



USER'S MANUAL

Tenma 72-10175



www.tenma.com

USER'S MANUAL

72-10175



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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

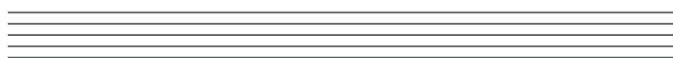
- **Use Proper Power Cord.** Use only the power cord specified for this product and certified for the country of use.
- **Connect and Disconnect Properly.** Do not connect or disconnect probes or test leads while they are connected to a voltage source.
- **Connect and Disconnect Properly.** Connect the 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 Rating.** 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 72-10175 is small, lightweight, portable oscilloscope which does not require external power! The 72-10175 is ideal for production test, research, design and any other 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 your product
- General Features
- General Check
- Perform a probe check and compensate probes
- Match your probe attenuation factor
- Use the self calibration routine
- Accessories



System Requirement

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

Minimum System Requirements

Operating System

Window NT/2000/XP/VISTA/Win7

Processor

1.00GHz processor

Memory

256MB

Disk Space

500M disk free space

Screen resolution

800 x 600

Recommended Configuration

Operating System

Windows XP SP3 System

Processor

2.4G Processor

Memory

1GB Memory

Disk Space

80GB Disk Space

Screen resolution

1024 x 768 or 1280 x 1024 resolution

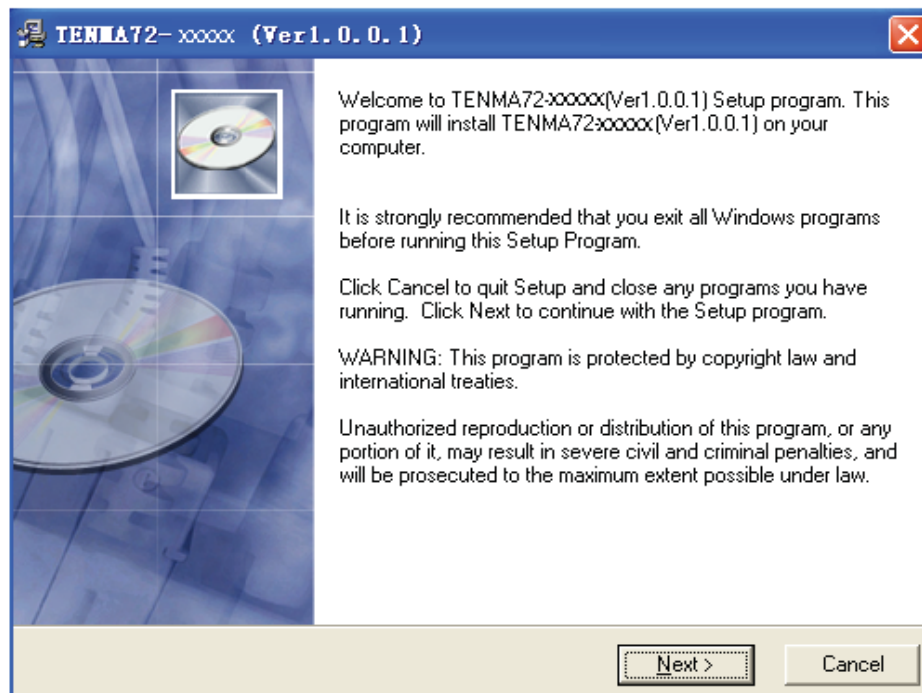
DPI Setting

Normal Size (96DPI)

