

DMO 20/8.USB
Digitale Multikanal-Oszilloskop

USER'S MANUAL

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(Version 1.0.0)



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General Safety Summary

Review the following safety precautions carefully before operating the device to avoid any personal injuries or damages to the device including any products connected to it. To avoid any 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 correct 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 to the device, have it inspected by qualified service person 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 Started

The oscilloscope is small, compact, portable oscillo-scopes! The oscilloscope 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 requirement
- Install software
- Install driver
- General features
- General check
- Probe compensation
- Function check
- Self calibration
- Accessories

System Requirement

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

Minimum System Requirement

Operating System

Window NT/2000/XP/VISTA/Win7

Processor

Upwards of 1.00G processor

Memory

256M byte

Disk Space

500M disk free space

Screen Resolution

800 x 600 pixel

Recommended Configuration

Operating System

Windows XP SP3 System

Processor

2.4G Processor

Memory

1G Byte

Disk Space

80G Disk Space

Screen Resolution

1024 x 768 or 1280 x 1024 pixel

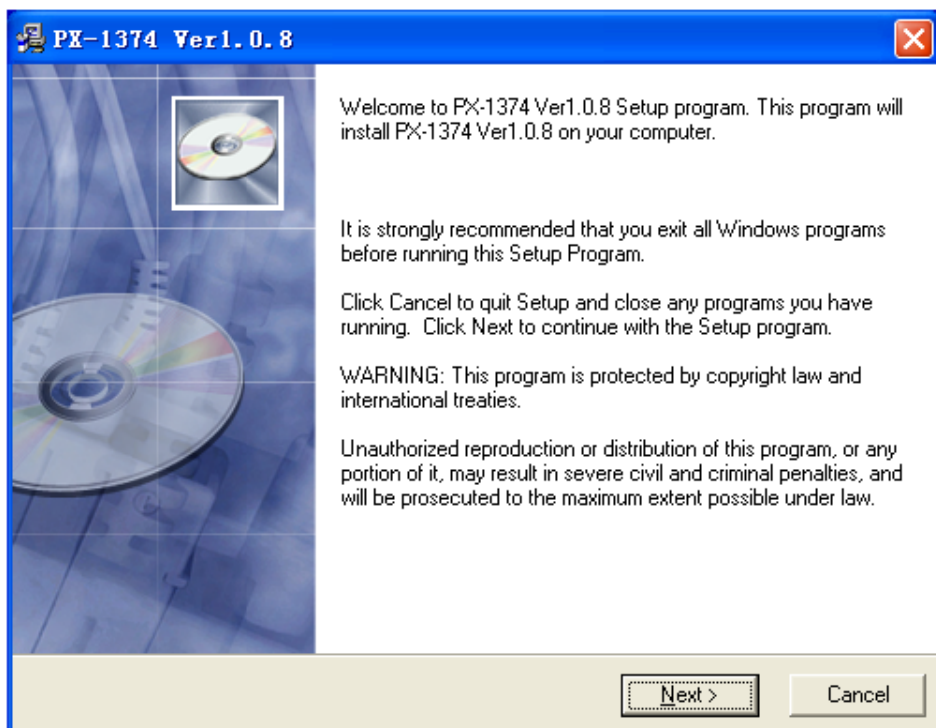
DPI Setting

Normal Size (96DPI)

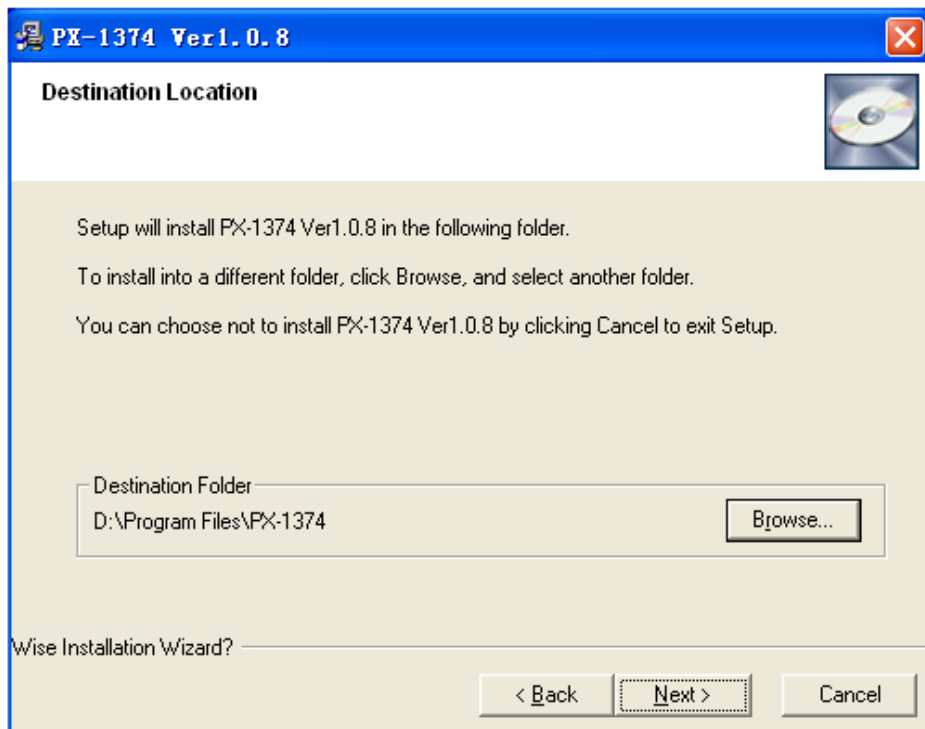
Install Software

Note: Do not connect the USB connection until the software installation is complete.

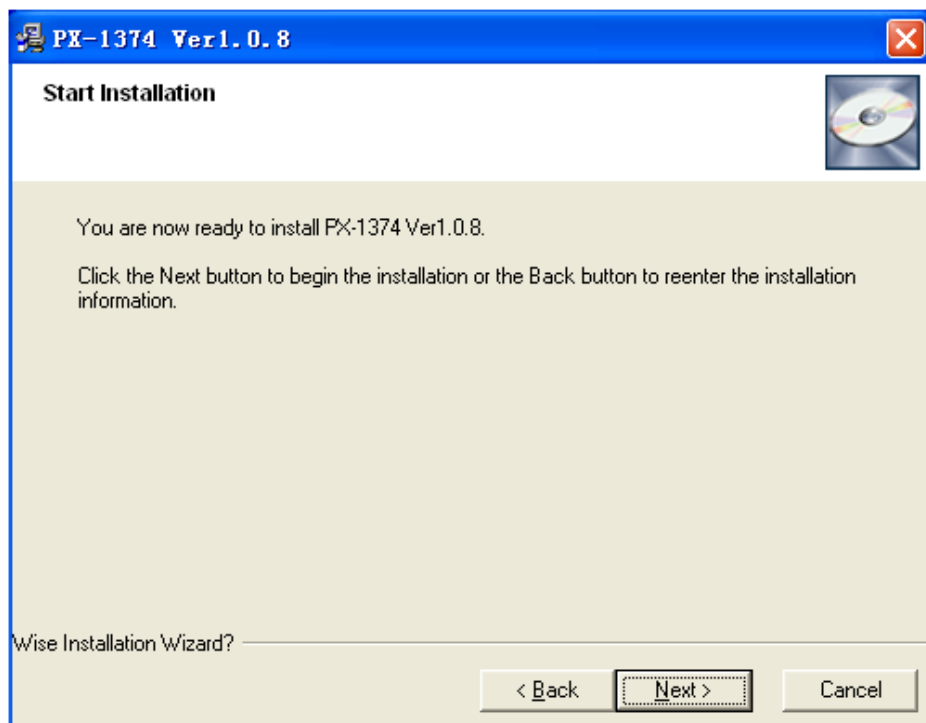
1. While in Windows, insert the installation CD into the CD-ROM drive.
2. The installation should start up automatically. Otherwise in Windows Explorer, switch to the CD-ROM drive and run Setup.exe.
3. The software Installation is started. Click 'Next' to continue.



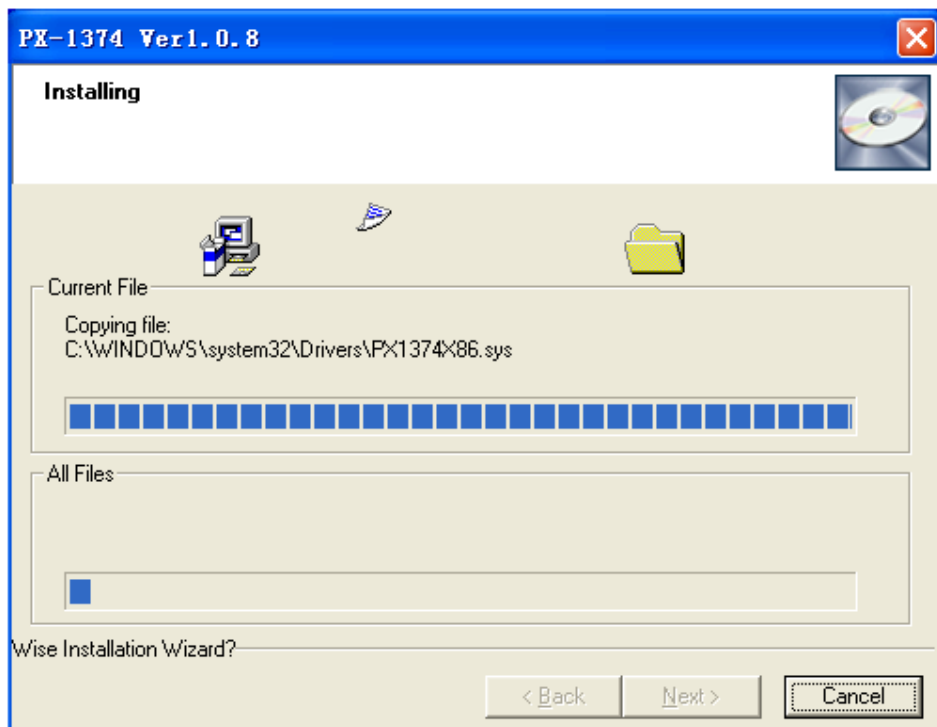
4. Choose a destination directory. Click 'Next' to continue.



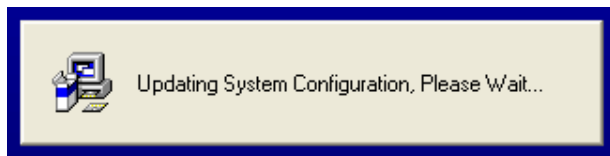
5. Check the setup information. Click Next to start copying files.



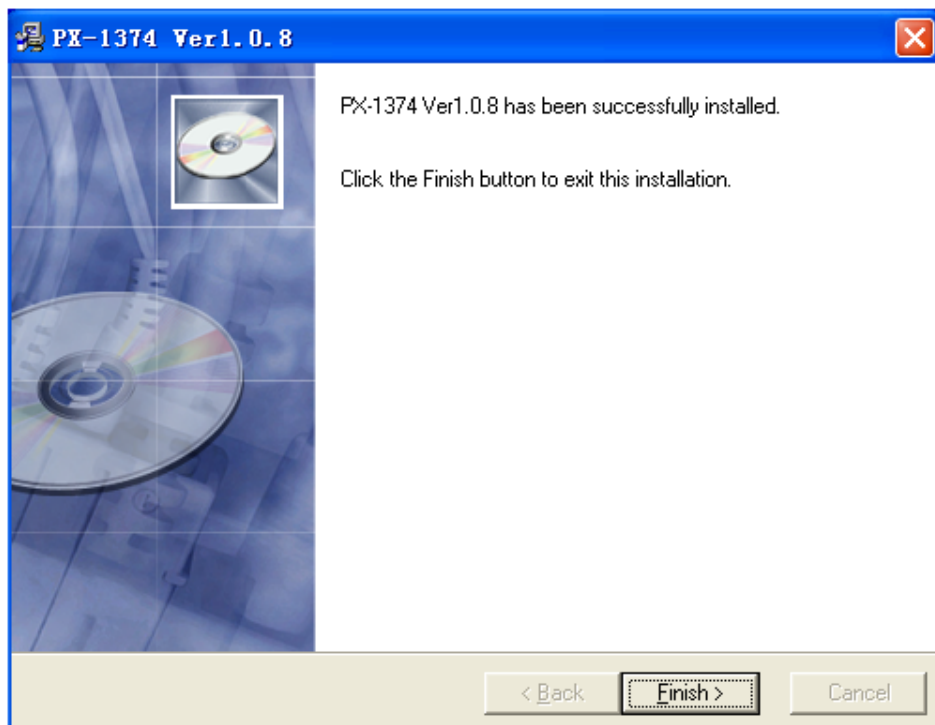
6. This Status dialog is displayed during files copying.



