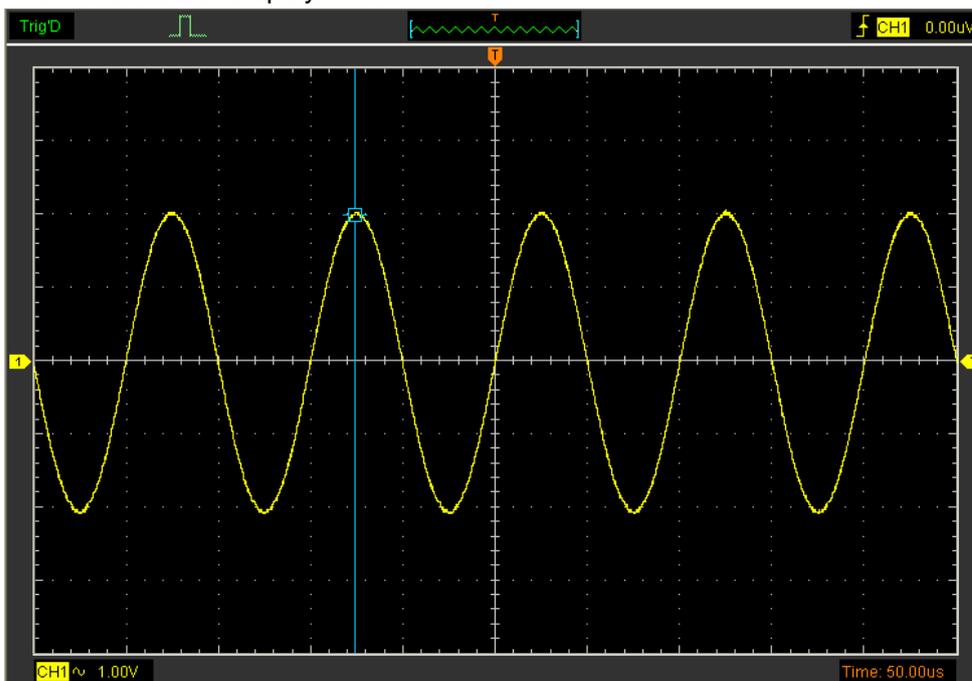
The **Cross** measure result displays on status bar



2) Trace

The **Trace** cursors appear as vertical lines on the display and measure the waveform amplitude at the point the waveform crosses the cursor.

The **Trace** cursor display window



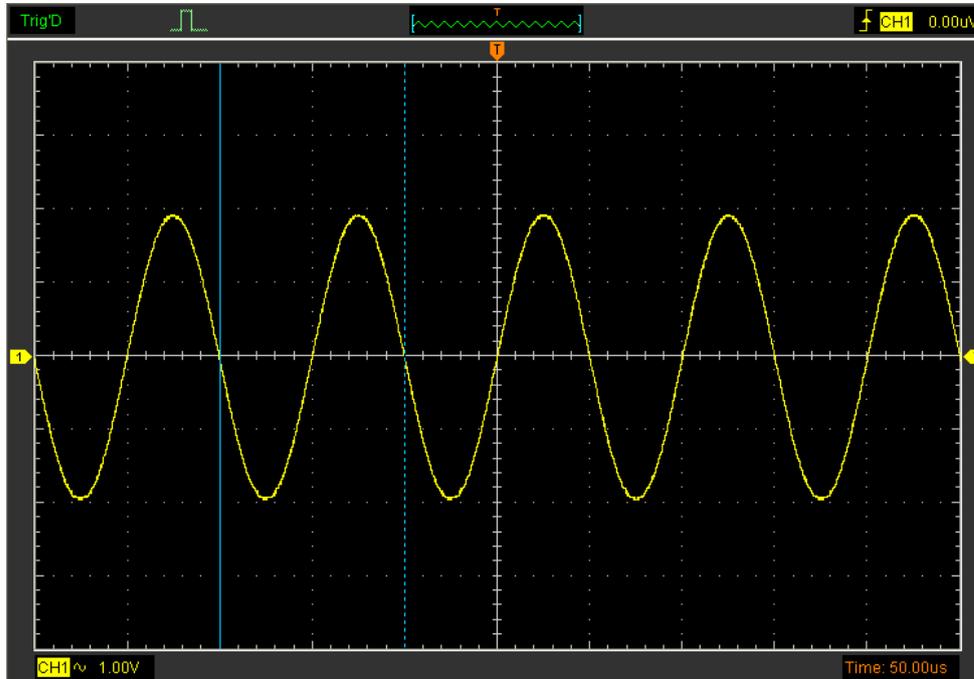
The **Trace** cursor measure result display on status bar



3) Vertical

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

The **Vertical** cursor display window:



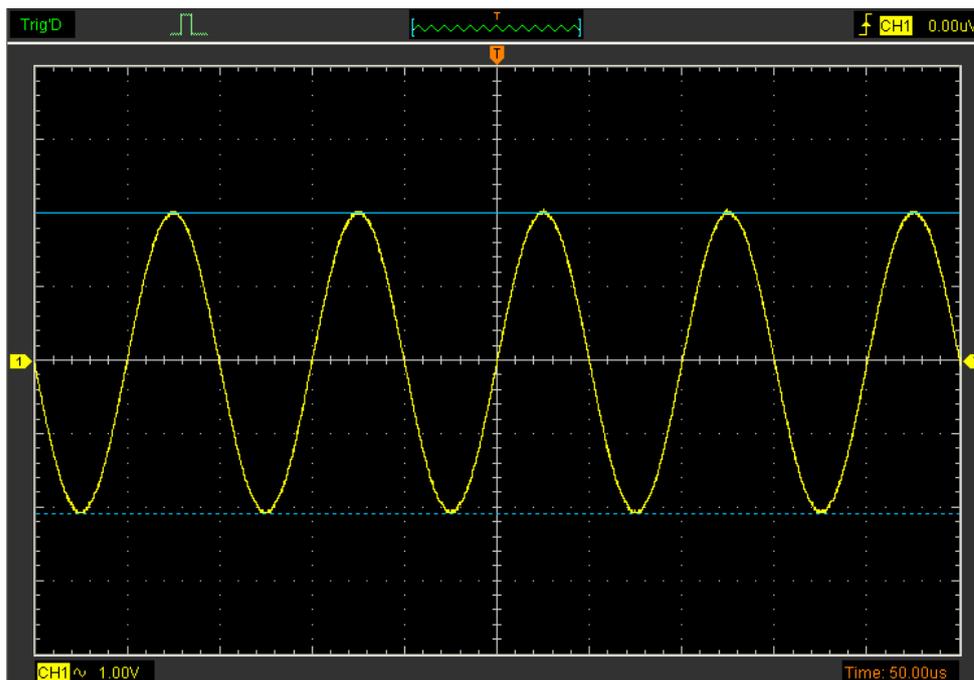
The **Vertical** cursor measure result display on status bar

Freq: 820.1Hz Time: 1.22mS

4) Horizontal

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

The **Horizontal** cursor display window:



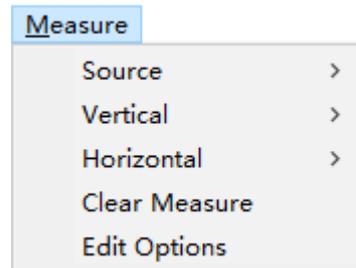
The **Horizontal** cursor measure result display on status bar

Volt: -3.01V

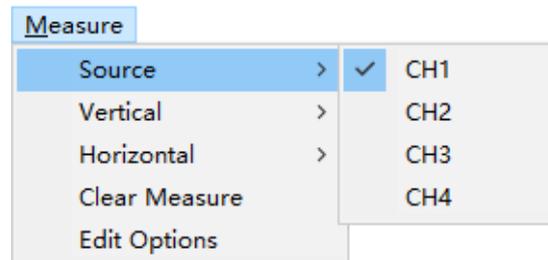
3.7.2 Measure Menu

Click “**Measure**” in main menu.

The oscilloscope provides 20 parametric auto measurements (12 voltage and 8 time measurements).

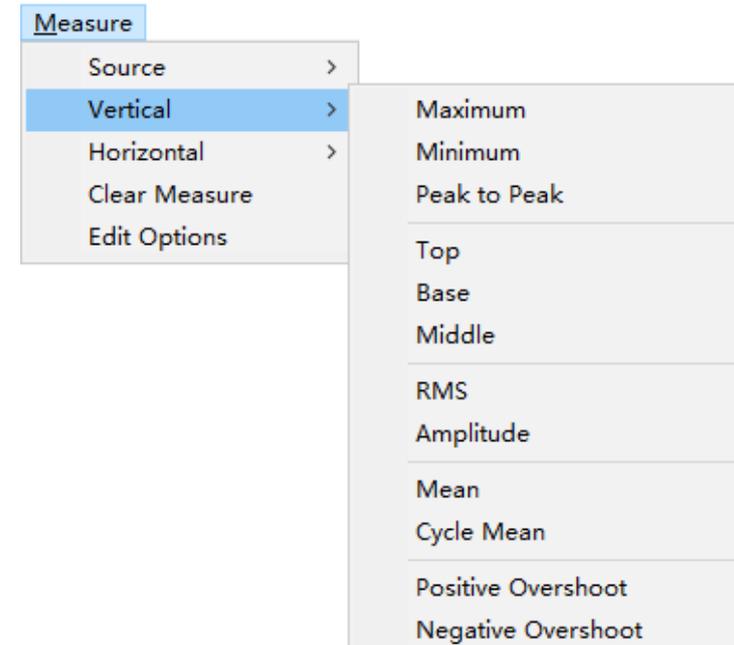


1. Source



The user can use the “**Source**” menu to select a measure source.

2. Vertical



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

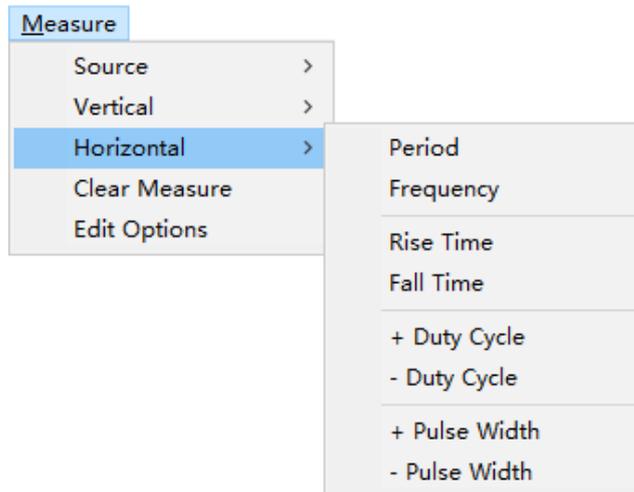
Mean: The arithmetic mean over the entire waveform

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.