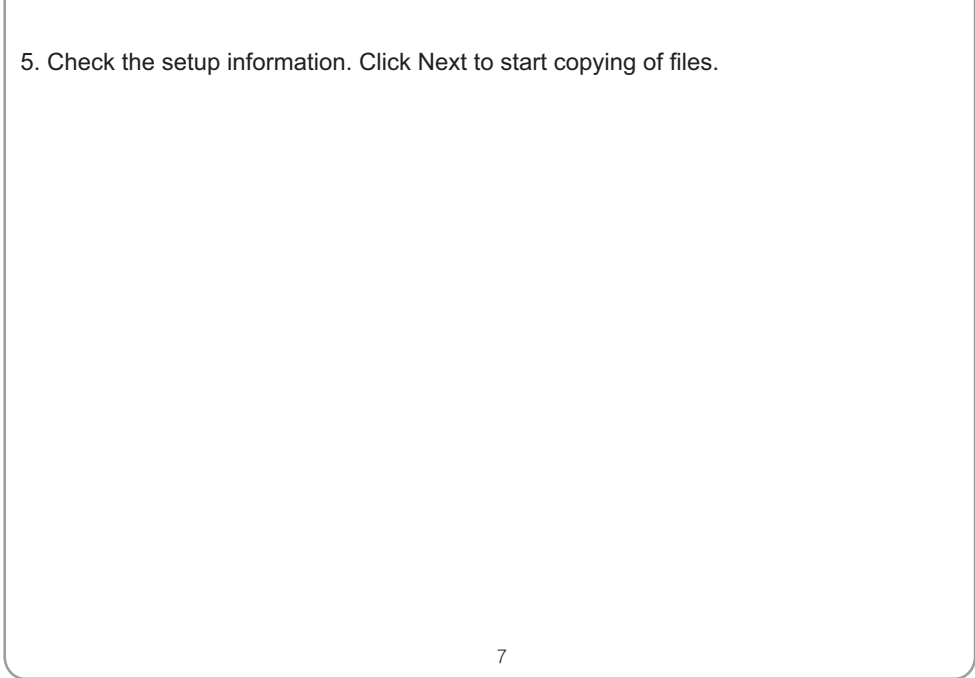
Install Software

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

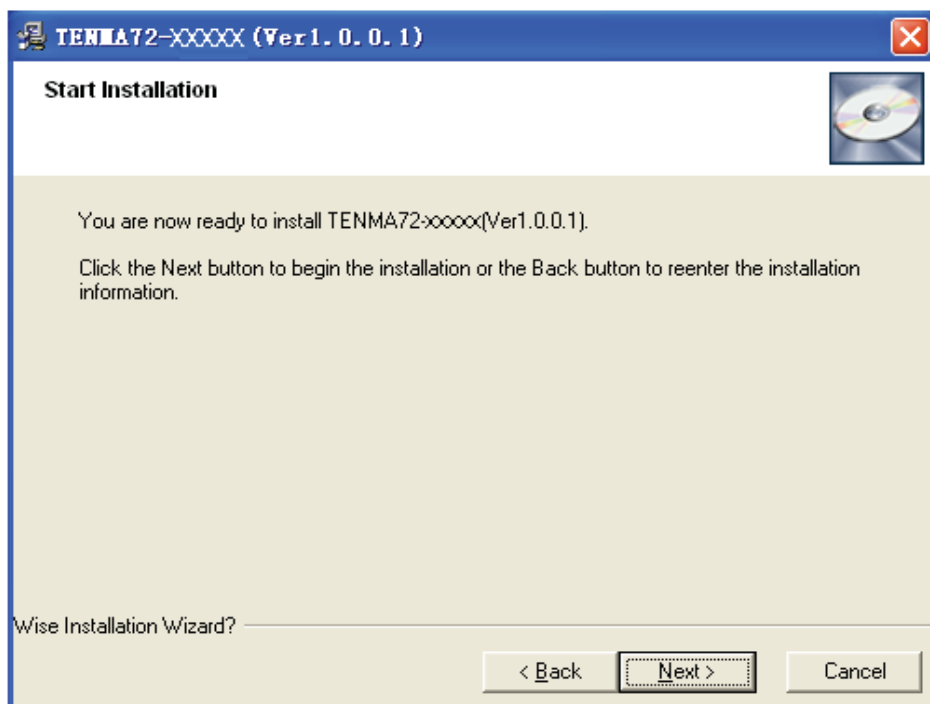
1. While in Windows, insert the installation CD into the CD-ROM drive.
2. The installation should start up automatically. Otherwise in Windows Explorer, switch to the CD-ROM drive and run Setup.exe.
3. The software Installation is started. Click 'Next' to continue.