7. Updating Your System Configuration.



8. The installation is completed.



Install Driver

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



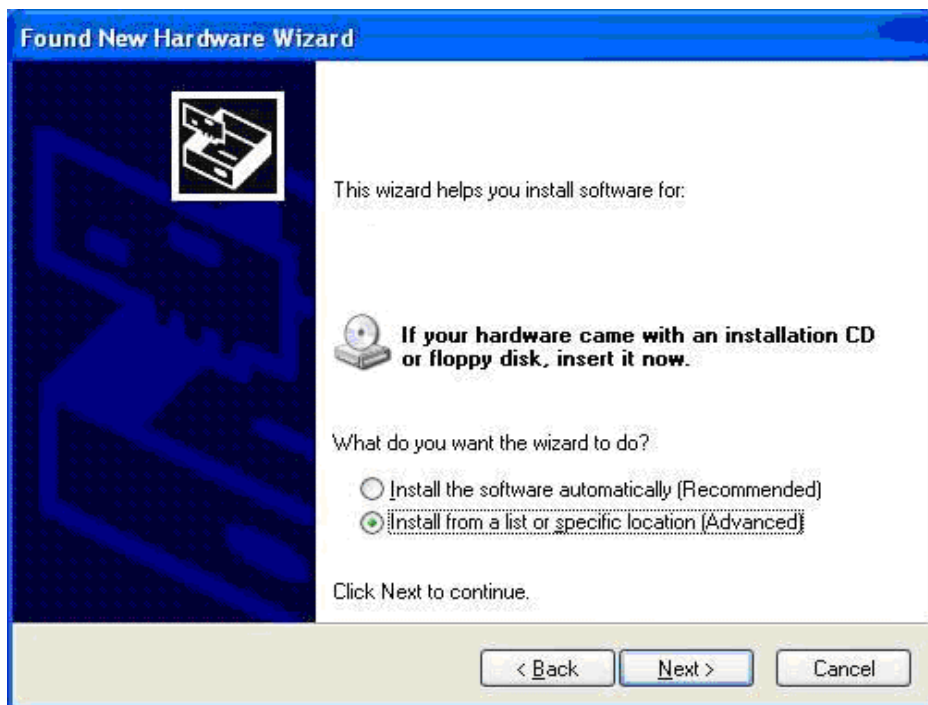
2. Connect the B-Type Plug of USB cable to the device's USB port.



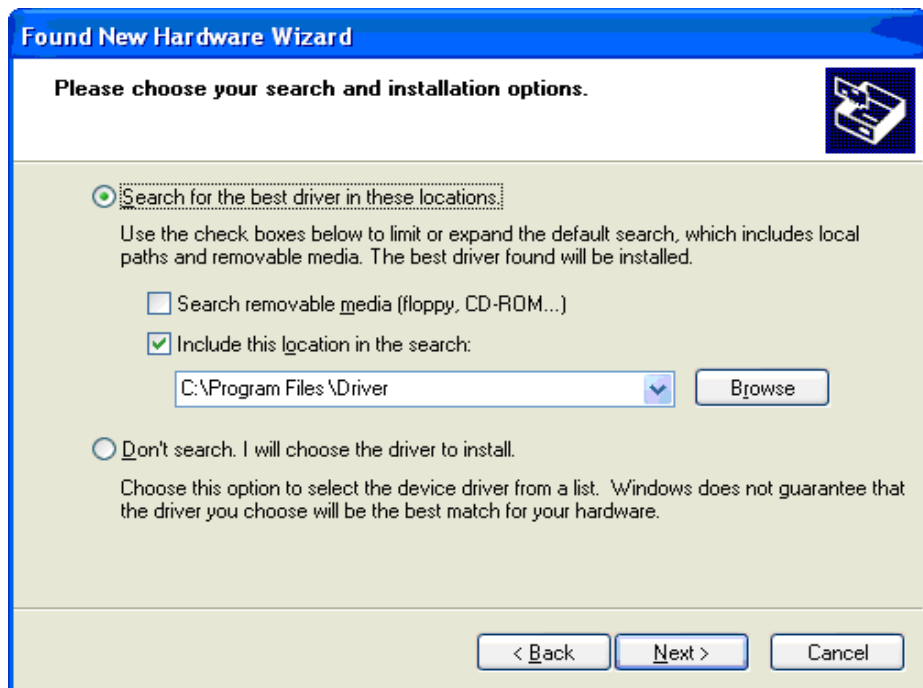
3. New hardware is found.



4. New hardware search wizard starts.



5. Select the specific location.



Found New Hardware Wizard

Please choose your search and installation options.

☒ **Search for the best driver in these locations:**

Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.

☐ Search removable media (floppy, CD-ROM...)

☒ Include this location in the search:

C:\Program Files\Driver Browse

☐ **Don't search. I will choose the driver to install.**

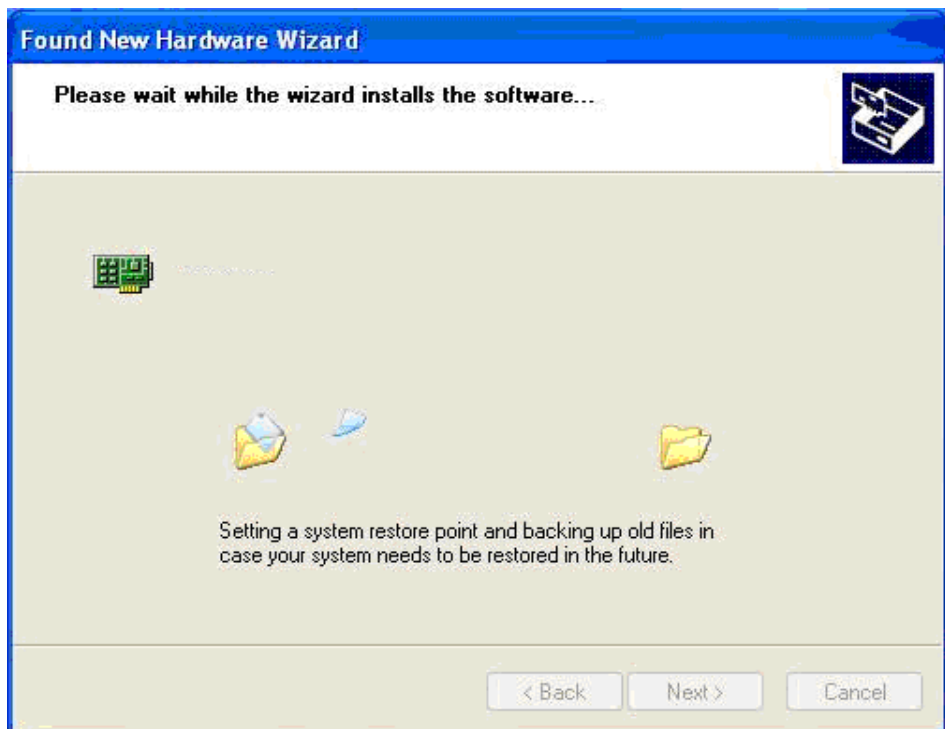
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.

< Back Next > Cancel

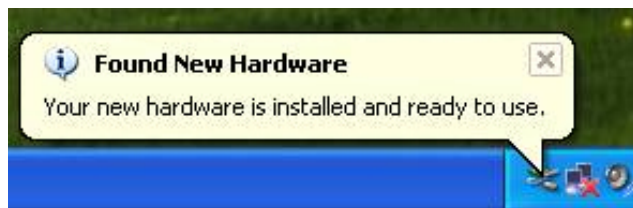
6. New hardware search wizard starts to search the driver.



7. New hardware wizard installs "DRIVER".



8. The wizard has finished installation of "DRIVER".



General Feature

Product features:

- 8 channel
- Maximum real-time sample rate
2.4MSa/s
- Max memory depth
4K points
- 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, multiply and division mathematic fuctions;
- Adjustable waveform intensity, more effective waveform view;

General Check

Please check the instrument as following steps after receiving the 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. Ensure 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.

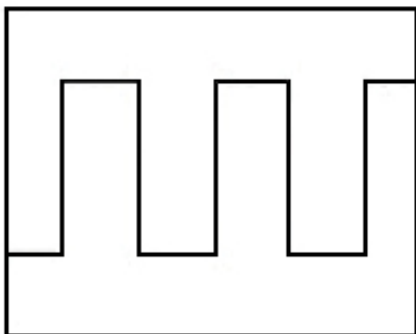
Check the instrument:

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

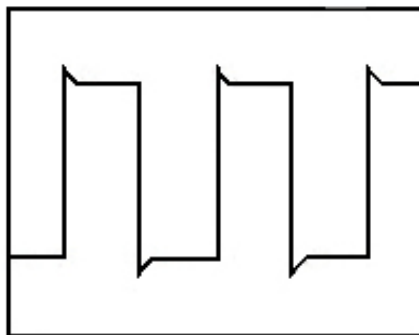
Probe Compensation

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.

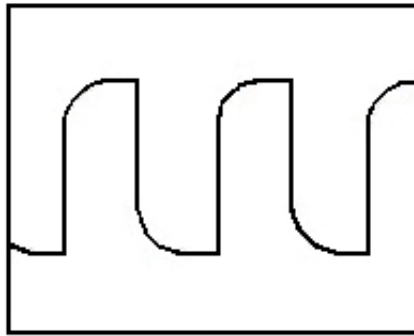
- From the "Probe" menu, select attenuation to 1:10. Set the switch to "X10" on the probe and connect it to CH1 of the oscilloscope. When using the probe hook-tip, insert the tip onto the probe firmly to ensure a proper connection.
- Attach the probe tip to the Probe Compensator and the reference lead to the ground connector, select CH1, and then adjust the timebase and Volt/Div in sidebar.
- Check the shape of the displayed waveform.



Correct Compensated



Over compensated



Under Compensated

- If necessary, use the supplied non-metallic tool to adjust the trimmer capacitor of the probe for the flattest 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.

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.



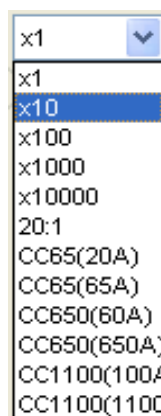


■ Input a signal to a channel of the oscilloscope

The oscilloscope is equipped with eight channels.

Please input signal in the following steps:

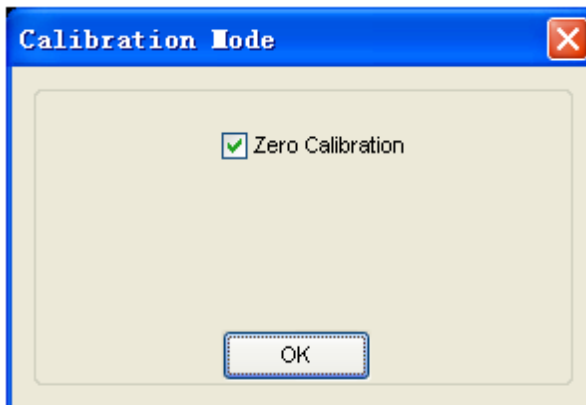
1. Set the attenuation switch on the probe as 10X and connect the probe on the oscilloscope with CH1. Aim the slot in the probe connector at the faucet on BNC of CH1 and insert, then, turn right to lock the probe. Finally, attach the tip of probe and ground nip to the Connector of Probe compensator.
2. Set the CH1 probe attenuation of the oscilloscope to X10. (The default is X1).



3. Attach the tip of probe and ground tab to the Connector of Probe compensator. Click the button. A square wave will be displayed in several seconds. (Approximately 1 kHz, 2V, peak- to- peak).
4. Inspect CH2-CH8 with the same method. Repeat step 2 and 3.

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 deg 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.



Accessories

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

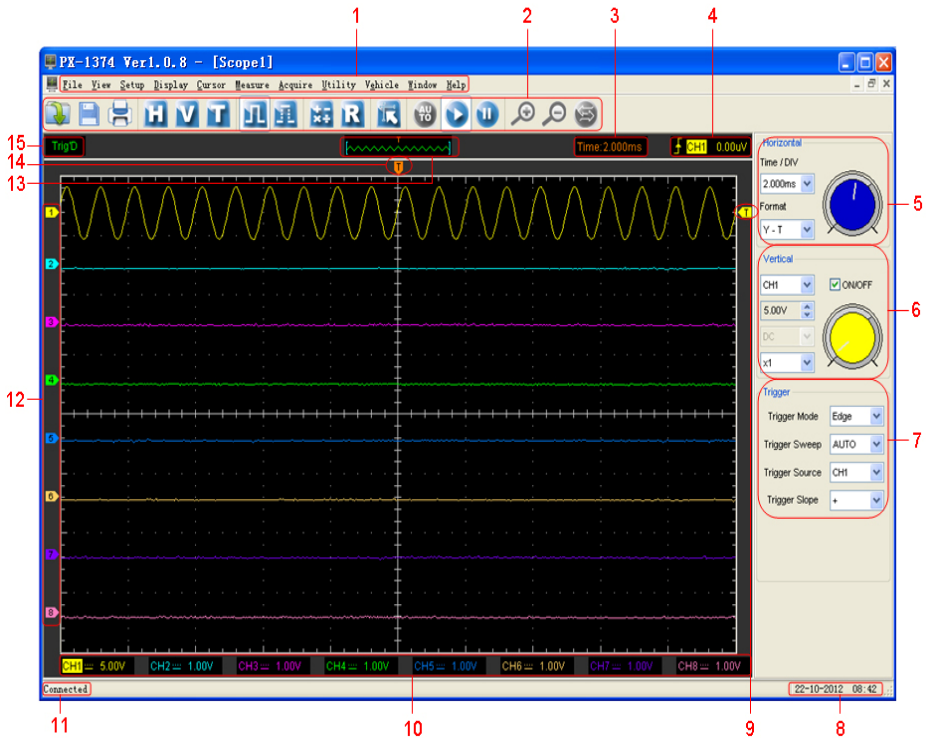
- Four Test Cables
- An Auto Ignition Probes
- A USB Cable
- A PC software of the oscilloscope

Chapter 2 Operating Basics

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

The User's Interface

Click the software icon on the desk after you finished the software installation 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. It shows the trigger information

It shows the edge trigger slope, source and level.