3.Horizontal



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

Frequency: Reciprocal of the period of the first cycle to complete 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 waveform.

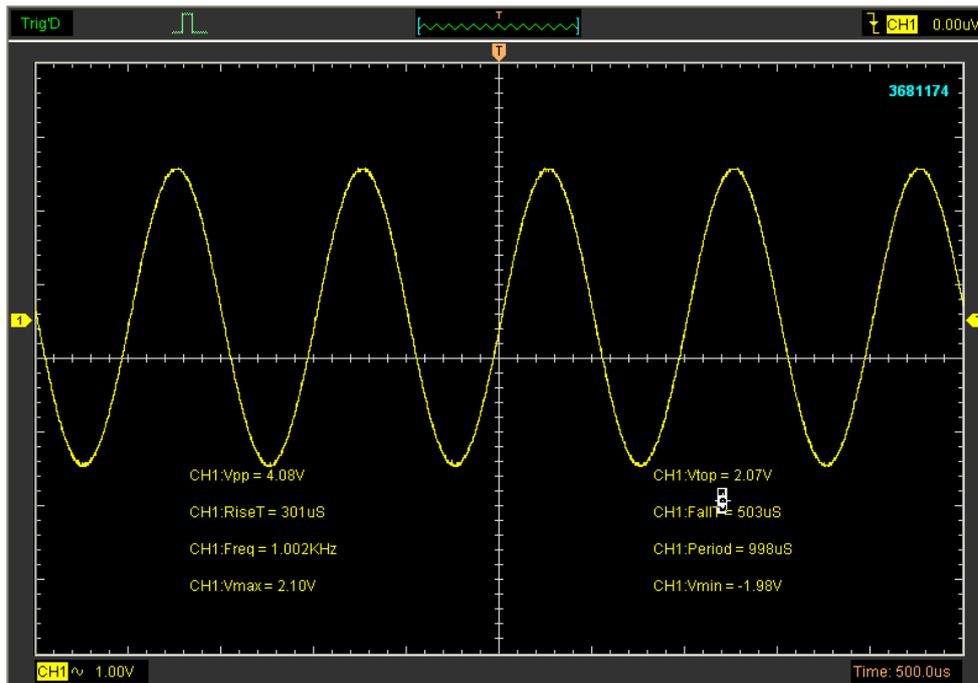
+Pulse Width: Measured of the first positive pulse in the waveform. The time between the 50% amplitude points

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

4. Clear Measure

Clear all measure items on display screen.

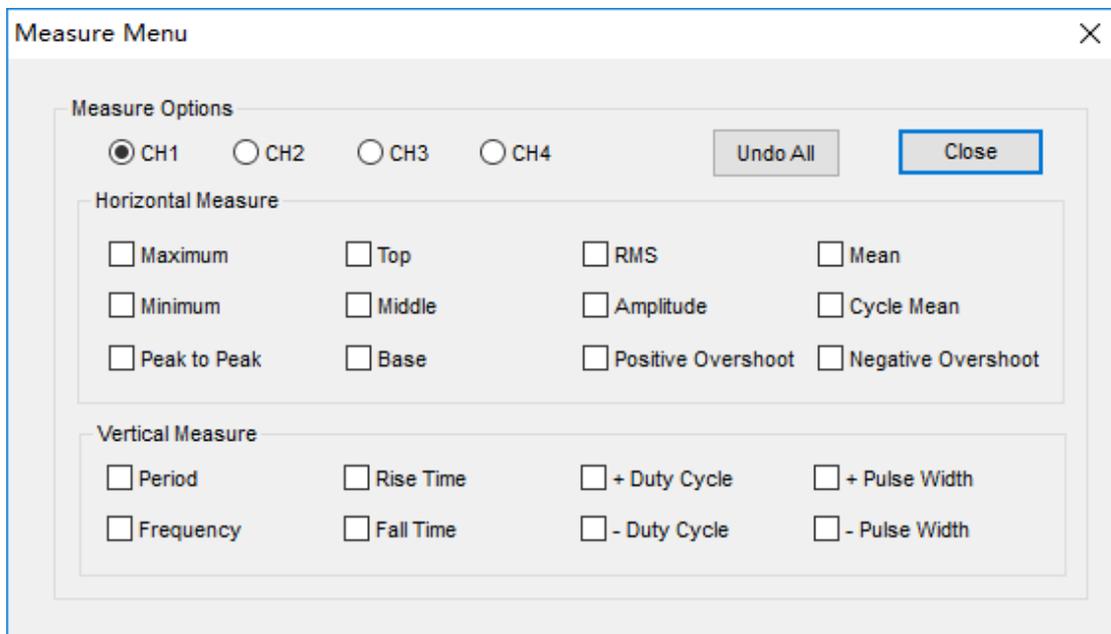
The **Measure** Display Window:



Note: The results of the automatic measurements will be displayed on the bottom of the screen. Maximum 8 results could be displayed at the same time. When there is no room, the next new measurement result will make the previous results moving left, out of screen.

5. Edit Measure

Click **“Measure->Edit Measure”**.



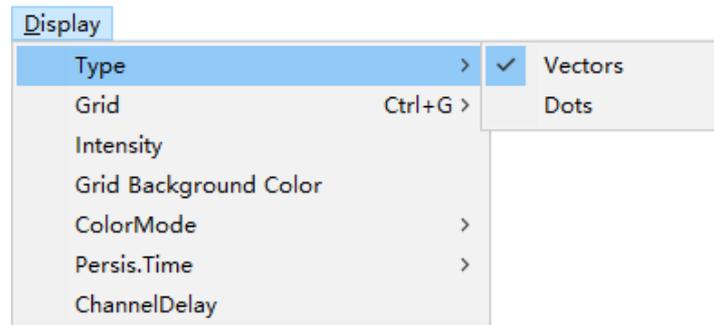
User can select Maximum 8 measure options to measure.

3.8 The Display System

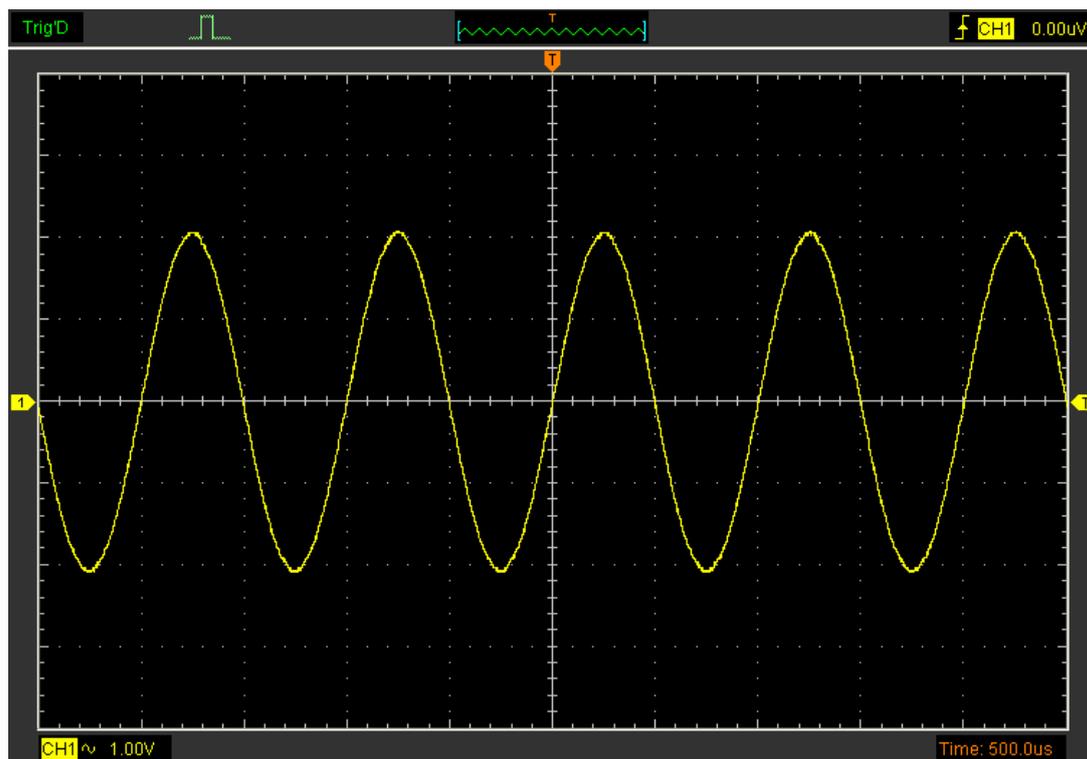
3.8.1 Display Type

Click “Type” in “Display” menu.

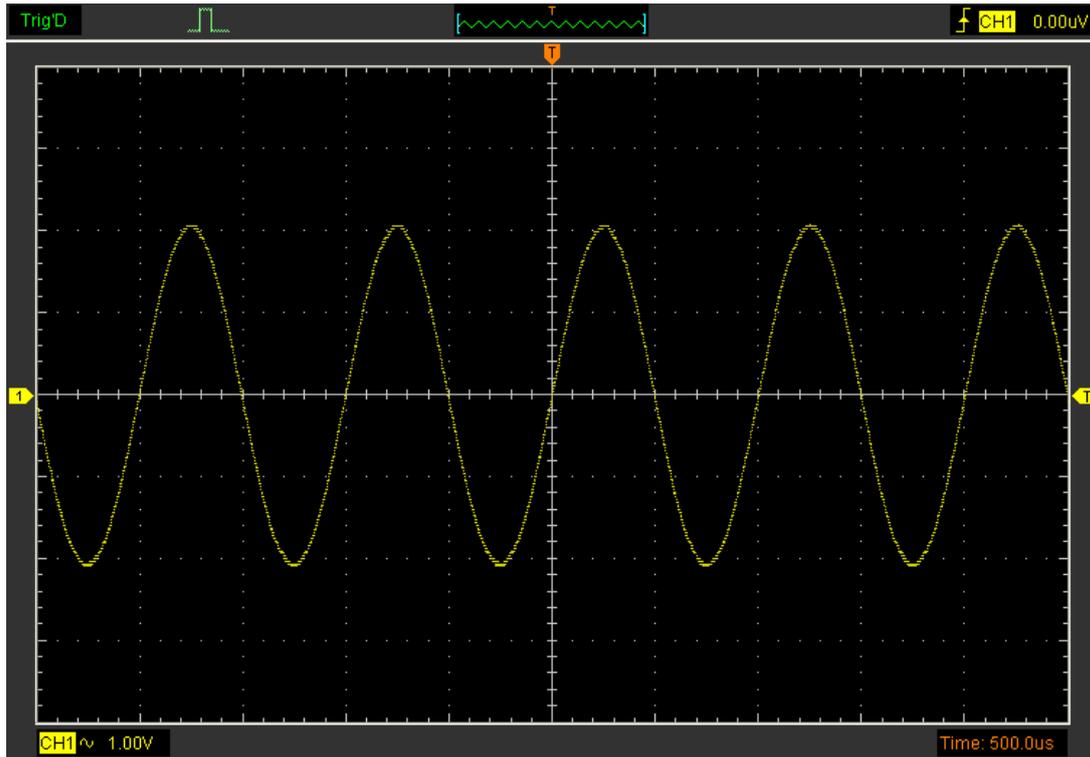
The following figure shows the type parameters setting.