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



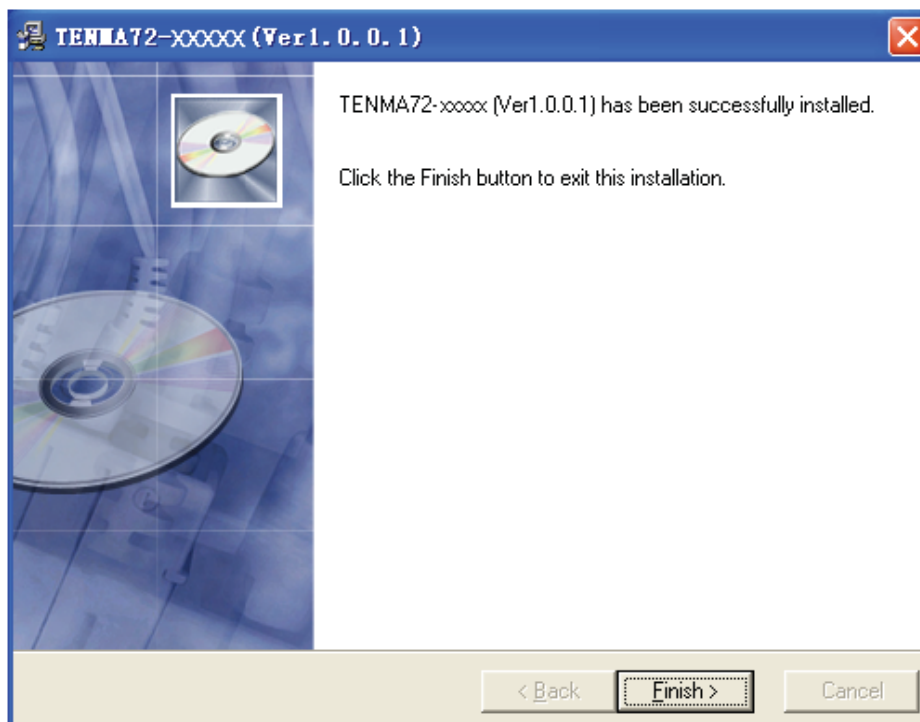
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6. This Status dialog is displayed during copying of files.



8. The installation is complete.



Install Driver

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



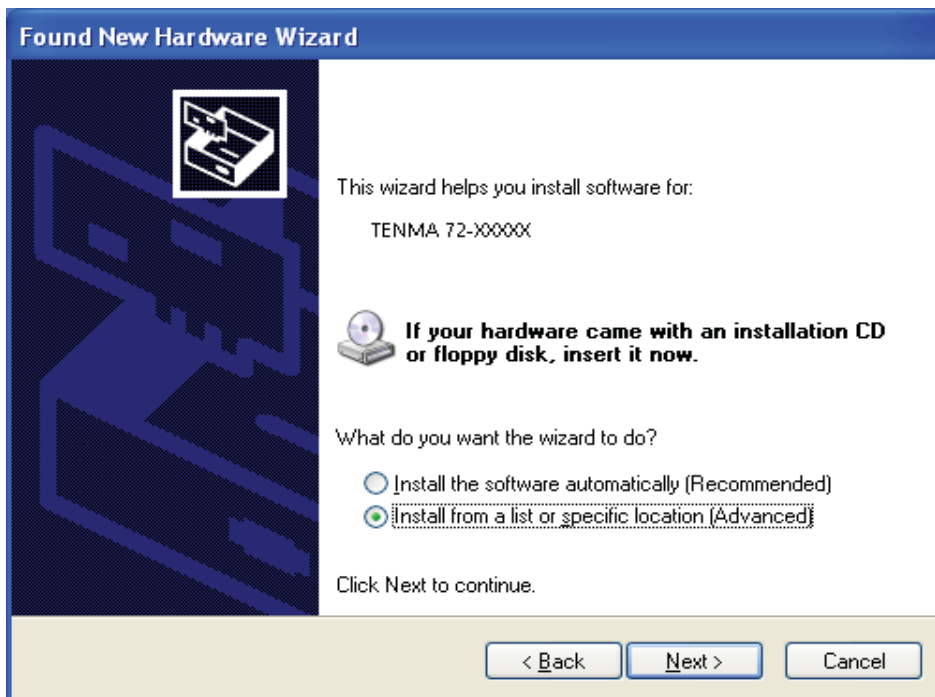
2. Connect the B-Type Plug of USB cable to USB'S USB port.