4. It shows the main time base setting.

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/.../CH8. Also the user can change the CH1/.../CH8 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. It shows the system time.

9. Marker shows edge trigger level.

10. **It shows the CH1-CH8 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. **The software status indicates it connected via USB.**

12. **The markers show the reference points of the displayed waveforms. If there is no marker, the channel is not displayed.**

13. **A window that shows the display waveform in buffer position.**

14. **Marker shows horizontal trigger position.**

15. **Trigger status indicates the following:**

AUTO: The oscilloscope is in auto mode and is acquiring waveforms even no triggers have been found.

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

WAIT: All pretrigger data has been acquired and the oscilloscope is ready to accept a trigger.

STOP: The oscilloscope has stopped acquiring waveform data.

RUN: The oscilloscope is running.

PLAY: The oscilloscope is displaying the record waveforms.

The Menu System

The Main Menu

File View Setup Display Cursor Measure Acquire Utility Window Help

1. **File:** load or save data, setup

<u>F</u> ile	
<u>N</u> ew	Ctrl+N
<u>C</u> lose	
<u>L</u> oad Data	Ctrl+L
Load Setup	
<u>S</u> ave Data	Ctrl+S
Save Setup	
Save <u>I</u> mage	
<u>P</u> rint...	Ctrl+P
Print Preview	
<u>P</u> rint Option	
<u>E</u> xit	

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

<u>V</u> iew
✓ <u>T</u> oolbar
✓ <u>S</u> tatus Bar
✓ <u>S</u> ide Bar

3. **Setup:** Setup setting

Setup	
<u>R</u> EF	Ctrl+R
<u>M</u> ATH	Ctrl+M
<hr/>	
<u>T</u> rigger	Ctrl+T
<u>V</u> ertical	Ctrl+V
<u>H</u> orizontal	Ctrl+H

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

Display	
Type	▶
✓ <u>G</u> rid	Ctrl+G
Intensity	
Grid Background Color	

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

Cursor	
Source	▶
Type	▶

6. **Measure:** Set measurement parameters

Measure	
Source	▶
Vertical	▶
Horizontal	▶
Clear <u>M</u> easure	Ctrl+M

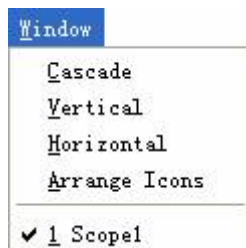
7. **Acquire:** Run, stop or other operation setting



8. **Utility:** Utility setting



9. **Window:** Window setting



10. **Vehicle:** Vehicle setting

Vehicle

Diagnosis Setup

Clear reference waveform

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

Help

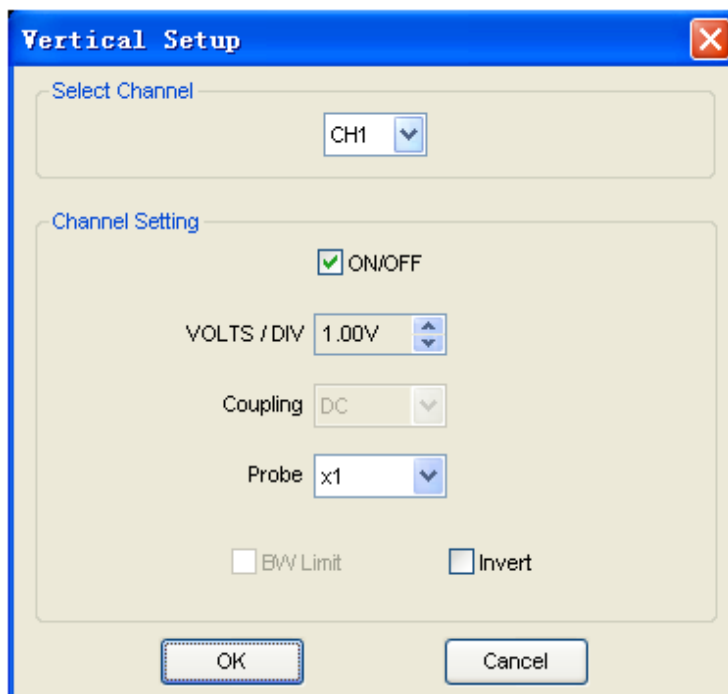
Contents F1

About... F9

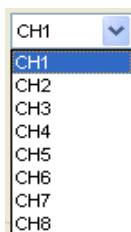
The Vertical System

Click "Setup"->" Vertical"

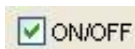
The following figure shows the vertical parameters setting in the vertical Setup window.



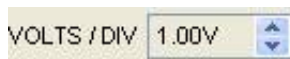
1. Select channel : User can select the channel by clicking the Combo Box.



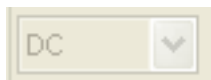
2. ON/OFF: Turn on or off the selected channel.



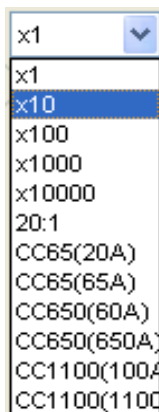
3. VOLTS/DIV: Set the selected channel voltage range.



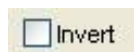
4. Coupling: DC



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



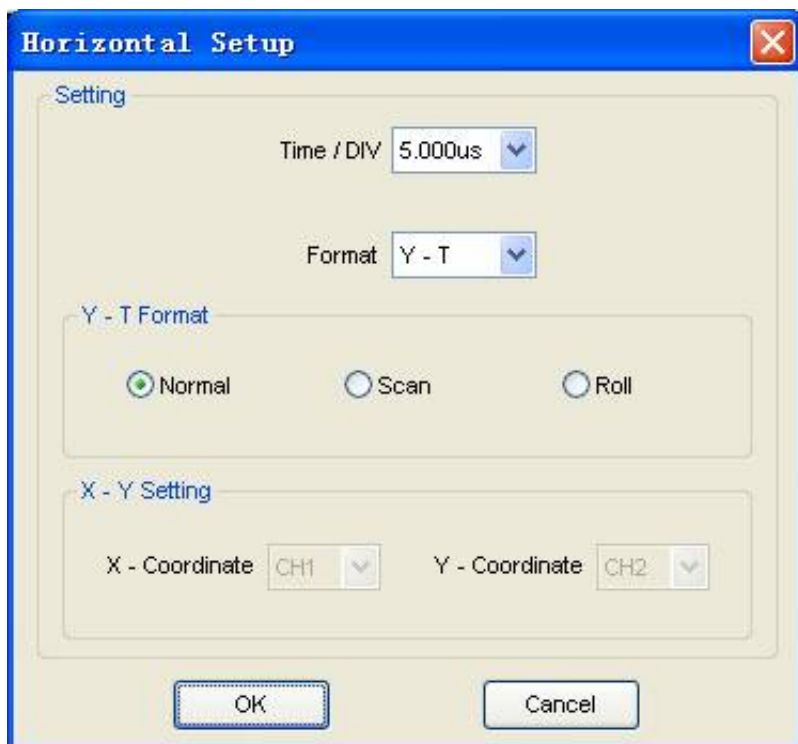
6. Invert: Invert the selected wave.



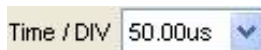
The Horizontal System

Click "Setup"->"Horizontal"

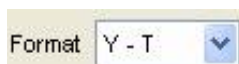
The following figure shows the horizontal parameters settings in the Horizontal System window.



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



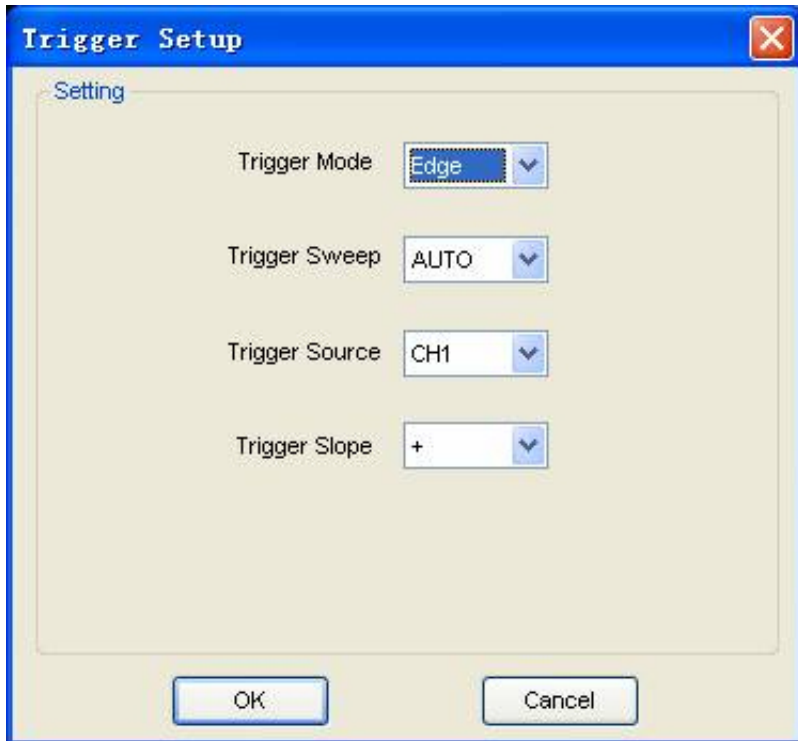
2. **Format:** lead the setting of the horizontal format parameters



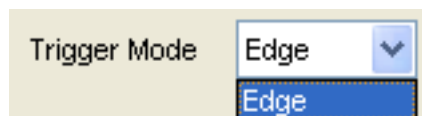
The Trigger System

Click “Setup”-> “Trigger”

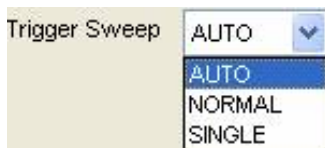
The following figure shows the trigger system control.



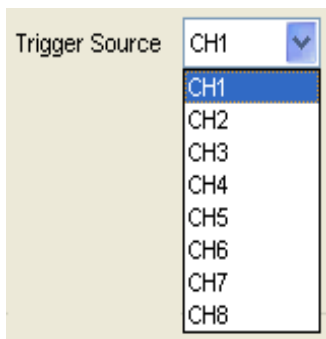
1. **Trigger Mode:** Sets the trigger mode



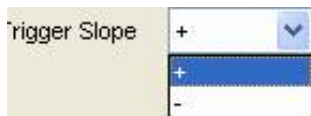
2. **Trigger Sweep:** Select the trigger sweep mode to AUTO, NORMAL or SINGLE



3. **Trigger Source:** Select the trigger source to CH1-CH8.



4. **Trigger Slope:** Select the edge trigger slope to Positive or Negative slope



Input Connector



CH1/.../CH8: Input connectors for waveform display.

CAL: Probe compensation output.

Other Connector:



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

Power Supply

D0 - D7: Built in waveform generator.

GND.: A ground terminal- not installed in this version.

Chapter 3 Understanding Oscilloscope Functions

- Set Oscilloscope
- Set Vertical System
- Set Horizontal System
- Set Trigger System
- Save/Load
- Utility Function
- Measure Signal
- Print

Setup the 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 several different setups.

Load Setup

The oscilloscope can recall the last setup-any saved setups or the factory setup-before the oscilloscope software was running. 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 System

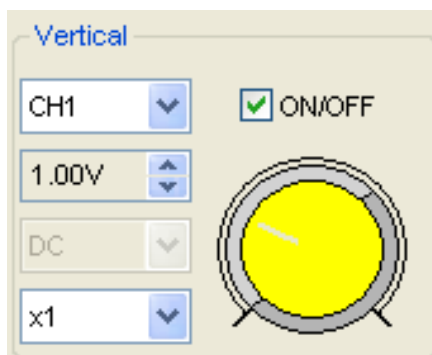
Set Channel

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: DC

Probe: Select the channel probe attenuation

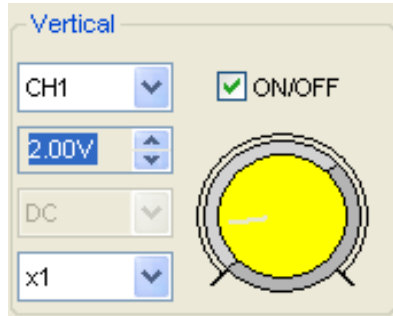
Invert: Turn on/off the invert function.