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

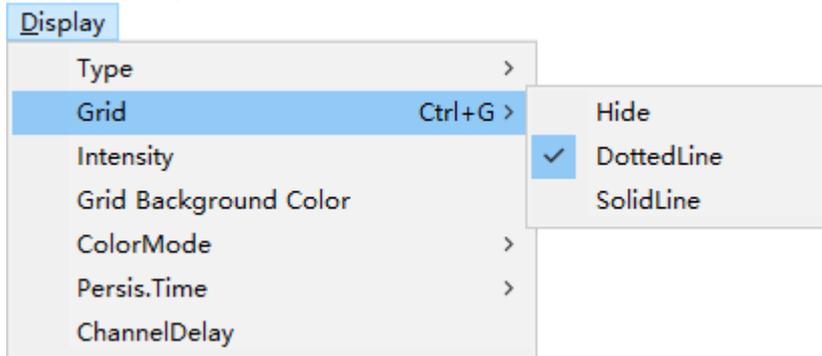


If the **Dots** type mode is selected, the waveform will be displayed as following figure.

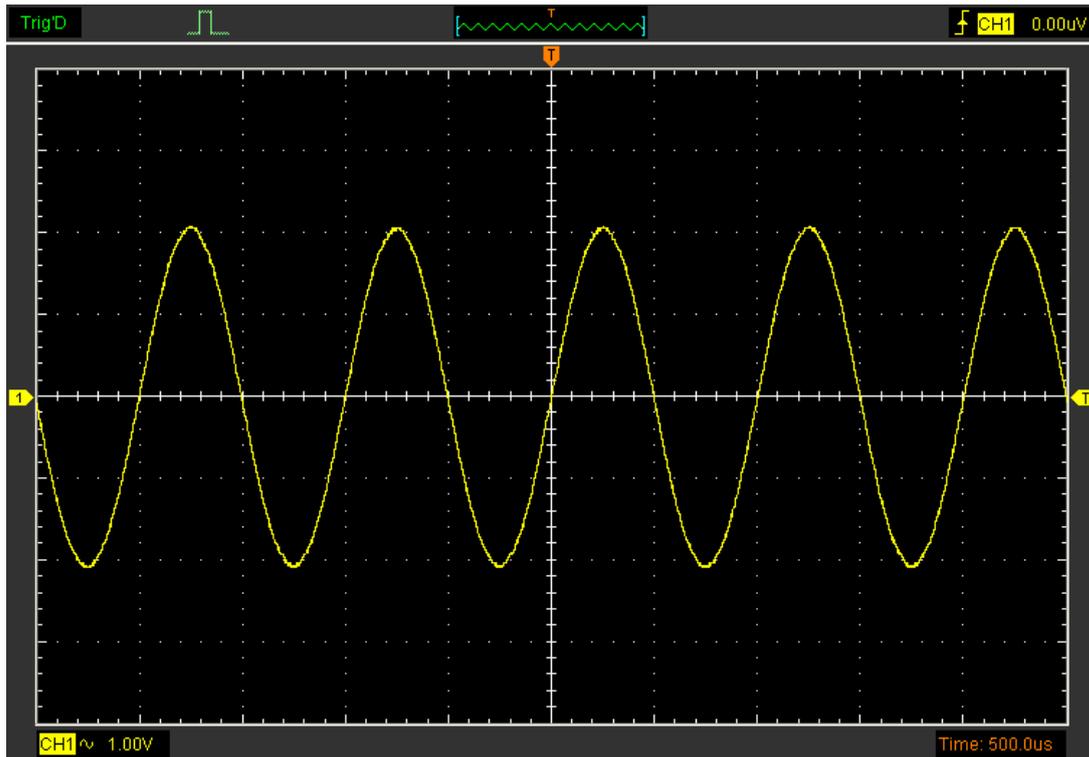


3.8.2 Display Grid

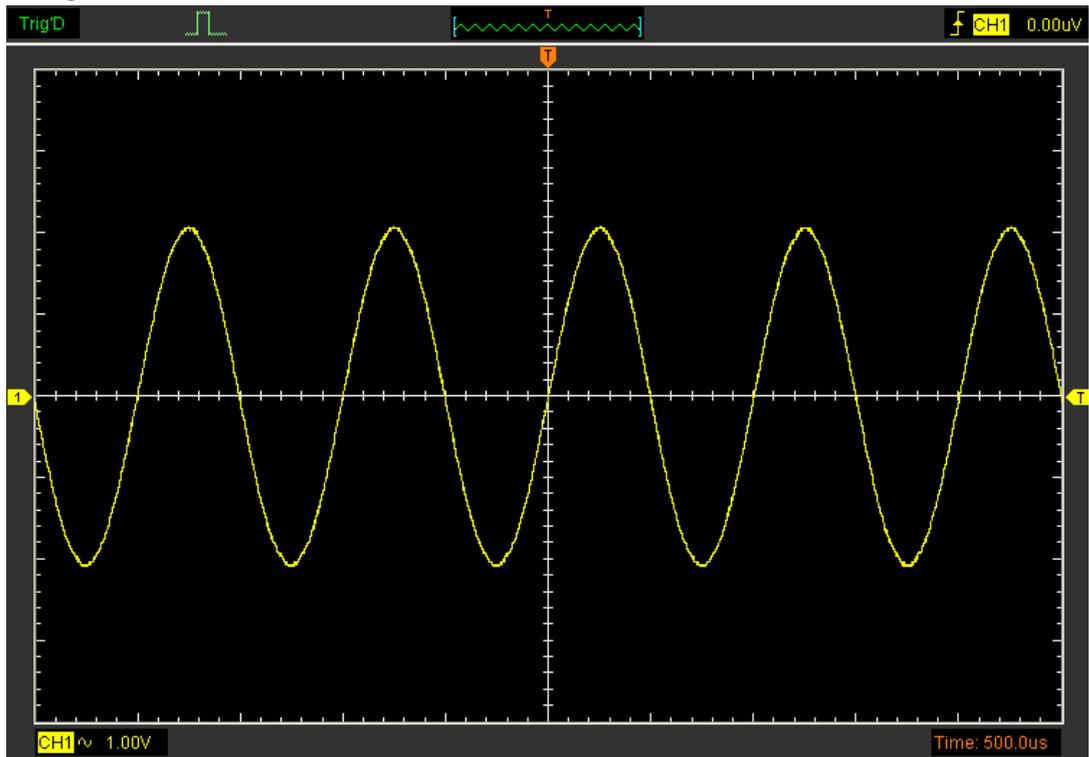
Click “Display” in main menu



The grid shows:



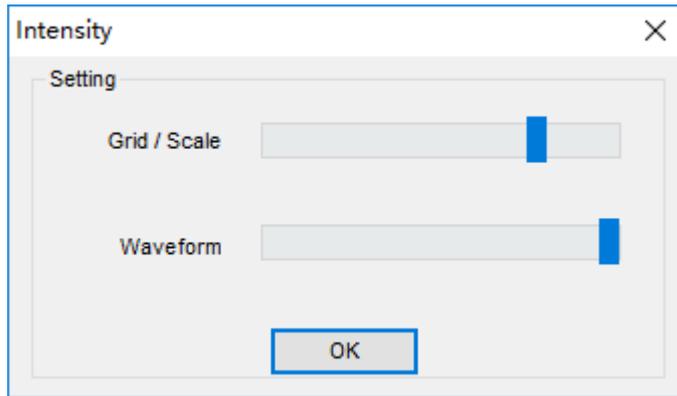
The grid not shows:



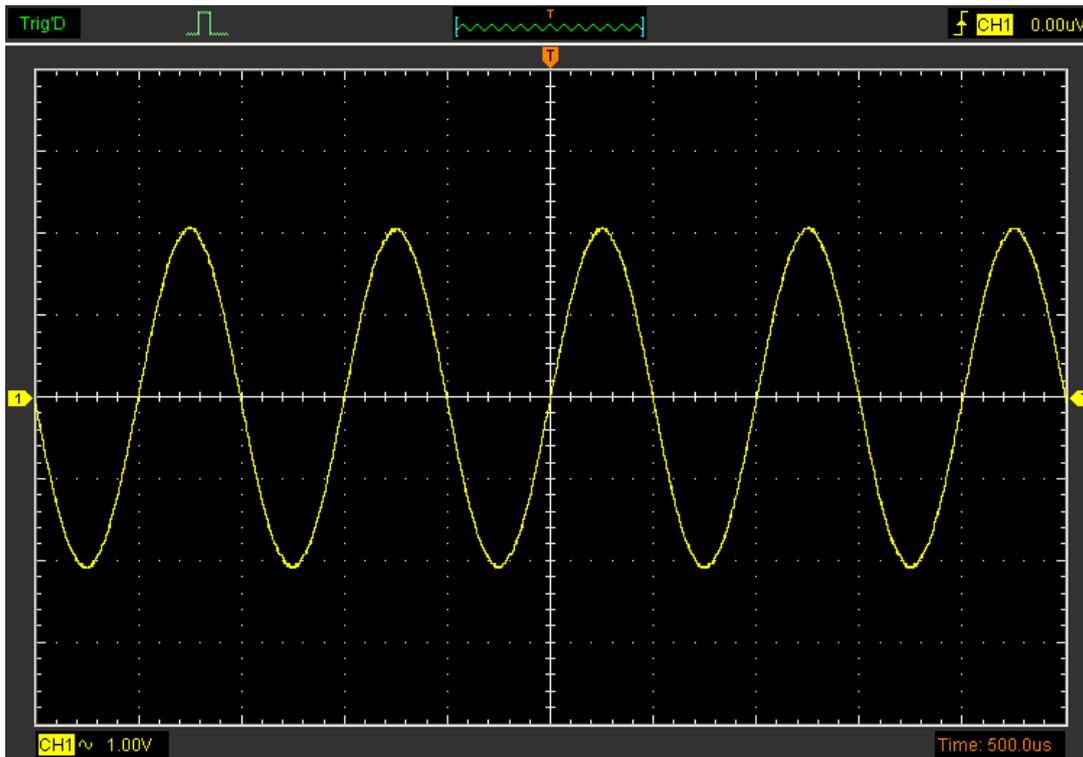
3.8.3 Intensity

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

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



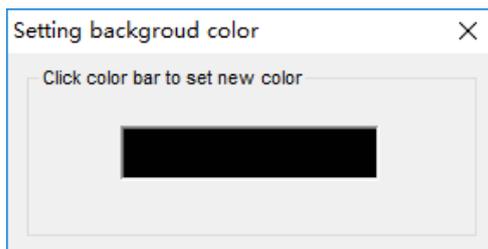
You can change the grid and waveform color intensity in this dialog.