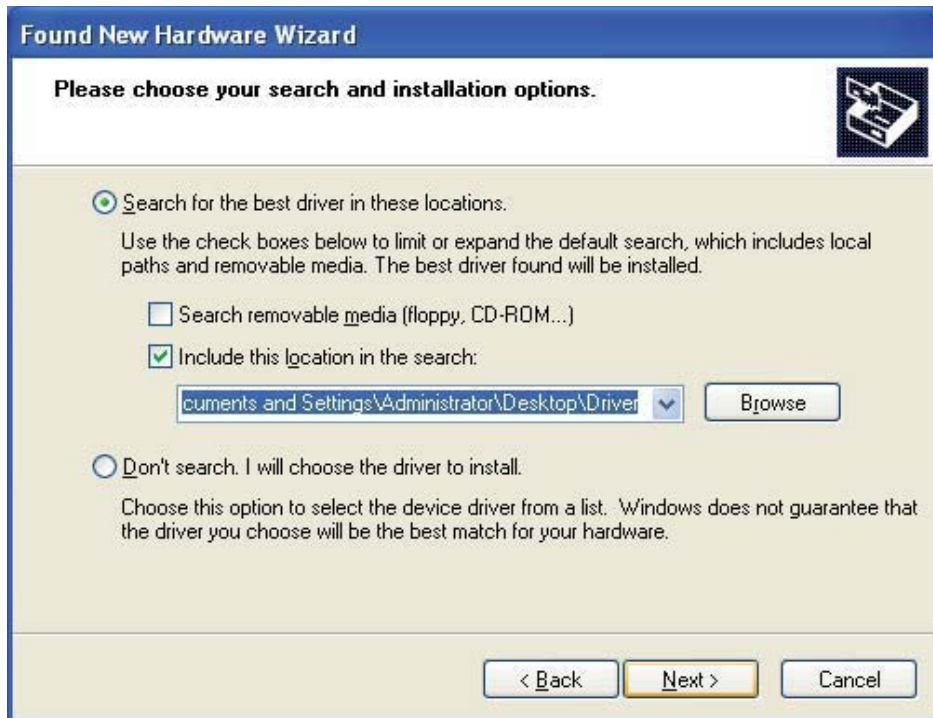
3. New hardware is found.



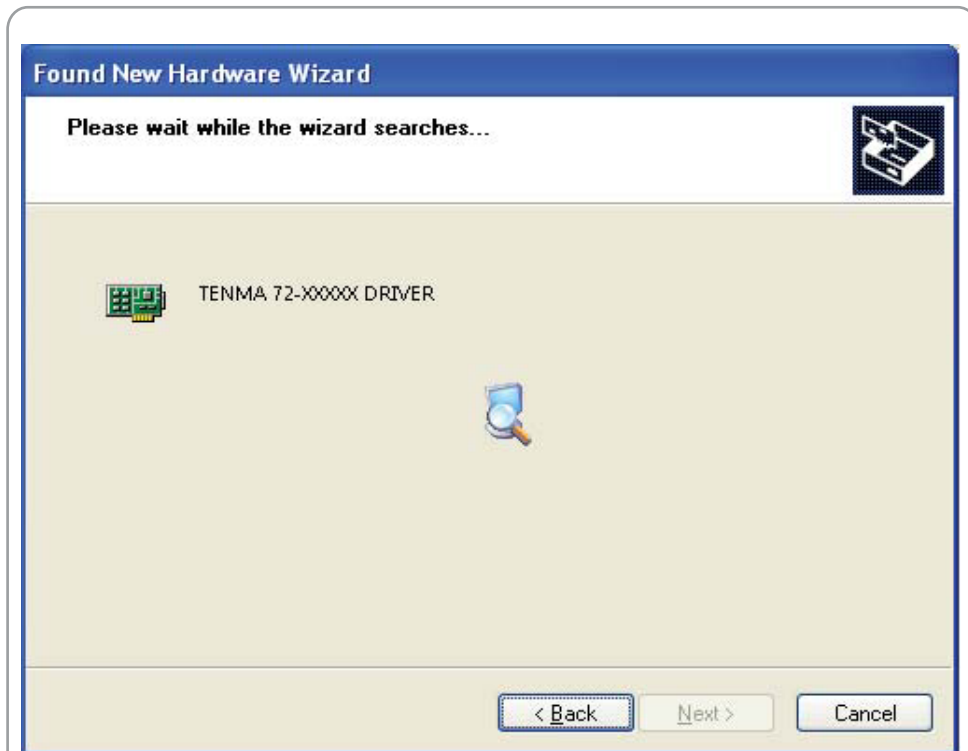
4. New hardware search wizard starts.