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.



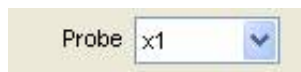
You can left click and drag the mouse on the knob to change the voltage.

Probe Attenuation Setting

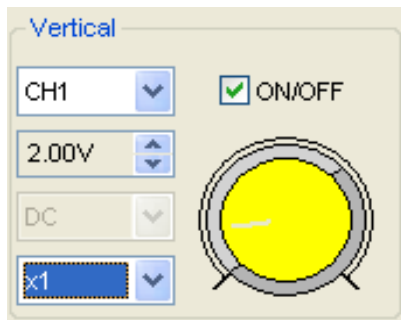
Select the attenuation factor for the probe. To check the probe attenuation setting, toggle the probe menu to match the attenuation factor of the probe.

This setting remains in effect before you change again.

Click "**Probe**" in Vertical Setup window to select the probe attenuation.



The probe setting window in the sidebar



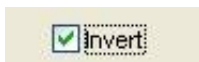
Note: The attenuation factor x1 - x10000 and 20:1 changes the vertical scale of the oscilloscope so that the measurement results reflect the actual voltage levels at the probe tip.

The attenuation factor CC65-CC1100 is used for current measurement work with AC/DC Current Clamp.

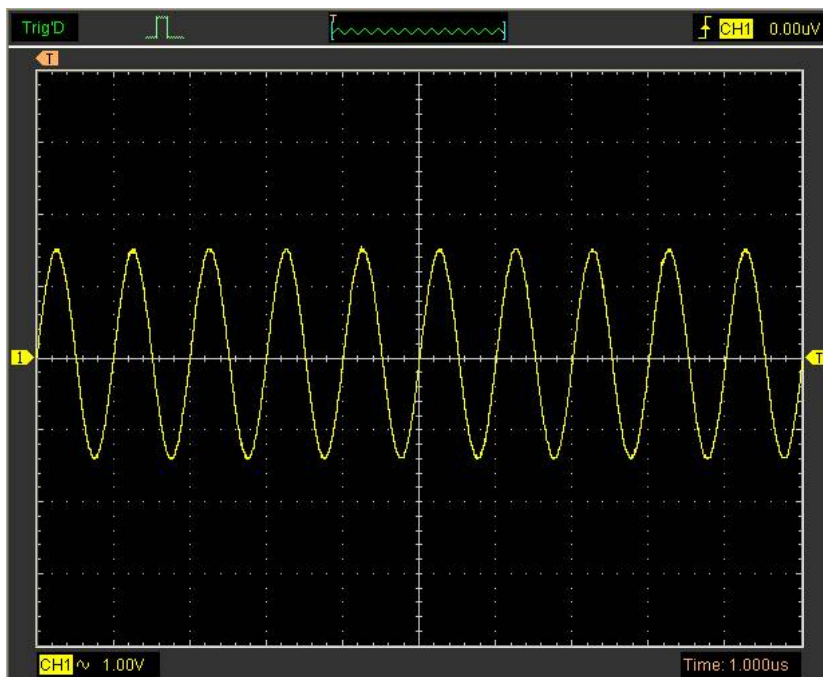
Invert

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.

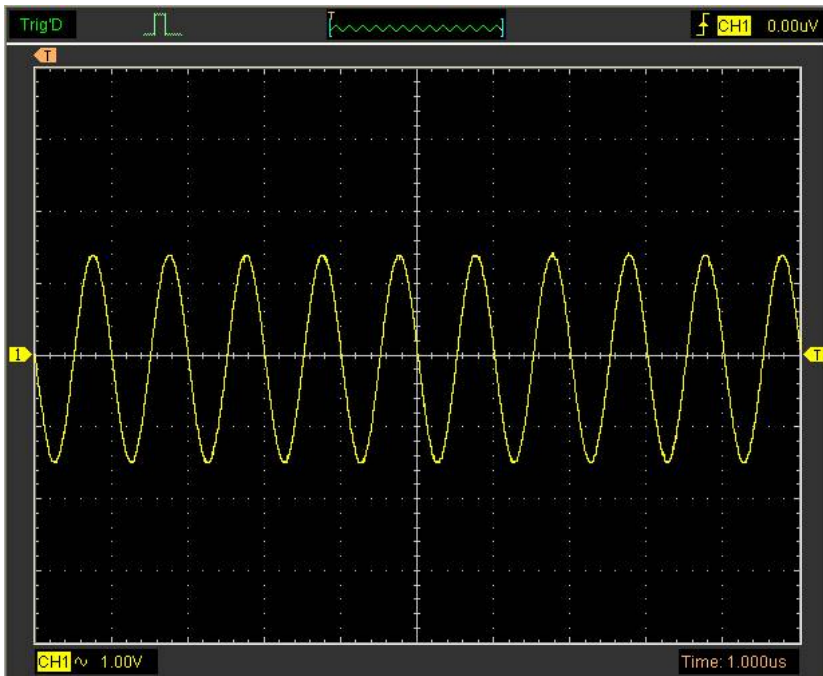
Click **"Invert"** in Vertical window



The following picture shows the waveform before inversion:



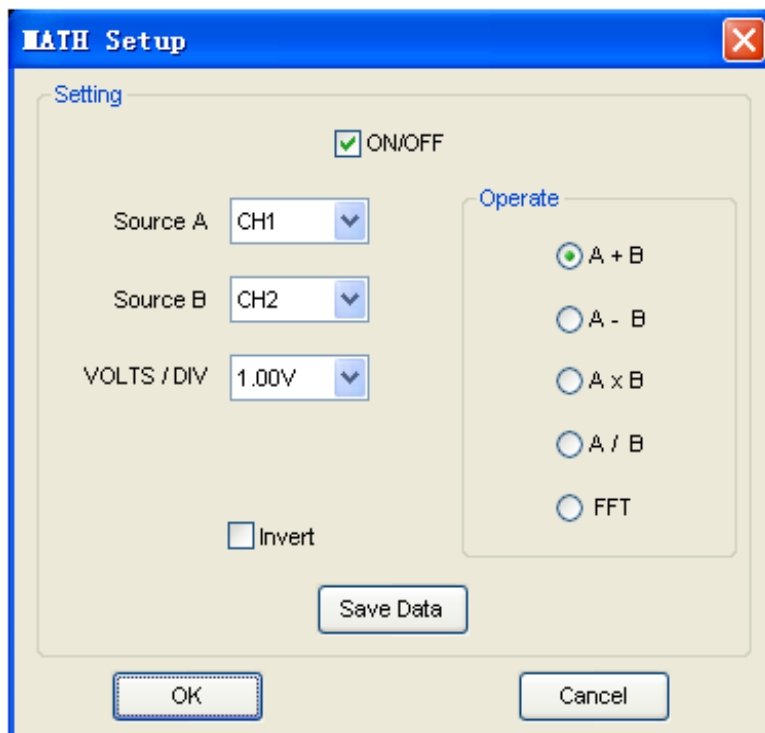
The following picture shows the waveform of inversion:



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 source of the math channel.

Operate: Set operation type of the math channel.

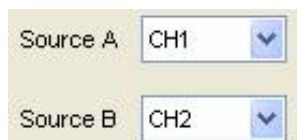
Volt/DIV: Set the resolution of the math channel.

Probe: Set the math channel probe attenuation.

Invert: Turn on/off the invert function.

The mathematic functions include addition, subtract, multiply, division and FFT for CH1-CH8.

Source A/B



Operate

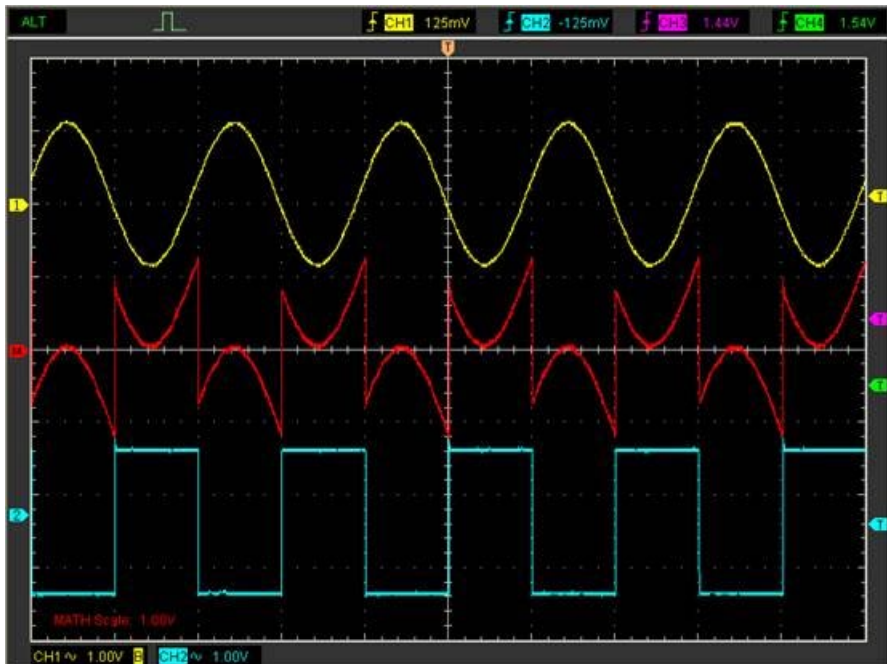
Four Types:

- A + B Add source A and source B
- A - B Subtract source B from source A
- A × B Multiply source A by source B
- A / B Divided source A by source B
- FFT Convert a time-domain signal into its frequency components (spectrum).

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

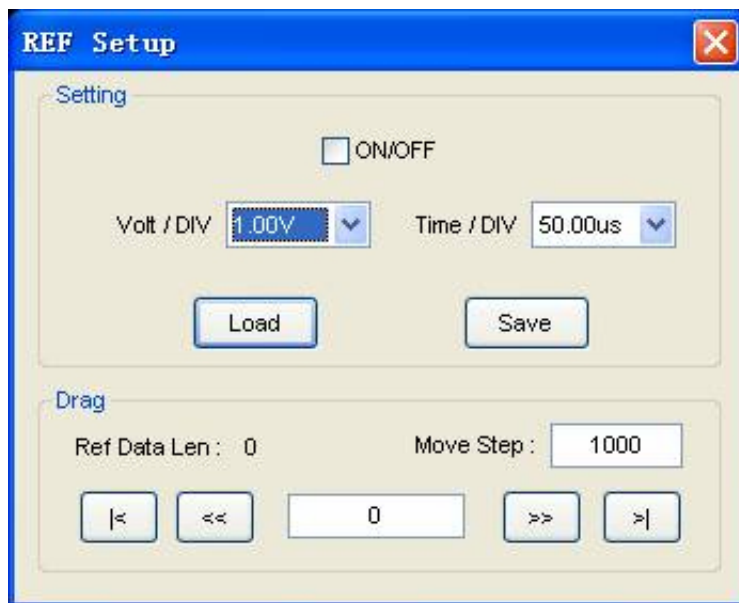
Select the operate type in the **Operate** menu. Select source A and B. Then adjust the vertical scale and offset to view the math channel clearly. The mathematic result can be measured by the measure window and the cursor.

The Math Function Display



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: Change 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 zoom in or zoom out according to the reference level.

Load

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

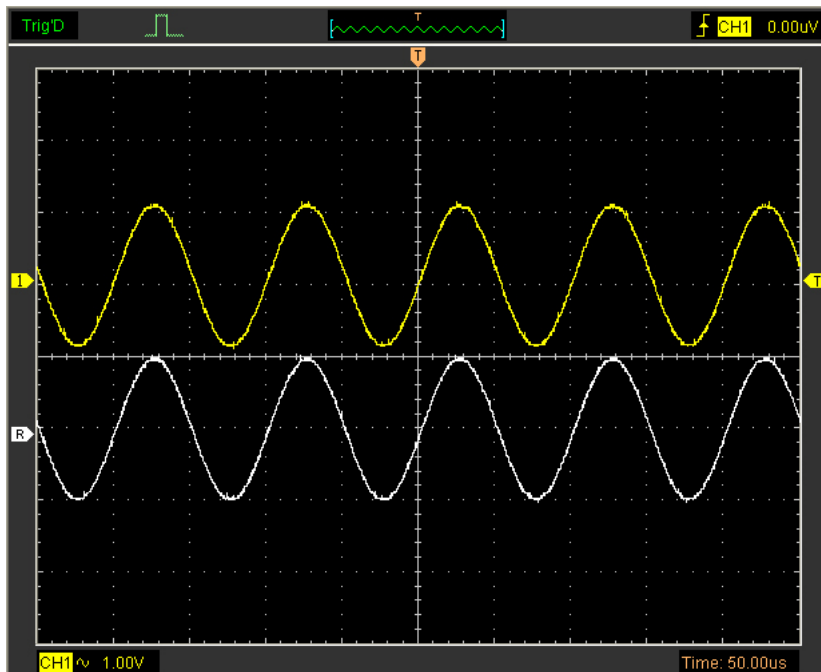
Save

Click **"Save"** to save the waveform to *.rfc file. Then a saved source window appears.