3.8.4 Grid Background Color

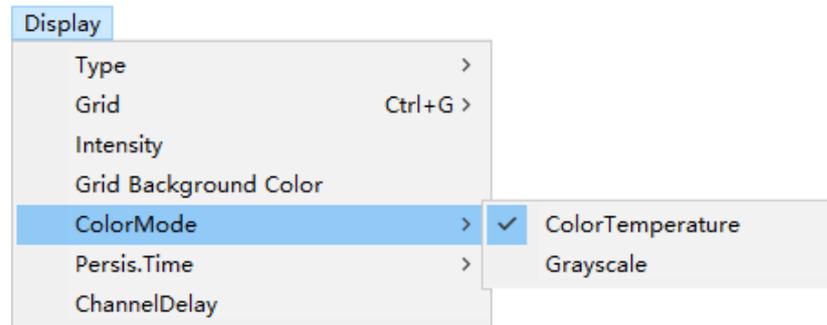
Click “**Display-> Grid Background Color**” in main menu.

The following Settings you can change the test the background color of the display area.



3.8.5 Color Mode

The following figure shows the type Color Mode.

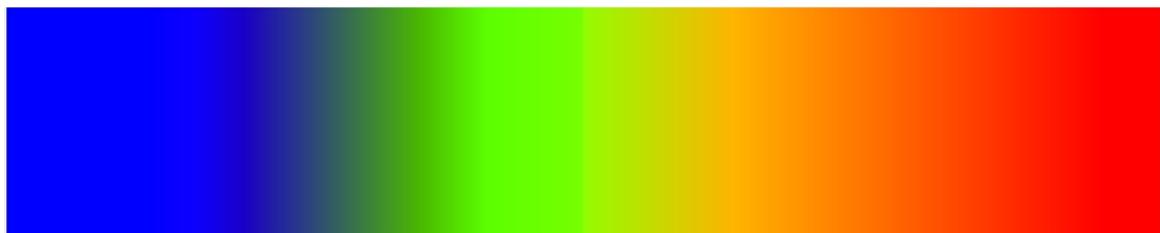


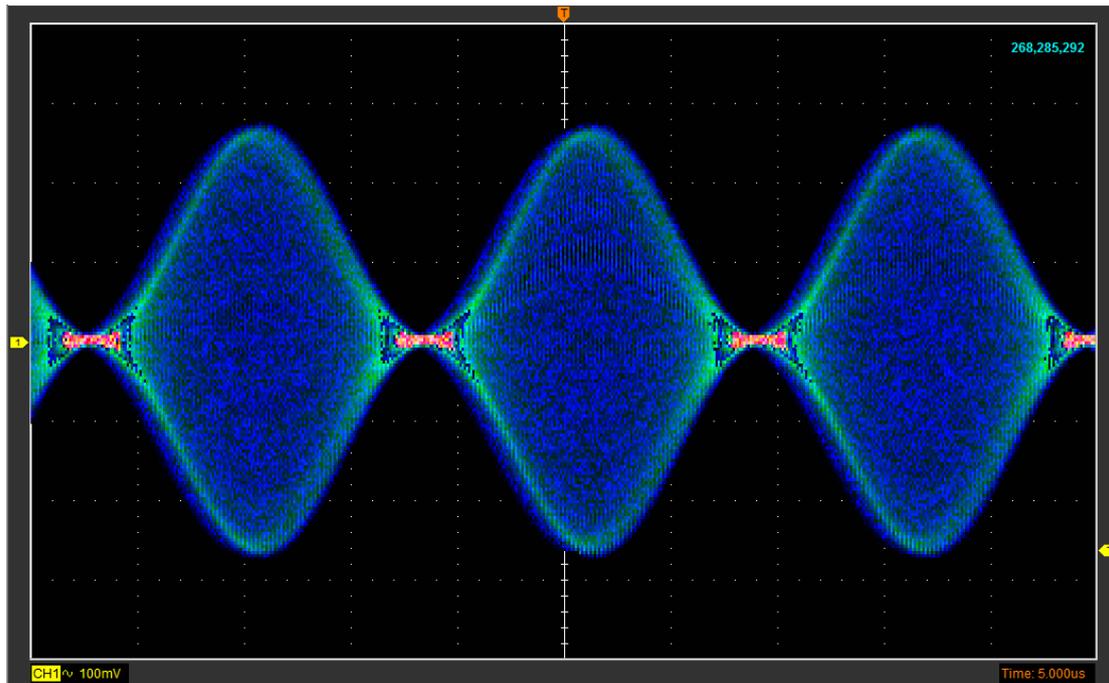
Click “**Display-> Color Mode->Color Temperature**” ,you can turn on the color temperature function.

Color temperature adopts the change of waveforms’ color to reflect the change of the waveforms’ appearing probability. The greater the probability that the waveform appears, the warmer the color is; the smaller the waveform appears, the colder the color is.

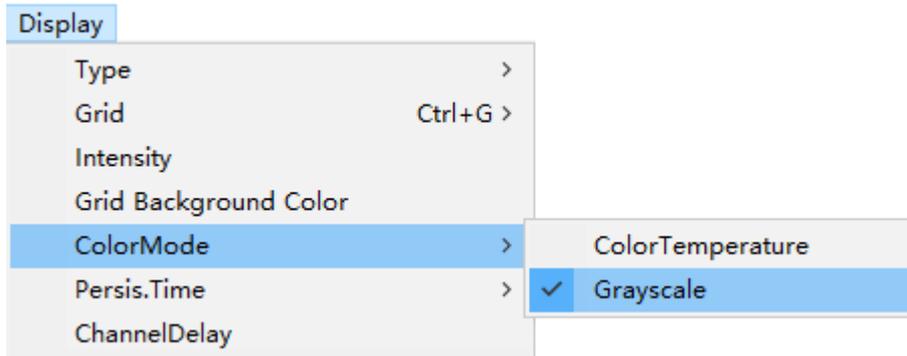
The picture below shows the change of color from cold to warm. You can compare the waveform’s color with the picture below to just the probability that the waveform appears.

Cold Color —————> Warm Color

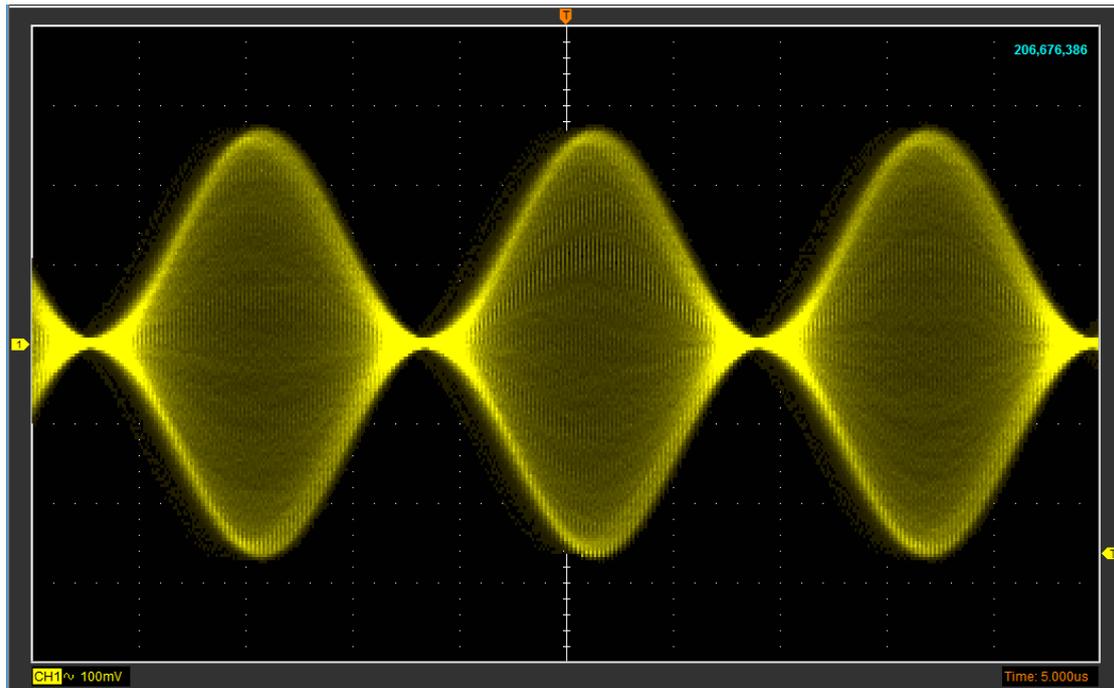




Click **“Display-> Color Mode->Grayscale”**.

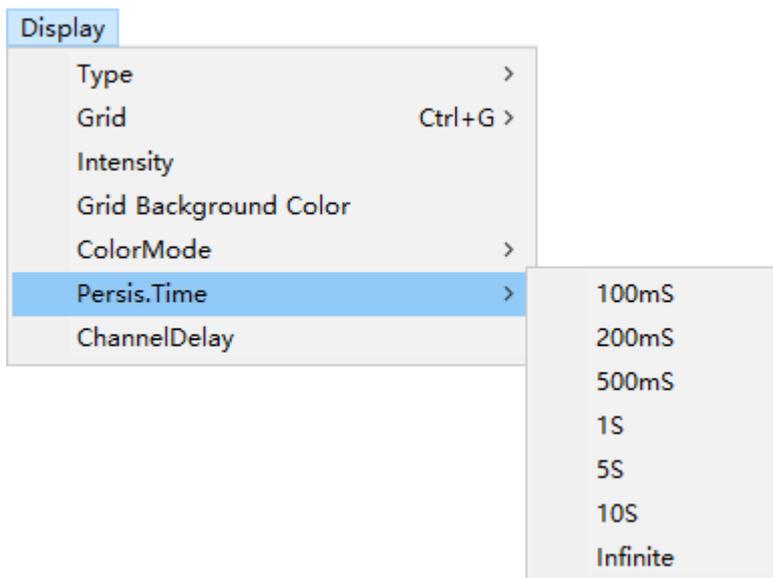


There are two kinds of grayscale display mode, When choosing a DPO mode for level 256 grayscale display and the max waveform capture rate to 60,000 wfm/s, but if the Acquire is on the FastAcq model,so the oscilloscope is only with 1-level intensity grading display function and the max waveform capture rate to 400,000wfm/s.



3.8.6 Persis. Time

Click “Display-> Persis.Time ” ,to set the persistence time of the oscilloscope to 100 ms, 200 ms, 500 ms, 1 s, 5 s and 10 s or Infinite.



With persistence, the oscilloscope updates the display with new acquisitions, but does not immediately erase the results of previous acquisitions. All previous acquisitions are displayed with reduced intensity. New acquisitions are shown

in their normal color with normal intensity.

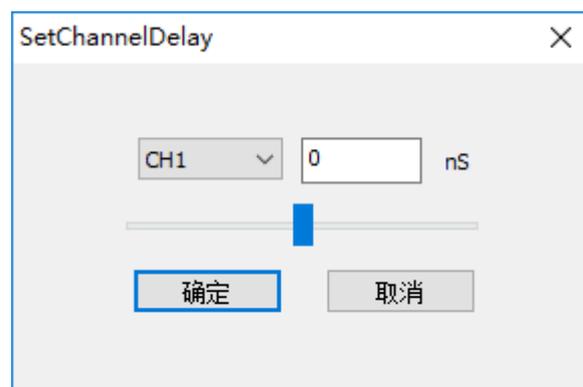
1: Variable persistence time (100 ms, 200 ms, 500 ms, 1 s, 5 s, 10s)

select different persistence time, the results of previous acquisitions are erased after a certain amount of time. You can refer to the following presentation images

2: When you chose the Infinite, the oscilloscope displays the waveform newly acquired without clearing the waveforms acquired formerly. The waveforms acquired formerly will be displayed in relatively low-brightness color and the waveform newly acquired will be displayed in normal brightness and color. Infinite persistence can be used to measure noise and jitter and to capture incidental events.

3.8.7 Channel Delay

Click “**Display->Channel Delay**”

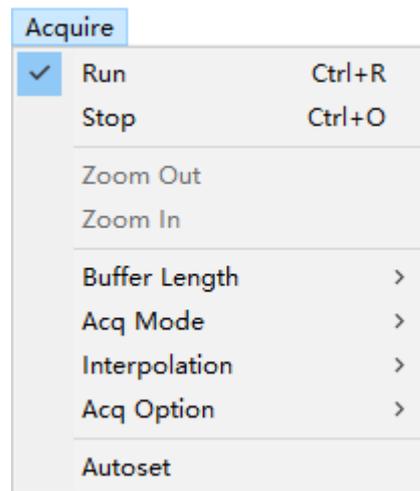


When using the oscilloscope for actual measurement, the transmission delay of the probe cable may cause relatively larger error (zero offset). Zero offset is defined as the offset of the crossing point of the waveform and threshold level line relative to the trigger position. You can set a delay time to calibrate the zero offset of the digital channels. The range is from

-100 ns to 100 ns.

3.9 Zoom In/Out and Drag Waveforms

The software will stop updating waveform after the user clicked “**Stop**” button. The user can change the waveform display by adjusting the scale and position. When you change the scale, the waveform display will increase or decrease in size. When you change the position, the waveform will move up, down, right, or left. The channel reference indicator identifies each waveform on the display. The indicator points to the reference level of the waveform record.



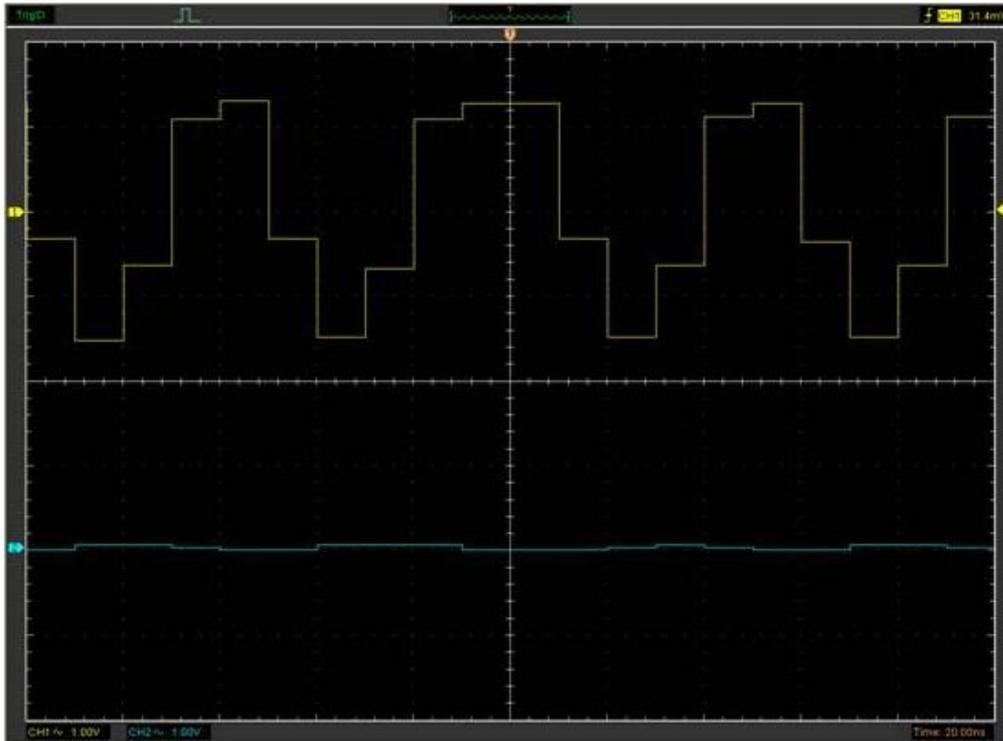
Zoom In/Out

The user can click “**Zoom In/Out**” in “**Acquire**” menu, then left or right click the mouse button on display screen to **zoom in/out** the waveform. Also the user can change **Time/Div** in **Horizontal** menu or in **Horizontal** panel to zoom in/out the waveform.

3.10 Interpolation

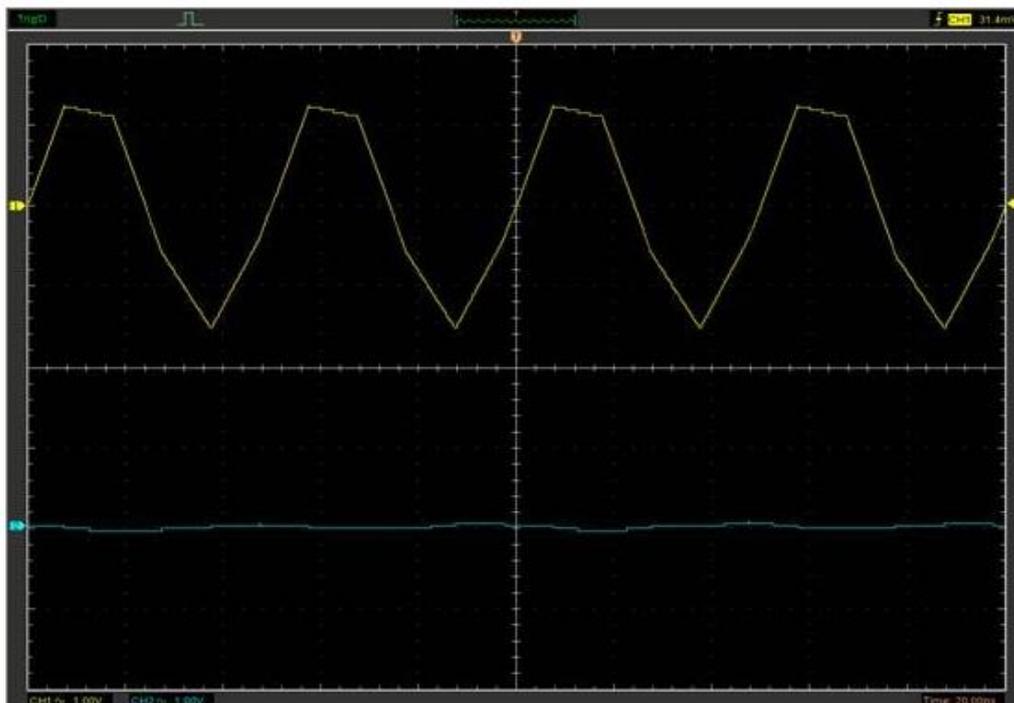
At the time base 20ns/div or faster, user can use the 3 different interpolation mode to get waveforms of different smoothness.