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

The Reference Waveform Display Window:



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

Setup Horizontal System

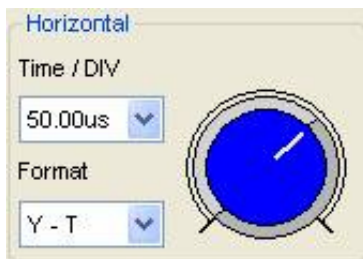
Change Time/DIV

The “Time/DIV”



Select the horizontal **Time/DIV** (scale factor) for the main time base or for 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.

Set Trigger System

Set 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**.

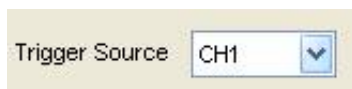


Auto: Acquire waveform even no trigger occurred.

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.



CH1: Select CH1 as trigger signal

CH2: Select CH2 as trigger signal

CH3: Select CH3 as trigger signal

CH4: Select CH4 as trigger signal

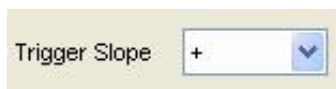
CH5: Select CH5 as trigger signal

CH6: Select CH6 as trigger signal

CH7: Select CH7 as trigger signal

CH8: Select CH8 as trigger signal

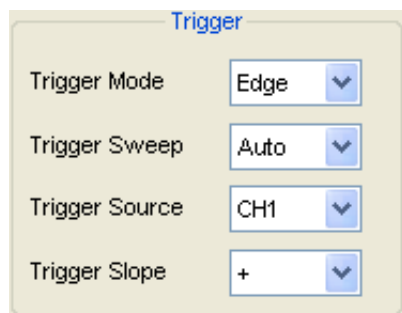
Slope: Set the slope to **Rising (+)** or **Falling (-)**.



Rising: Trigger on rising edge

Falling: Trigger on falling edge

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



Save/Load

Save

Click “File” in main menu to save data, setup and image.

File	
<u>N</u> ew	Ctrl+N
<u>C</u> lose	
<u>L</u> oad Data	Ctrl+L
Load Setup	
<u>S</u> ave Data	Ctrl+S
Save Set <u>u</u> p	
Save <u>I</u> mage	
<u>P</u> rint...	Ctrl+P
Print Preview	
<u>P</u> rint Option	
<u>E</u> xit	

1. Save Data

Save waveform data as one of type file under Save Data.

2. Save Setup

Save the current oscilloscope setup to file.

3. Save Image

Save the software display window in a .bmp or .jpg format file.

Load

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

File	
<u>N</u> ew	Ctrl+N
<u>C</u> lose	
<u>L</u> oad Data	Ctrl+L
Load Setup	
<u>S</u> ave Data	Ctrl+S
Save Setup	
Save <u>I</u> mage	
<u>P</u> rint...	Ctrl+P
Print Preview	
Print Option	
<u>E</u> xit	

1. Load Data

Load the waveform that had saved.

2. Load Setup

Load the instrument that had saved.

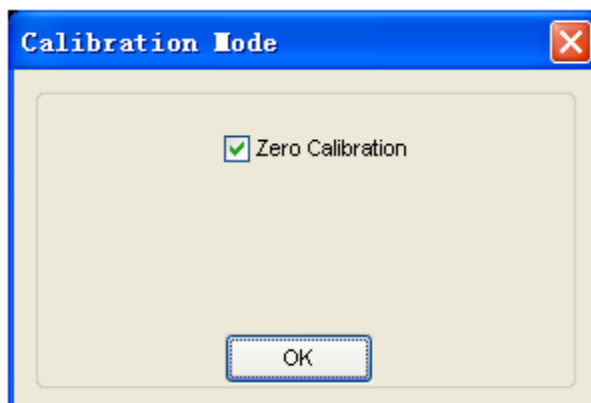
Utility/Function

Click "Utility" in main menu.



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 deg 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.



Factory Setup

Click "**Factory Setup**" in "**Utility**" menu to load default setups.

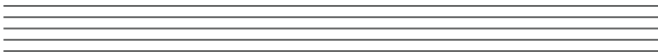


When you click the **Factory Setup** in **Utility** menu, the oscilloscope displays the CH1-CH8 waveforms and removes all waveforms.

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

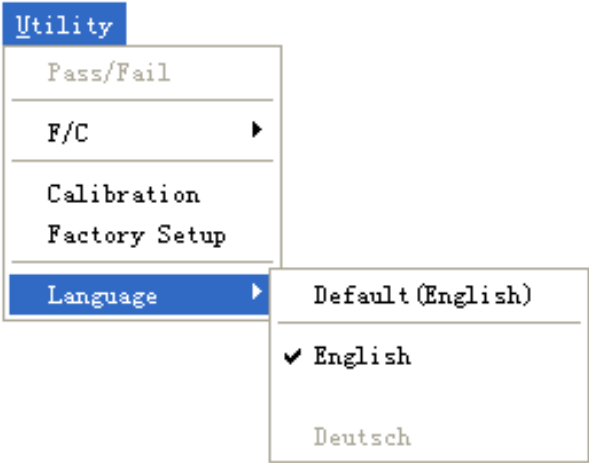
The Factory Setup function does not reset the following settings:

- Language option
- Date and time



Language

Click “Language” in “Utility” menu.

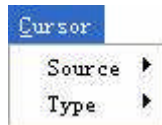


There are two languages in “Language” menu. The default language is English.

Measure Signal

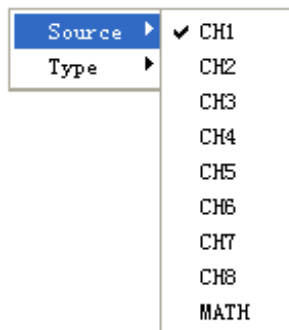
Cursor Menu

Click "**Cursor**" in main menu.



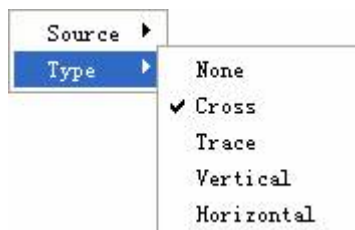
This method allows you to take measurements by moving the cursors.

1. Source



The user can set the source to **CH1**, **CH2**, **CH3**, **CH4**, **CH5**, **CH6**, **CH7**, **CH8** 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

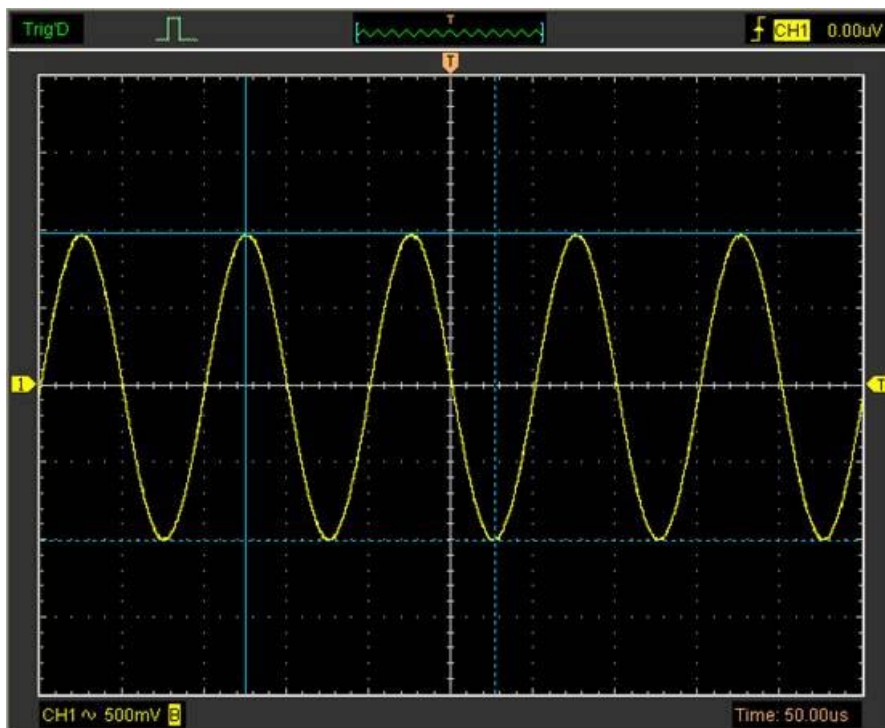


There are four types of cursors: **Cross**, **Trace**, **Vertical** and **Horizontal**.

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.

Freq: 6.590KHz

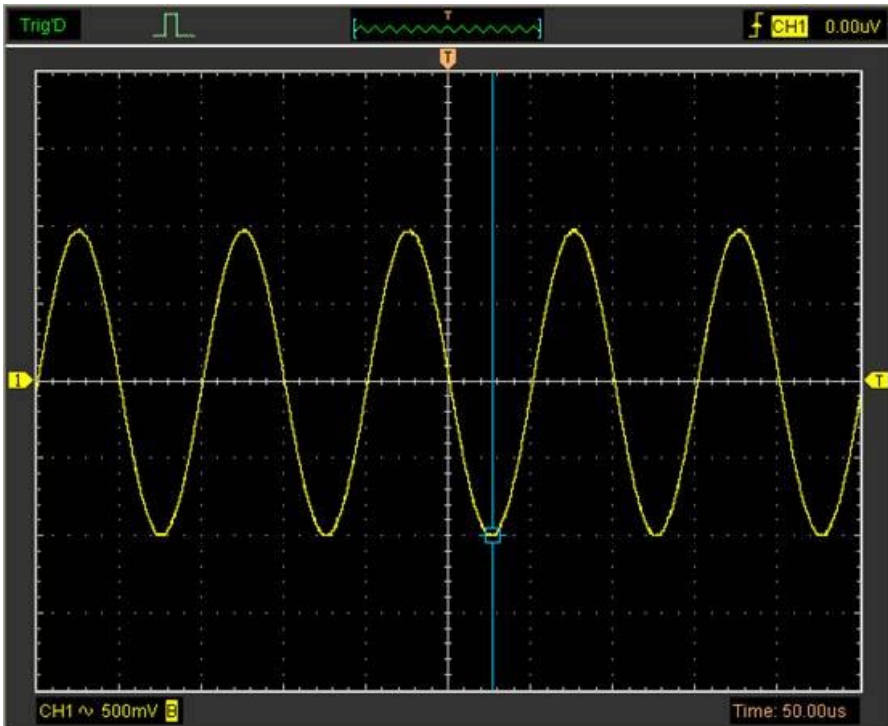
Time: 152uS

Volt: 2.00V

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



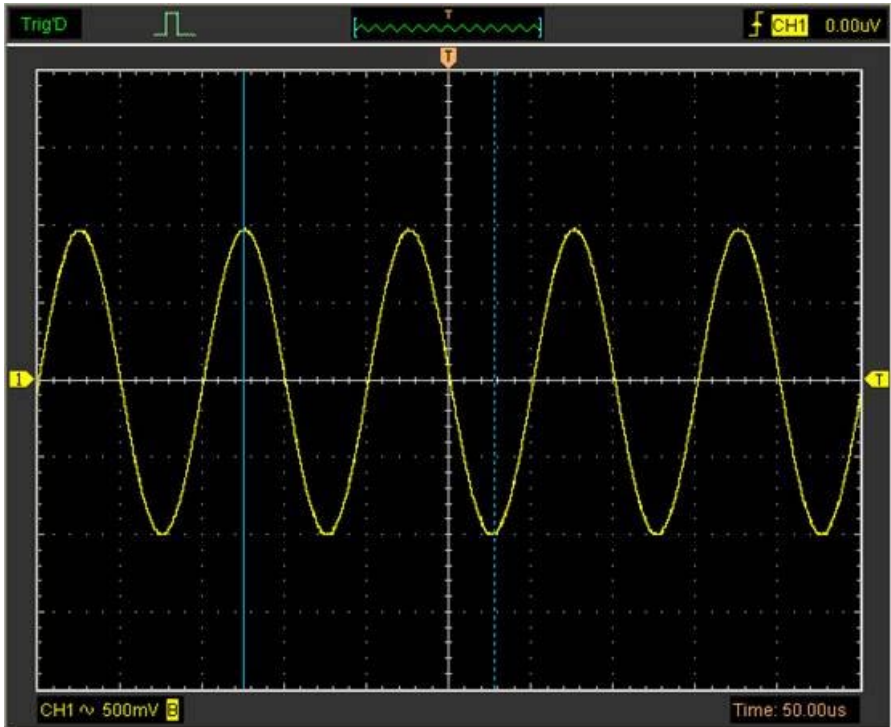
The **Trace** cursor measure result display on status bar.