The **Step** Interpolation:

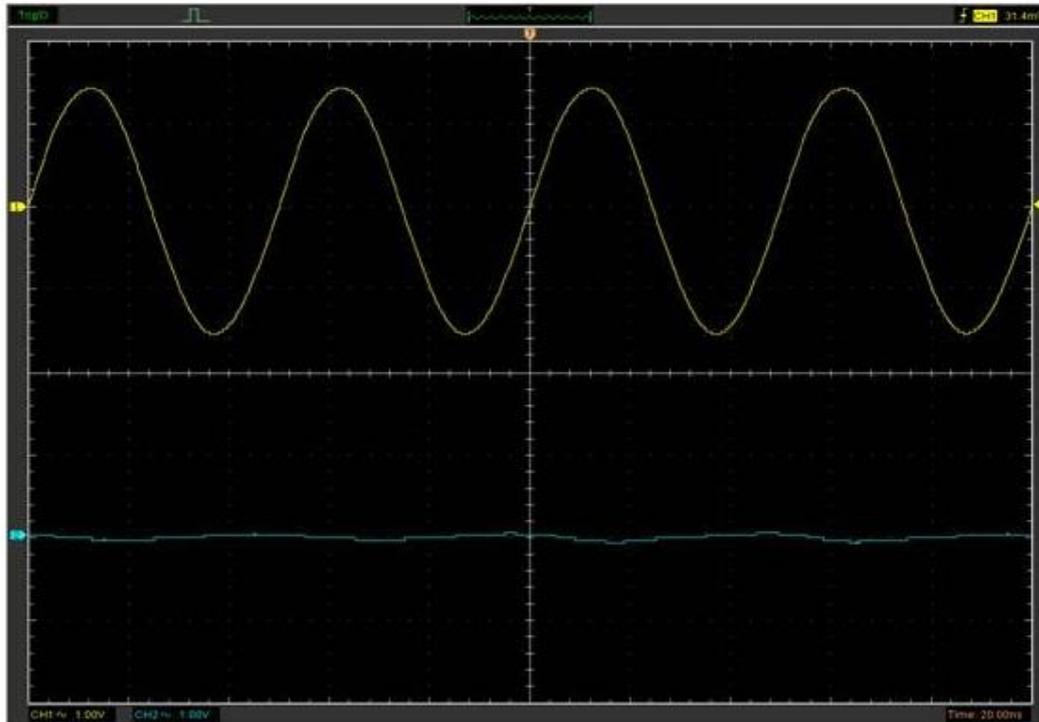


The

Linear Interpolation:



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



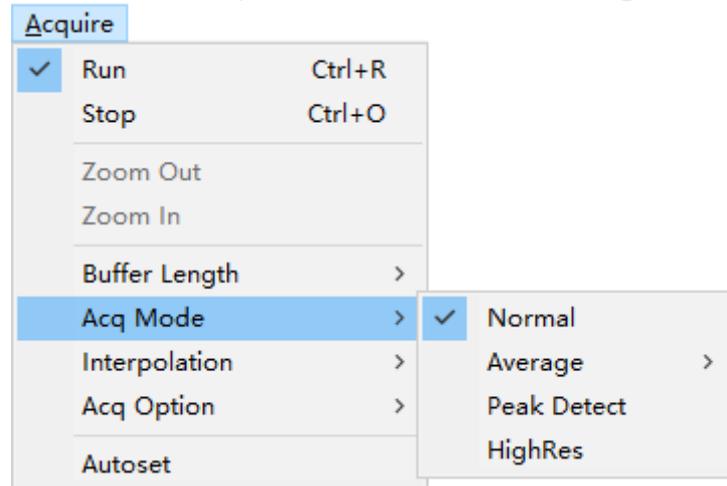
Note: The default interpolation mode is Sin(x)/x.

Acquisition

When you acquire a signal, the oscilloscope converts it into a digital form and displays a waveform. The acquisition mode defines how the signal is digitized and the time base setting affects the time span and level of detail in the acquisition.

3.11 Acquisition Modes

There are four acquisition modes: Normal, Average, Peak Detect and High Res.



Normal: In this acquisition mode, the oscilloscope samples the signal in evenly spaced intervals to construct the waveform.

Average: In this acquisition mode, the oscilloscope acquires several waveforms, averages them, and displays the resulting waveform. You can use this mode to reduce random noise.

Peak Detect: In this acquisition mode, the oscilloscope finds the maximum and the minimum in every sampling interval, and use these values to show waveform.

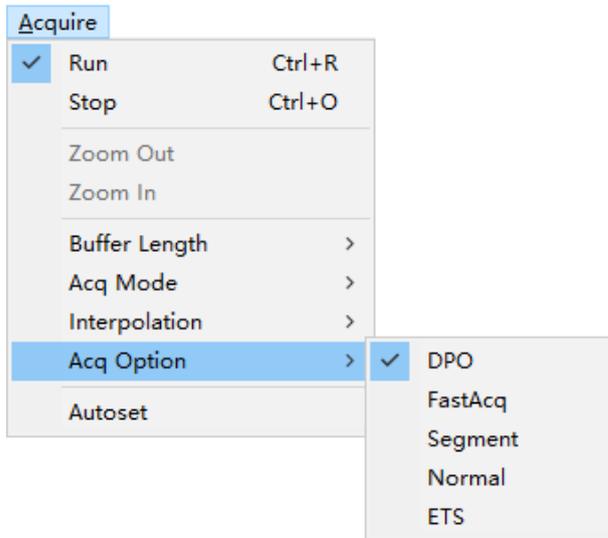
High Resolution: This mode uses a kind of ultra-sample technique to average the neighboring points of the sample waveform to reduce the random noise on the input signal and generate much smoother waveforms on the screen. This is generally used when the sample rate of the digital converter is higher than the storage rate of the acquisition memory.

Note: "Average" and "High Res" modes use different averaging methods. The former uses

"Multi-sample Average" and the latter uses "Single Sample Average".

3.12 Acquisition Option

There are five acquisition option: DPO, FastAcq, Segment, Normal and ETS.



DPO: In this mode, the oscilloscope supports 256-level intensity grading display with one channel. The Max Waveform capture rate up to 60,000 wfm/s.

FastAcq: In this mode, the oscilloscope supports 1-level intensity grading display with one channel. The Max Waveform capture rate up to 400,000 wfm/s.

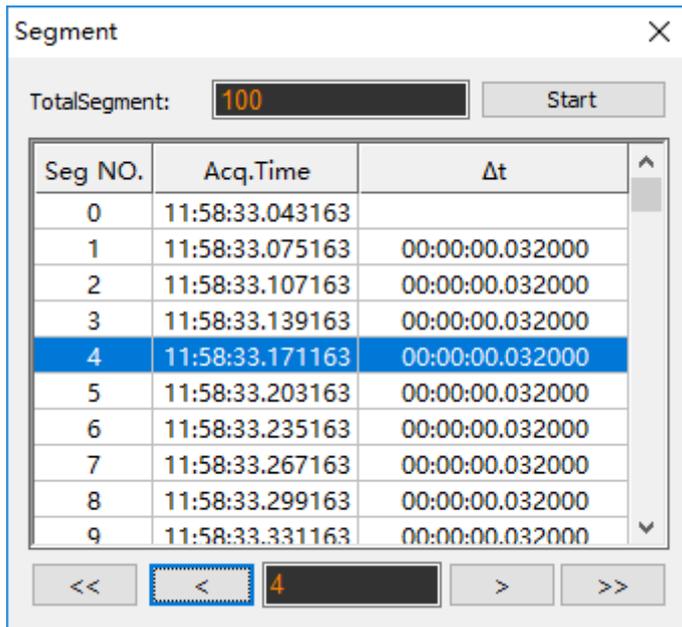
Segment: In this mode, the oscilloscope does not display waveform during sampling process. It can be improves the waveform capture rate, so it can capture the small probability event effectively. The oscilloscope continues to trigger until memory is filled, and then display the waveforms on the screen. Upper left corner of the screen, it displays the completed waveform number

Segment 42/100

The segment mode can be used with all the trigger sweep.

Do the following steps to set and check the segment waveform.

1. Press the Acquire -> Acq Option -> Segment.
2. Set the number of the "TotalSegment".The max number of the "TotalSegment" is 50000.
3. Press the menu with "Start"



| Seg NO. | Acq.Time | Δt |
|---------|-----------------|-----------------|
| 0 | 11:58:33.043163 | |
| 1 | 11:58:33.075163 | 00:00:00.032000 |
| 2 | 11:58:33.107163 | 00:00:00.032000 |
| 3 | 11:58:33.139163 | 00:00:00.032000 |
| 4 | 11:58:33.171163 | 00:00:00.032000 |
| 5 | 11:58:33.203163 | 00:00:00.032000 |
| 6 | 11:58:33.235163 | 00:00:00.032000 |
| 7 | 11:58:33.267163 | 00:00:00.032000 |
| 8 | 11:58:33.299163 | 00:00:00.032000 |
| 9 | 11:58:33.331163 | 00:00:00.032000 |

ETS: Equivalent Time Sampling. A method of increasing the effective sampling rate of the scope. In a scope view, the program captures several cycles of a repetitive signal, then combines the results to produce a single waveform with higher time-resolution than a single capture. For accurate results, the signal must be perfectly repetitive and the trigger must be stable.

3.13 Print And Print Preview

| | |
|---------------|--------|
| New | Ctrl+N |
| Close | |
| Load Data | Ctrl+L |
| Load Setup | |
| Save Data | Ctrl+S |
| Save Setup | |
| Save Image | |
| Print... | Ctrl+P |
| Print Preview | |
| Print Option | |
| Exit | |

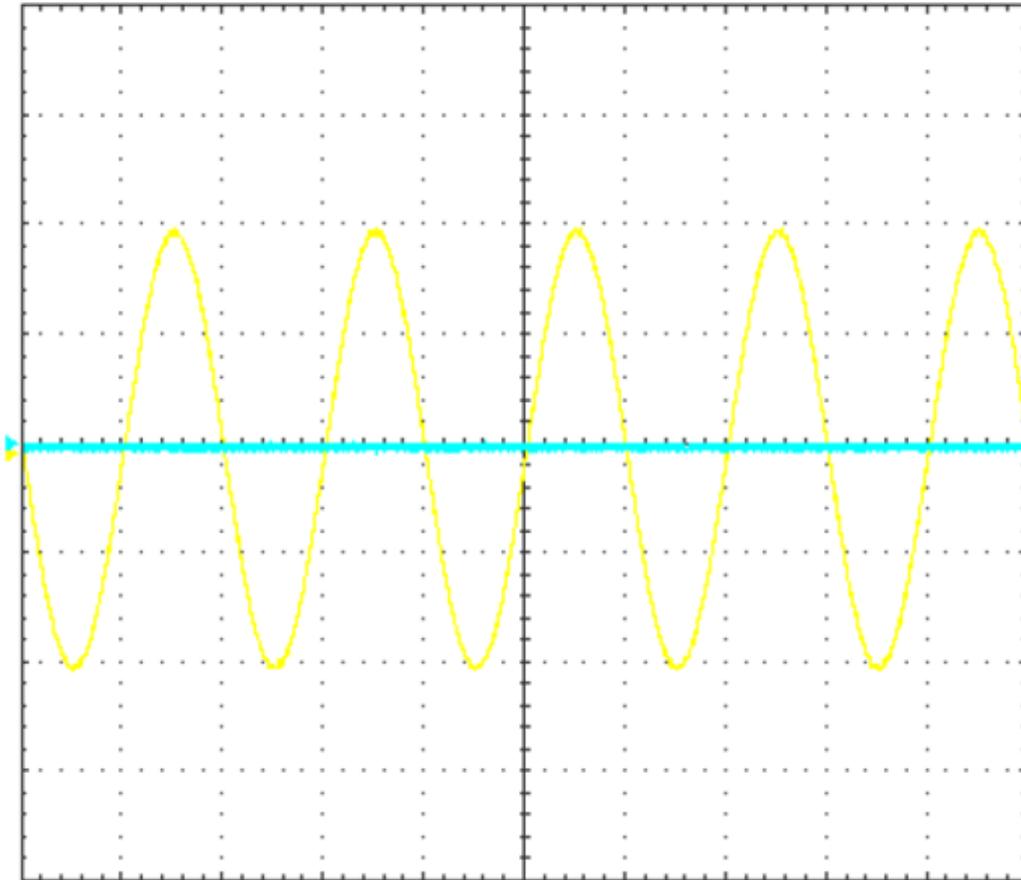
1. Click **Print** in **File** menu to set the printer to print the current waveform
2. Click the **PrintPreview** in **File** menu to get into the Preview window.

In **PrintPreview** window, use the **Zoom In** button and the **Zoom Out** 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.

The Print report:

Test Report

Date 02-08-2015 ne = 11:20:38



NOTE : _____

Chapter 4 Application Example

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

4.1 Simple Measurement

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

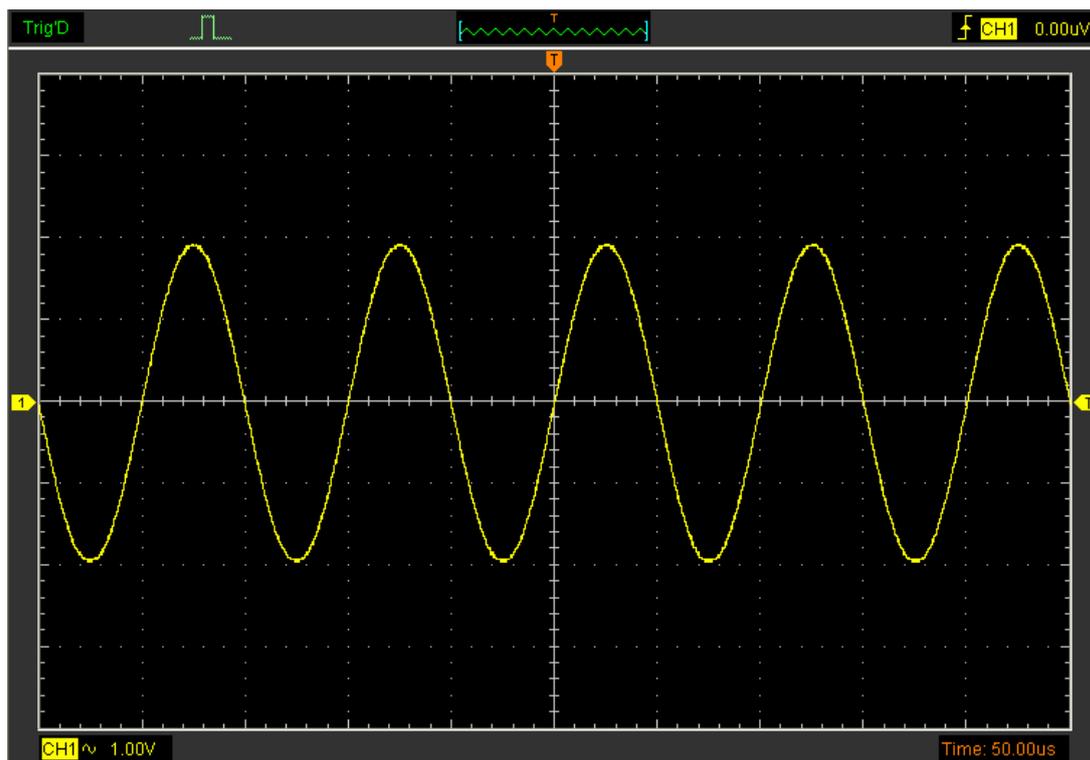
1. Connect signal to **CH1** by using probe
2. Click the  button on toolbar or “**Acquire -> Auto Setup**” on menu.

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.

To measure the frequency and “**Vpp**”, you can do these steps as follows:

1. Click the “**Measure->Horizontal->Frequency**” button, the frequency of the signal display on the bottom of the waveform interface.
2. Click the “**Measure->Vertical->Peak-to-Peak**” button, the “**Vpp**” of the signal will also display on the bottom of the waveform interface.

To clear the measurement on the waveform interface, click the “**Measure->Clear Measure**” button.



4.2 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 ally higher a little above the normal level.
 - 7) Click **START** button 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.

This function helps to capture the signal occurrence easily, such as the noise with large amplitude; set the trigger level higher a little above the normal level and press and wait. When noise occurs, the instrument will record the waveform before and after the trigger.

4.3 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:

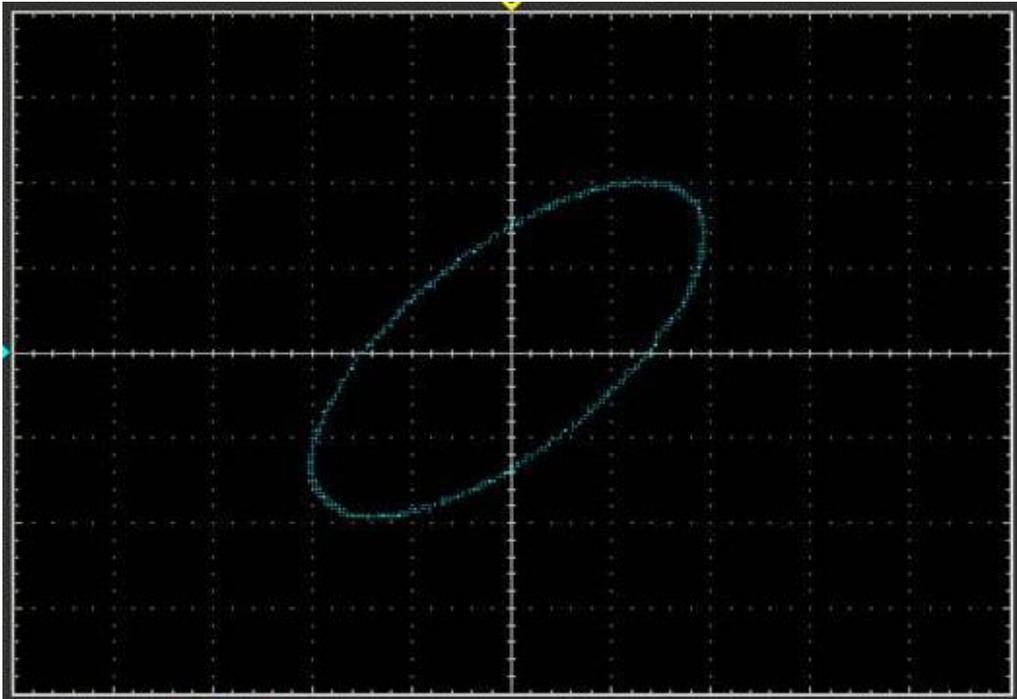
1. Set the probe attenuation to “**x10**” Set the switch to “**x10**” on the probes.
2. Connect the CH1 probe to the input of the circuit, and connect the CH2 probe to the output of the circuit.
3. Click  button.
4. Adjust the vertical scale and offset to display approximately the same amplitude signals 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.

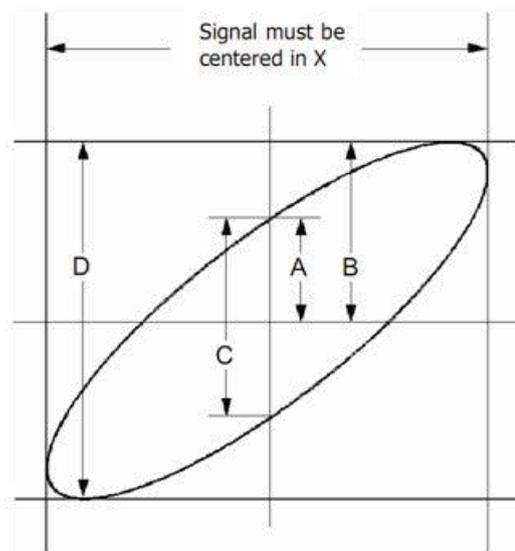
6. Adjust the scale and offset of the horizontal and vertical to a desirable waveform display. The following picture shows a typical example.

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 θ = phase shift (in degrees) between the two signals.

From the formula above:

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

θ 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, θ must be in the range of $(\pi/2 \sim \pi)$ or $(\pi \sim 3\pi/2)$.

4.4 Taking Cursor Measurements

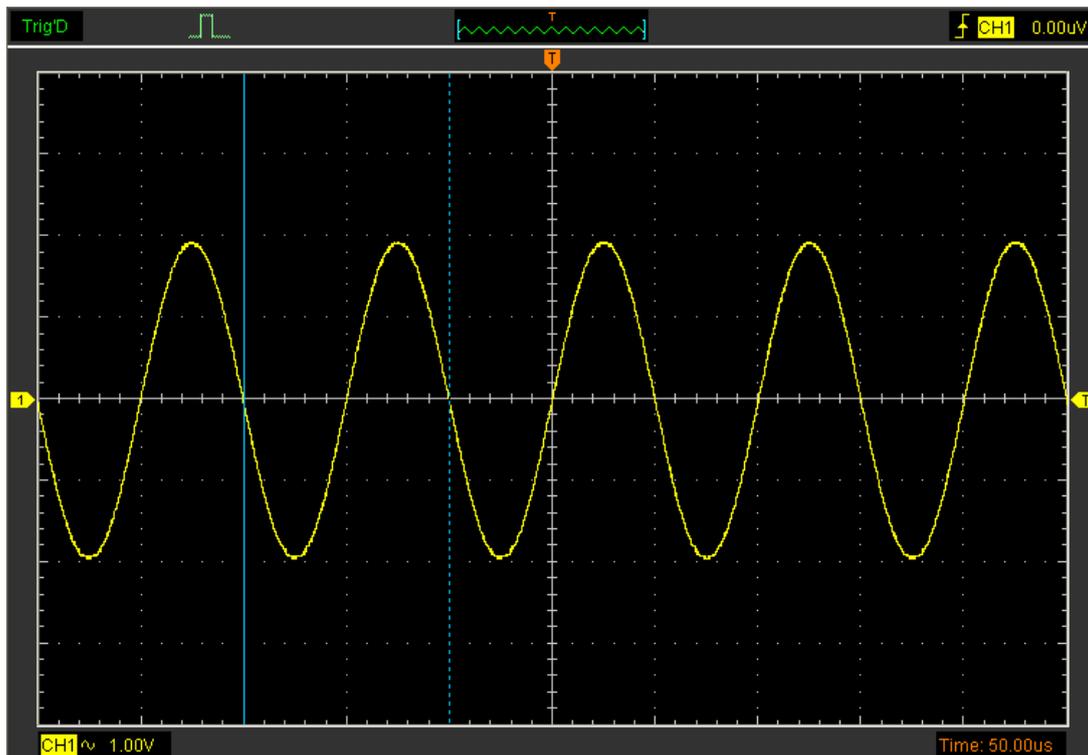
Use cursors to make time and amplitude measurements on a waveform quickly.