Volt: -1.01V

3) Vertical

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

The **Vertical** cursor display window



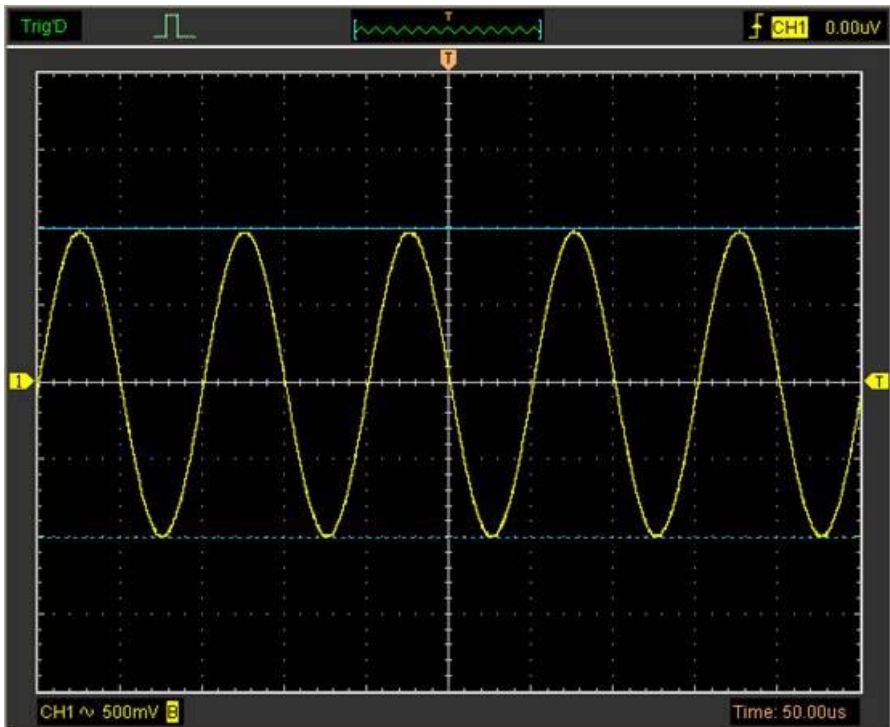
The **Vertical** cursor measure result display on status bar.



4) **Horizontal**

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

The **Horizontal** cursor display window



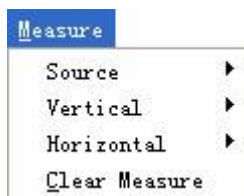
The **Horizontal** cursor measure result display on status bar.

Volt: 2.00V

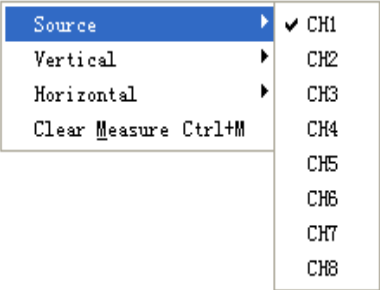
Measure Menu

Click "**Measure**" in main menu.

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

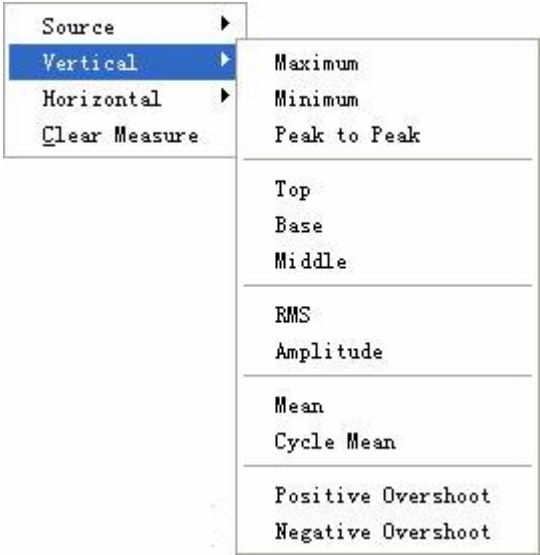


1. Source



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.

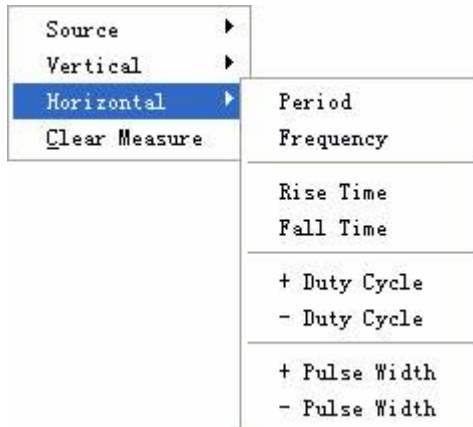
Mean: The arithmetic mean over the entire waveform.

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 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.

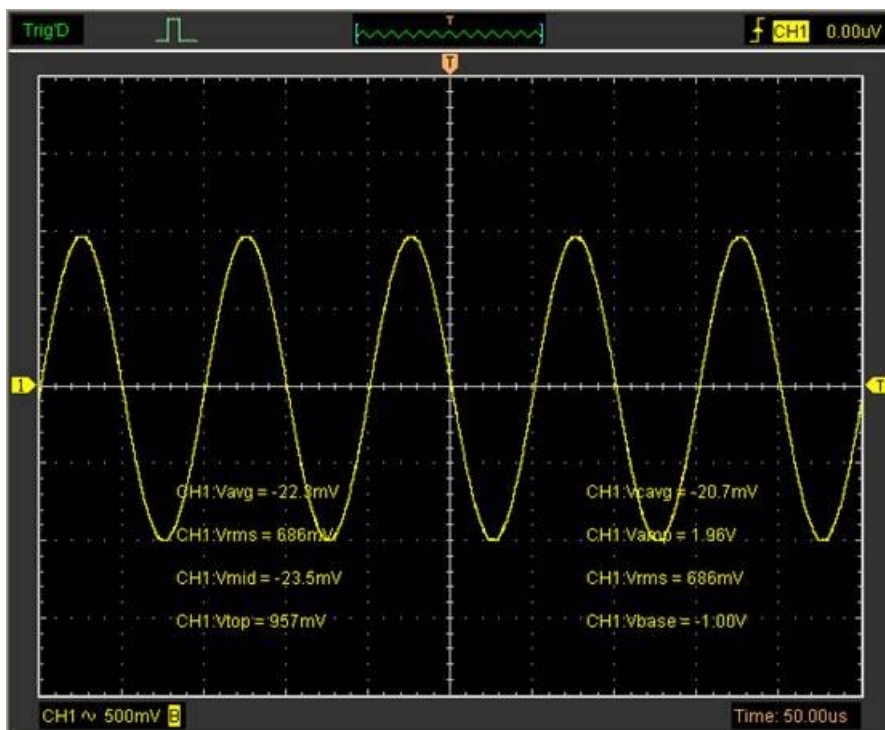
+Pulse Width: Measured of the first positive pulse in the waveform. The time between the 50% amplitude points.

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

4. Clear Measure

Clear all measure items on display screen.

The **Measure** Display Window



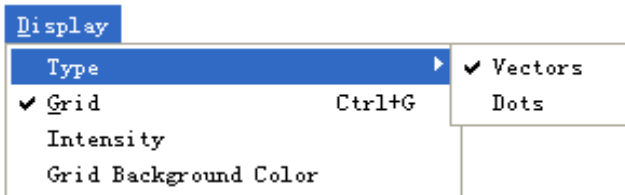
Note: The results of the automatic measurements will be displayed on the bottom of the screen. Maximum 8 results could be displayed at the same time. When there is no room, the next new measurement result will make the previous results moving left, out of screen.

The Display System

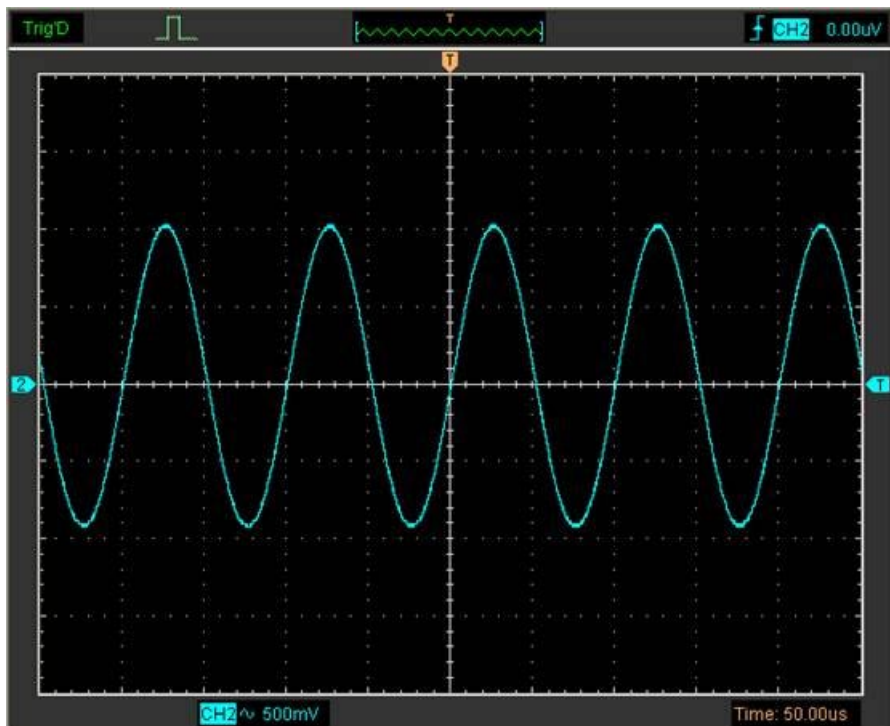
Display Type

Click “Type” in “Display” menu.

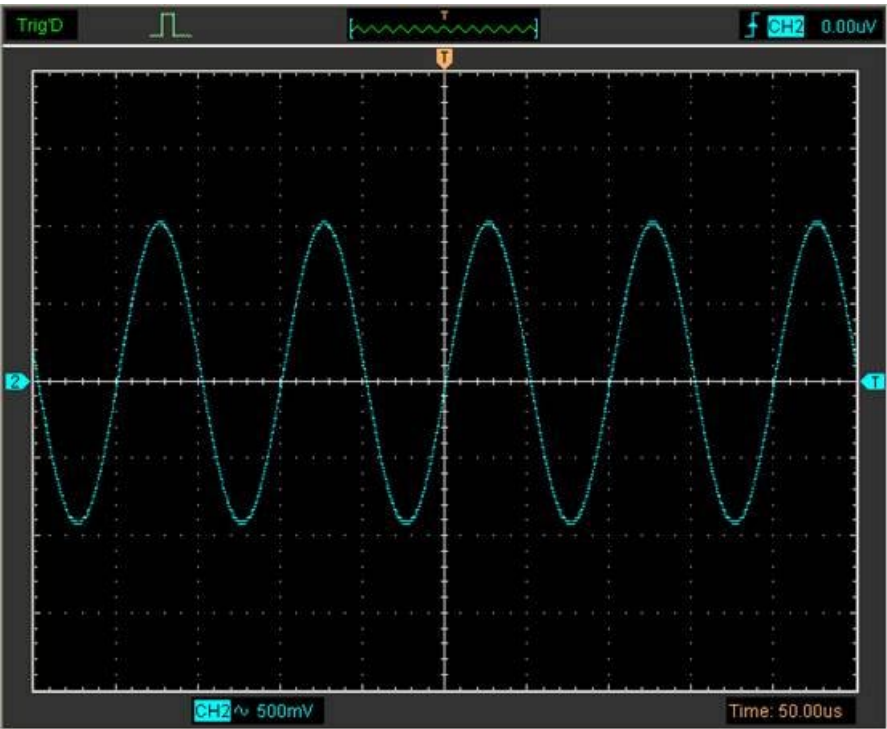
The following figure shows the type parameters setting.



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

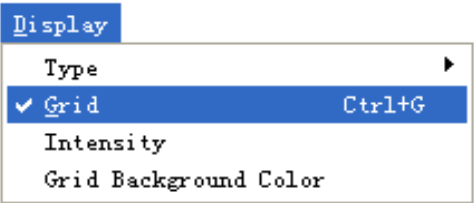


If the **Dots** type mode is selected, the waveform will be displayed as following figure.