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: 1.361KHz Time: 735uS

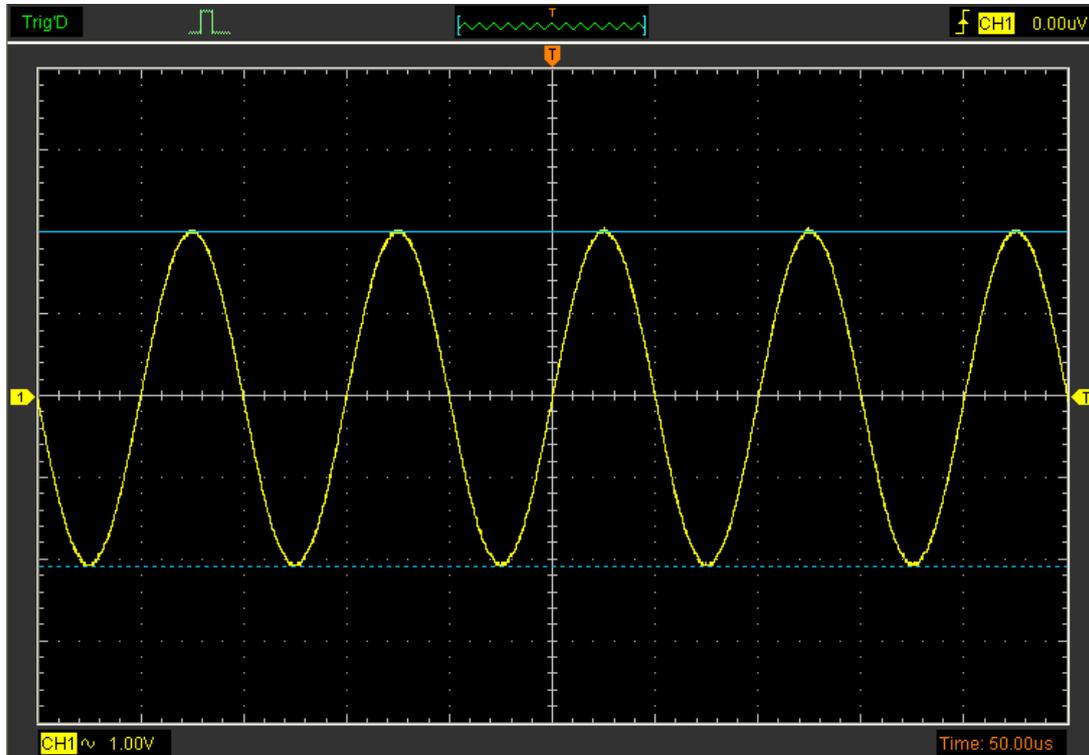
Measure the Amplitude of the First Waveform Peak of the Waveform

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:



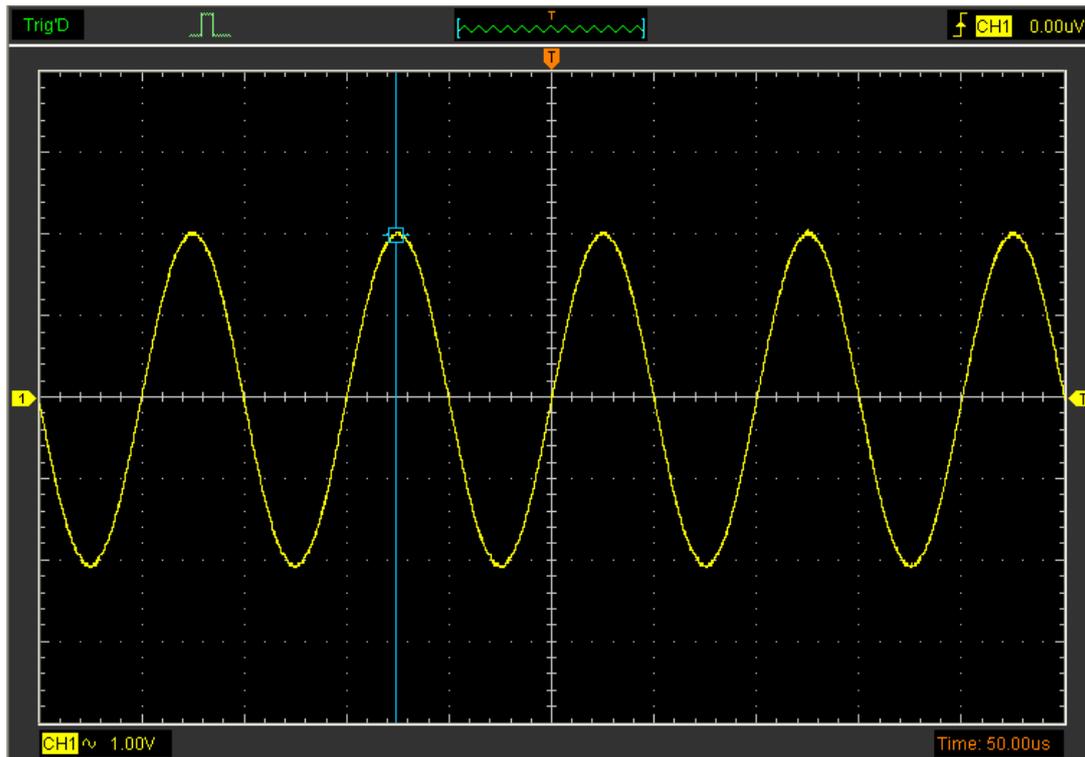
Read the details showing in the status bar.

Volt: 18.6V

Trace the Amplitude of a fixed position on X-axis in a Waveform

Do these steps:

1. Click "**Cursor->Source**", select CH1 (select CH2 if you want trace CH2).
2. Click "**Cursor->Type**", select Trace.
3. Click the cursor at the position that you want traced of the wave in the waveform window.

Trace the Amplitude:

Read the details showing in the status bar.

Volt: -9.45V

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

Chapter 5 Appendix

- ◆ **Appendix A: Specifications**
- ◆ **Appendix B: General Maintenance**

Appendix A: Specifications

Specifications Table:

| Vertical | |
|--|--|
| Analog Channels | 4 |
| Bandwidth | 250/200/100/70MHz(-3dB) |
| Input Impedance | Resistance: 1M Ω ; Capacitance: 25 pF \pm 3pF |
| Input Sensitivity | 500uV/div to 10V/div |
| Input Coupling | AC/DC/GND |
| Vertical Resolution | 8 bits |
| Memory Depth | 128M/CH; 62M/2CH; 32M/4CH |
| Analog Bandwidth Limit, typical | 20MHz |
| Low Frequency Response (-3db) | \leq 10Hz at BNC |
| DC Gain Accuracy | \pm 3% for Normal or Average acquisition mode, 5V/div to 10mV/div \pm 4% for Normal or Average acquisition mode, 5mV/div to 2mV/div |
| Delta Time Measurement Accuracy (Full Bandwidth) | Single-shot, Normal mode \pm (1 sample interval +100ppm \times reading + 0.6ns); >16 averages \pm (1 sample interval + 100ppm \times reading + 0.4ns) |
| Maximum Input Protection | 35V (DC+AC Peak) |
| Horizontal | |
| Real-Time Sampling Rate | 1GS/s |
| Time Base Range | 2ns/div to 1000s/div(1-2-5 sequences) |
| Waveform Interpolation | (sin x)/x |
| Time Base Precision | \pm 50ppm |
| Trigger | |
| Source | CH1, CH2, CH3, CH4 |
| Mode | Edge, Pulse, Video, Alternative |
| Trigger Level Accuracy, typical (Accuracy is for signals having rise and fall times \geq 20ns) | 0.2div \times volts/div within \pm 4 divisions from center of screen |
| X-Y mode | |
| X-Axis Input | CH1 |
| Y-Axis Input | CH2 |
| Phrase Shift | Max.3 degree |
| Cursors and Measurement | |
| Voltage Measurement | Vpp, Vamp, Vmax, Vmin, Vtop, Vmid, Vbase, Vavg, Vrms, Vcrms, Preshoot, Overshoot |

| | |
|-------------------------|---|
| Time Measurement | Frequency, Period, Rise Time, Fall Time, Positive Width, Negative Width, Duty Cycle |
| Cursors Measurement | Horizontal ,Vertical, Track, Cross |
| Waveform Signal Process | +, - , x, ÷, FFT, Invert |
| Voltage Range | |
| | 500uV to 10V/div @ x 1 probe |
| | 5mV to 100V/div @ x 10 probe |
| | 50mV to 1000V/div @ x 100 probe |
| | 500mV to 10000V/div @ x 1000 probe |
| | 5V to 100000V/div @ x 10000 probe |
| Others | |
| Cursor | Time/frequency difference, voltage difference |
| FFT | Rectangular, Hanning, Hamming, Blackman Window |
| MATH | Addition, subtraction, multiplication, division |
| AUTOSET | Yes($\geq 30\text{Hz}$) |
| Interface | USB 2.0 |
| Power Source | DC 12V |
| Volume | 175 x 105 x 25 (mm) |
| Weight | 1.5Kg |

Appendix B: Accessories

| | |
|--|--|
|  | <p>X1, X10 two passive probes. The passive probes have a 6MHz bandwidth (rated 100Vrms CAT III) when the switch is in the X1 position, and a maximum bandwidth (rated 300Vrms CAT II) when the switch is in the X10 position. Each probe consists of all necessary fittings.</p> |
|  | <p>A USB line, used to connect external devices with USB interface like a printer or to establish communications between PC and the oscilloscope.</p> |
|  | <p>Two gator clip lines.</p> |
|  | <p>A Switching Adaptor with Output is 12V DC.</p> |
|  | <p>A software installation CD and it contains the user manual for the oscilloscopes.</p> |

Appendix C: 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.

To avoid damages to the surface of the device or probes not use any abrasive or chemical cleaning agents.

Cleaning

Inspect the device and probes as often as operating conditions require. Make sure the device disconnect form 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.