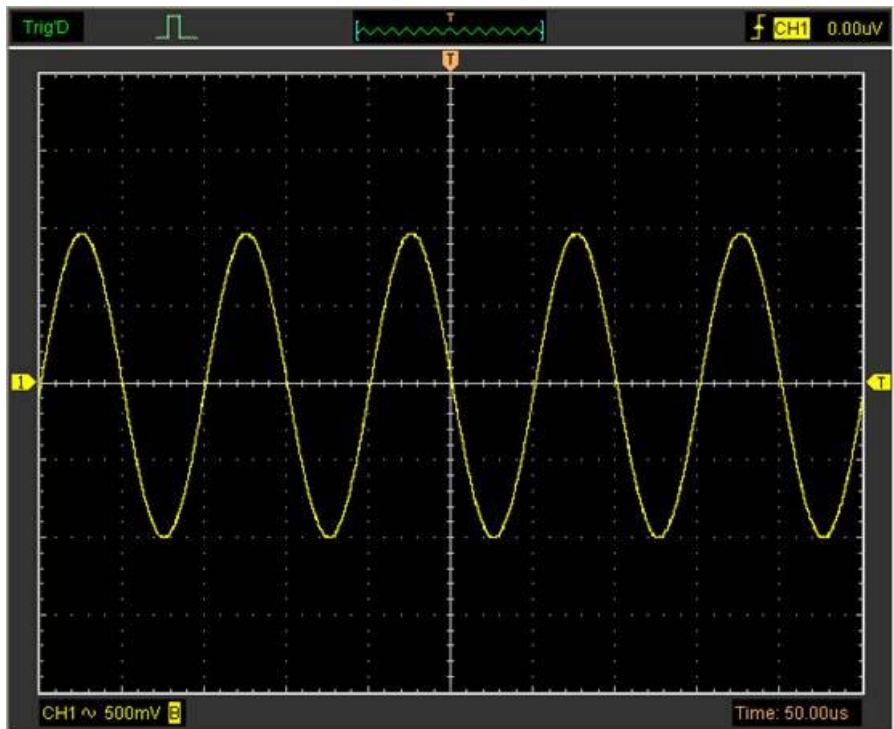


Display Grid

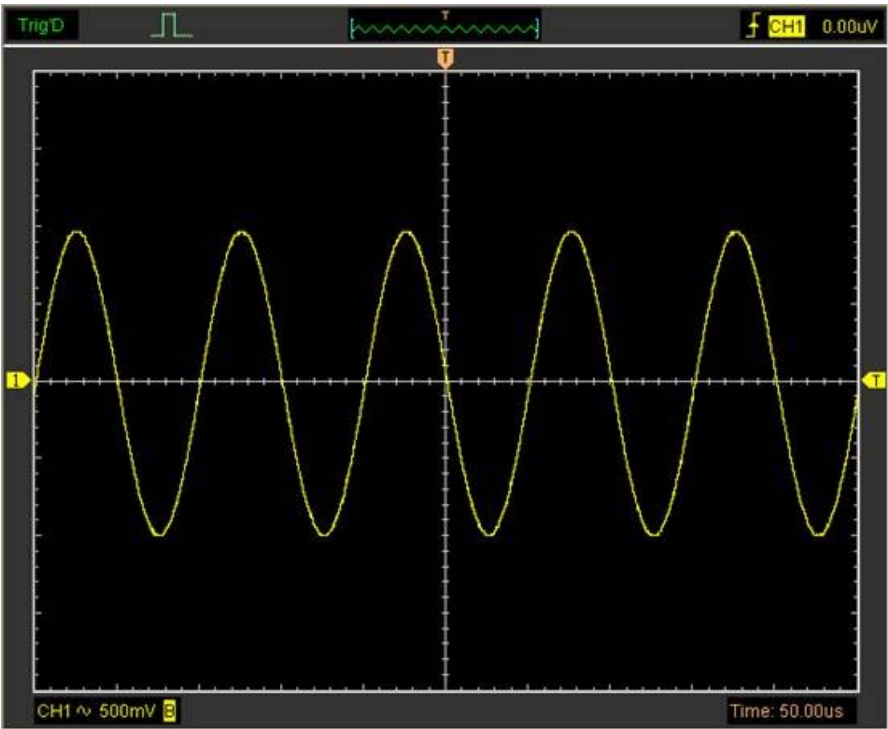
Click “Display” in main menu.



The grid shows:

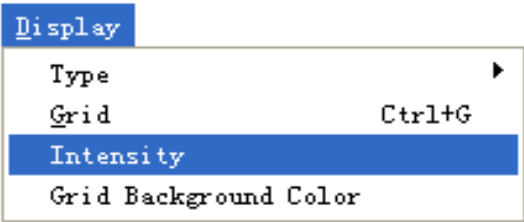


The grid not shows:

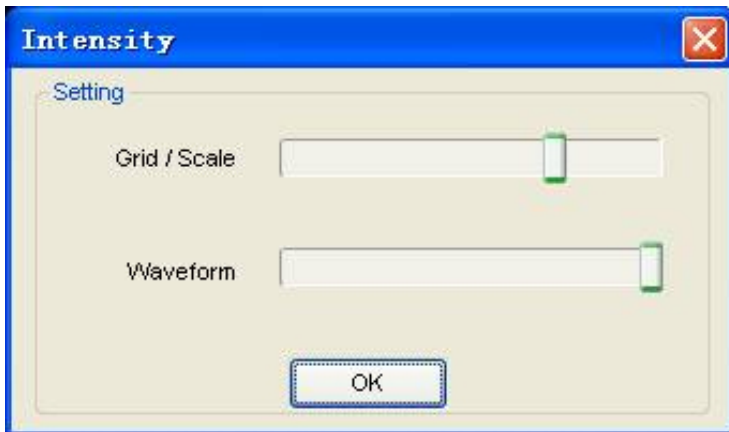


Intensity

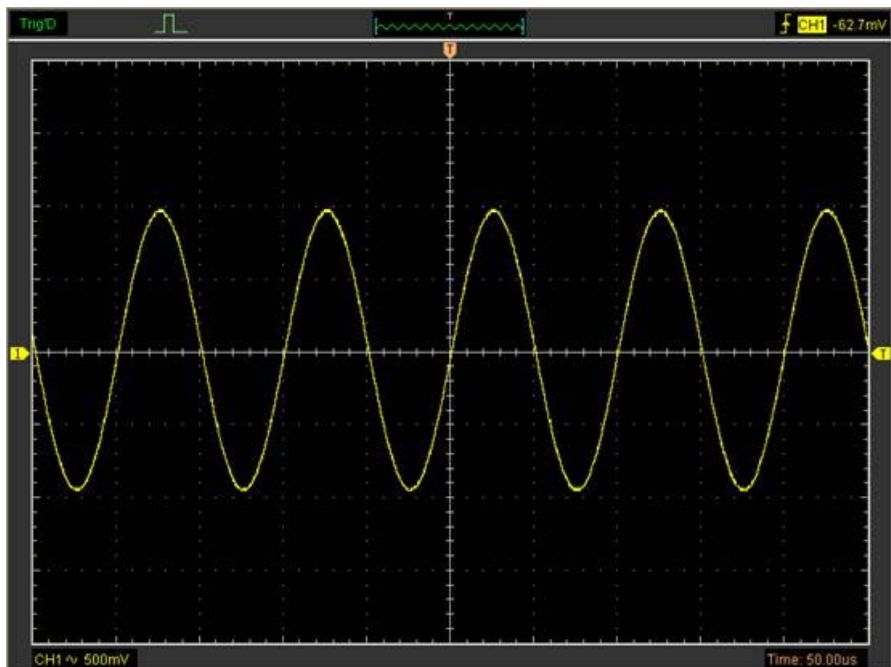
Click “Display->Intensity” in main menu.



The following figure shows the intensity dialog, which shows the display parameters setting.

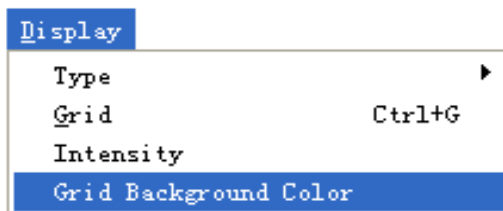


You can change the grid and waveform color intensity in this dialog.

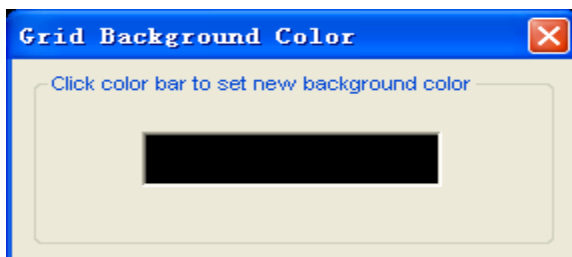


Grid Background Color

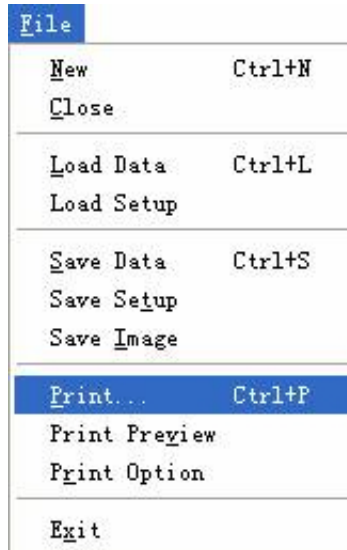
Click Grid Background Color in Display. You can change the background color.



Click the black box and you can set the background color.



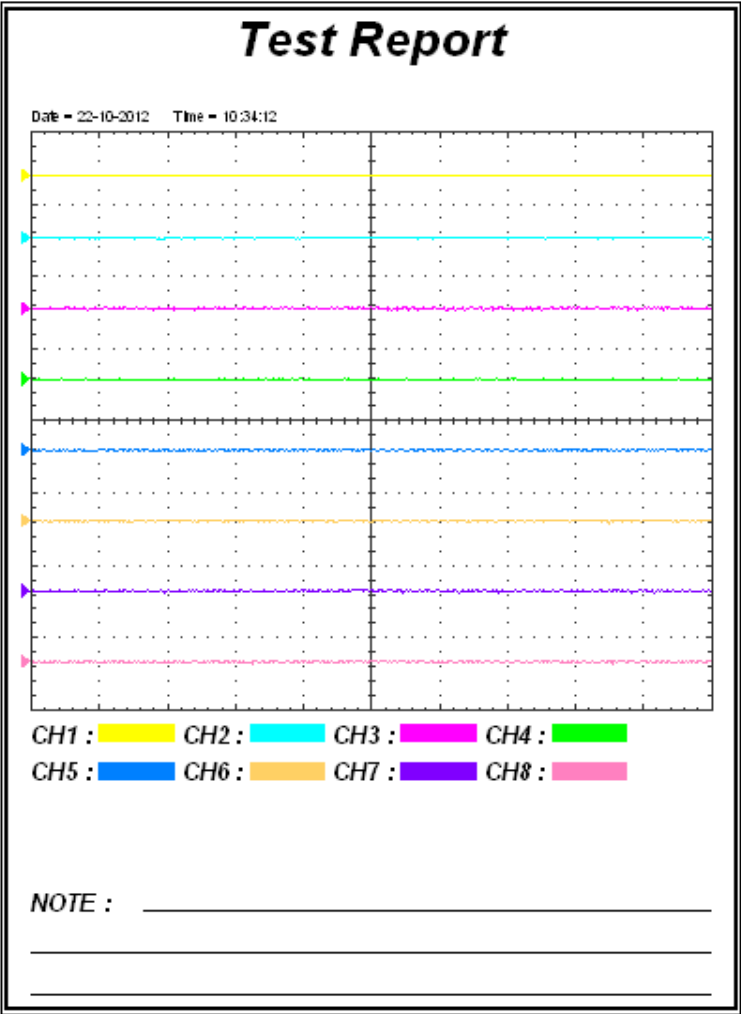
Print And Print Preview



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



Chapter 4 Application Example

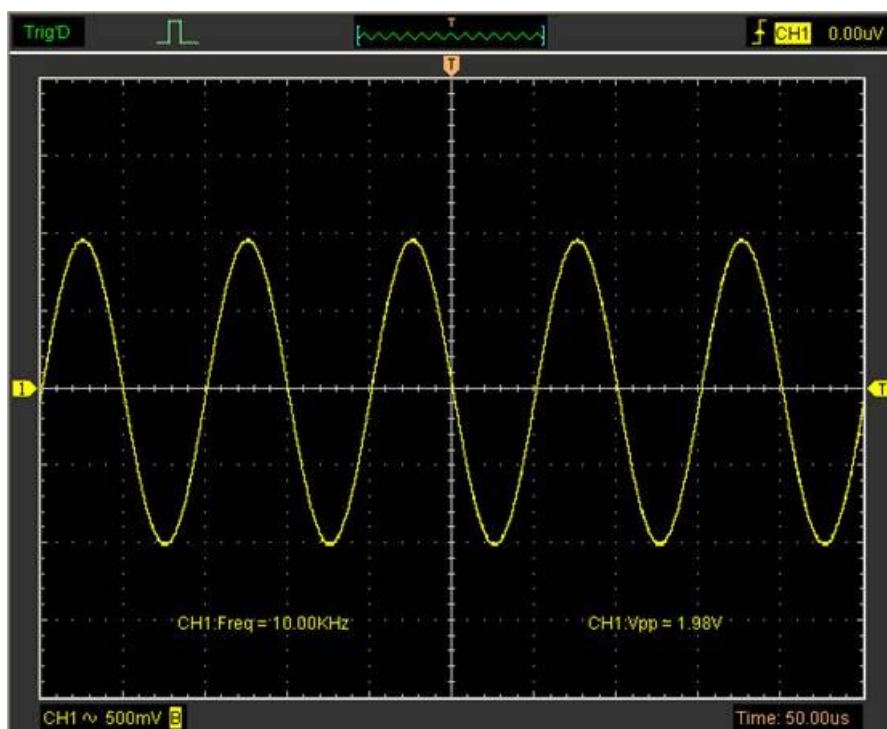
- Simple Measurement
- Capturing a Single-Shot Signal
- The Application of the X-Y
- Taking Cursor Measurement

Simple Measurement

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



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 **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.

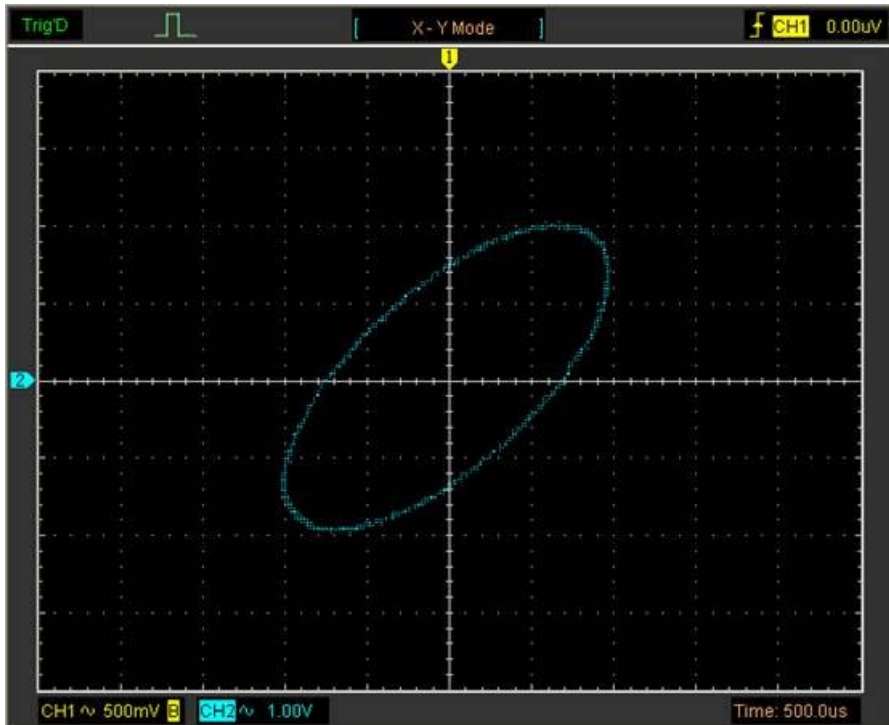
The Application of the X-Y Operation

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.

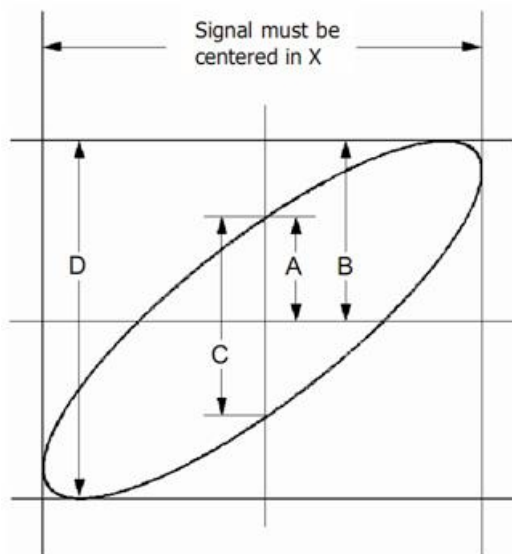
Do these steps as follows:

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. Adjust the vertical scale and offset to display approximately the same amplitude signals on each channel.
4. Select X-Y format at Horizontal window. The oscilloscope will displays a Lissajous pattern representing the input and the output characteristics of the circuit.
5. Adjust the scale and offset of the horizontal and vertical to a desirable waveform display. The following picture shows a typical example.
6. 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:

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

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

If the main axis is at II and IV quadrant, θ must be in the range of $(\pi/2 \sim \pi)$ or $(\pi \sim 3\pi/2)$.

Taking Cursor Measurements

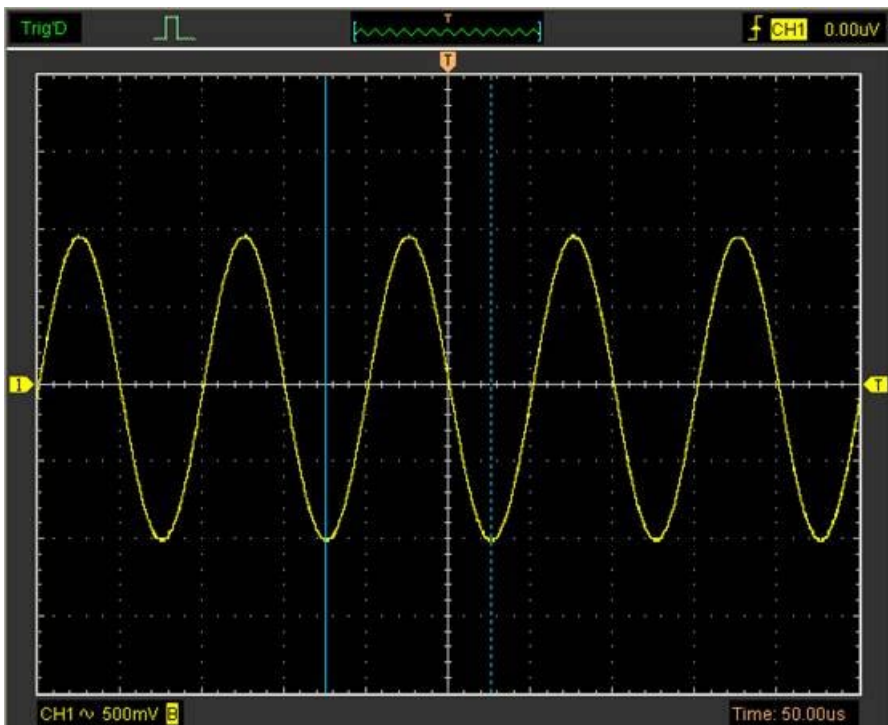
Use cursors to make time and amplitude measurements on a waveform quickly.

Measure the Peak Frequency or Time of the First Sine Waveform

Do these steps:

1. Click "**Cursor->Source**", select CH1(select CH2-CH8 if you want measure CH2-CH8).
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: 9.913KHz

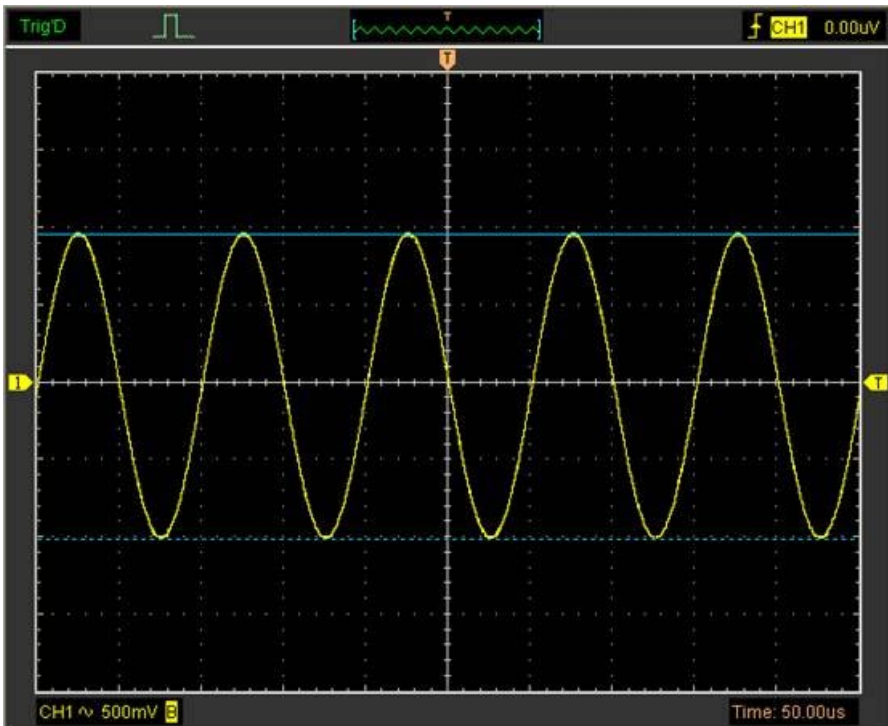
Time: 101uS

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.

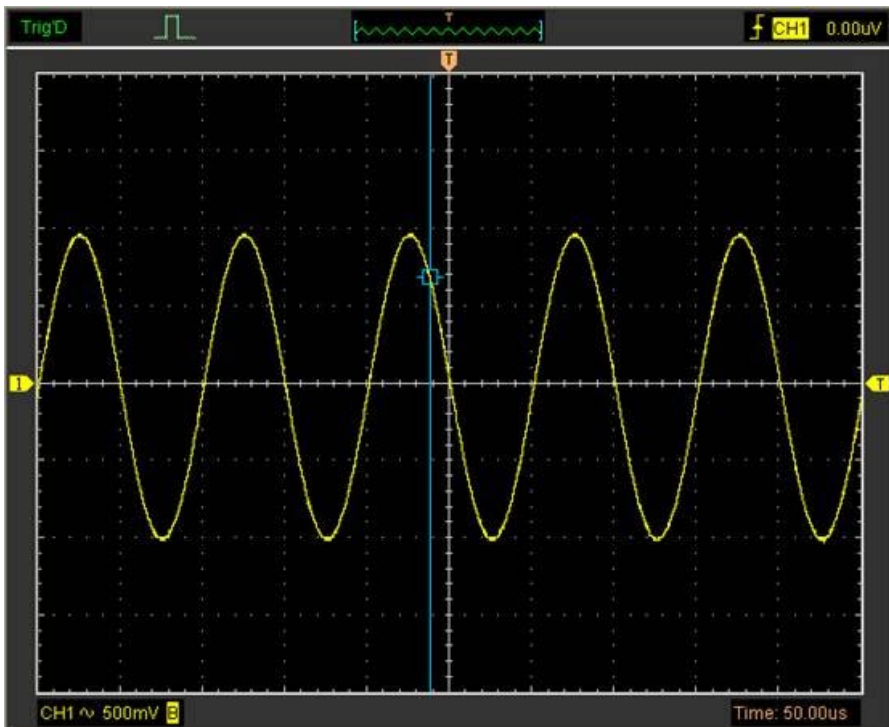
Volt: 1.98V

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

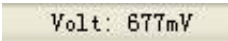
Do these steps:

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 to trace the wave in the waveform window.

Trace the Amplitude:



Read the details showing in the status bar.



Volt: 677mV

Note: Click "**Cursor->Type**", select "**Cross**", you can measure time and amplitude at the same time.

Chapter 5 Appendix

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

Appendix A: Specifications

Specifications Table:

Acquisition	
Sample Mode	Real-Time Sample
Sample Rate	2.4MSa/s(Single channel)

Input	
Input Coupling	DC
Input Impedance	Resistance: 1M Ω
Supported Voltage Attenuation Factors	1X, 10X, 100X, 1000X, 10000X, 20:1
Maximum Input Voltage	400Vpk(DC + peak)

Horizontal	
Scanning Speed Range(Sec/Div)	1ns/div ~ 20000s/div(1-2-5 sequences)
Time Base Accuracy	± 50 ppm
Memory Depth(Sample Points)	Max. 4k (Single channel)

Vertical	
Analog channel	8
Vertical Resolution	12 bit
Vertical Scale(Volt/div) Range	10mV ~ 5V/div @ x1 probe(1,2,5 sequence) 100mV ~ 50V/div @ x10 probe 1V ~ 500V/div @ x100 probe 10V ~ 5000V/div @ x1000 probe 100V ~ 50000V/div @ x10000 probe 200mV ~ 100V/div 20:1 probe

Trigger	
Trigger Source	CH1, CH2, CH3, CH4, CH5, CH6, CH7 and CH8
Trigger Mode	Auto, Normal and Signal
Trigger Type	Edge
Trigger Sensitivity	0.02 div increments
Trigger Level Accuracy	± 4 division

Measurement		
Cursor	Amplitude difference between cursors(ΔV)	
	Time difference between cursors(Δt)	
	Reciprocal of Δt in Hertz ($1/\Delta t$)	
	(Cross, Trace, Horizontal, Vertical)	
Auto Measure	Voltage Measurement	Vp-p, Vmax, Vmin, Vmean, Vamp, Vtop, Vbase, Vmid, Vrms, Vcrms, Preshoot, Overshoot
	Time Measurement	Frequency, Period, Rise Time(10%~90%), Fall Time(10%~90%), Positive Width, Negative Width, Duty Cycle

Programmable Generator	
Channel	8(D0-D7)
Output Level	LVTTL
Frequency Range	0-250kHz

Mechanical		
Size	Width	185mm
	Height	150mm
	Depth	27mm
Heavy	Withoput package	0.35kg

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 spray, 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 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 carefully to avoid scratching the glass display.
2. Use a soft semi-dry cloth to clean the device.