5. Select the specific location.



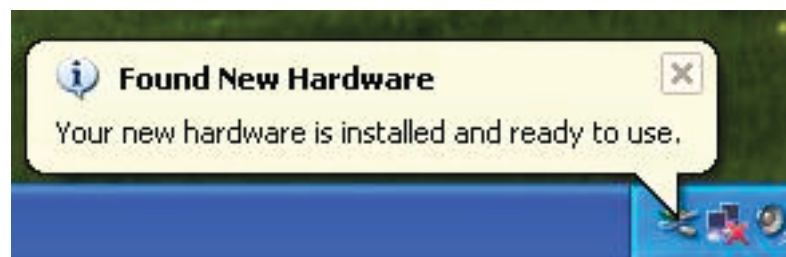
6. New hardware search wizard starts to search the driver.



7. New hardware wizard installs "USB DRIVER".



8. The wizard has finished installing for "USB DRIVER".



General Features

Product features:

- **Four channel,Bandwidth:**
60MHz
- **Maximum real-time sample rate:**
200MSa/s
- **Memory depth:**
10K-16M points
- **Automatic setup for ease of use (AUTASET);**
- **Pass/Fail;**
- **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;**
- **External trigger;**
- **Waveform average;**
- **Adjustable waveform intensity, more effective waveform view;**
- **User interface in several user-selectable languages;**

General Check

Please check the instrument for the following steps before use.

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 distributor.

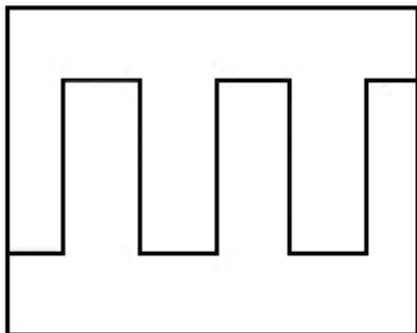
Check the instrument:

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

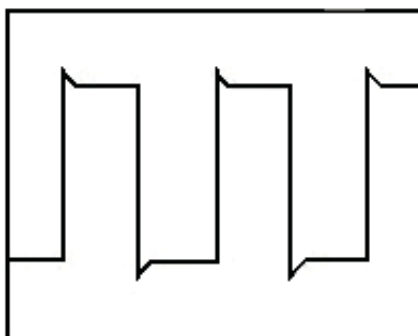
Probe Compensation

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

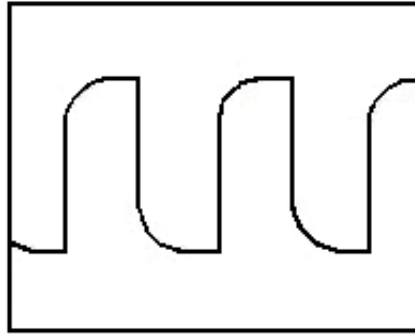
- From the "Probe" menu, select attenuation to 1:10. Set the switch to "X10" on the probe and connect it to CH1 of the oscilloscope. When using the probe hook-tip, insert the tip onto the probe firmly to ensure a proper connection.
- Attach the probe tip to the Probe Compensator and the reference lead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



Correctly Compensated



Over compensated



Under Compensated

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

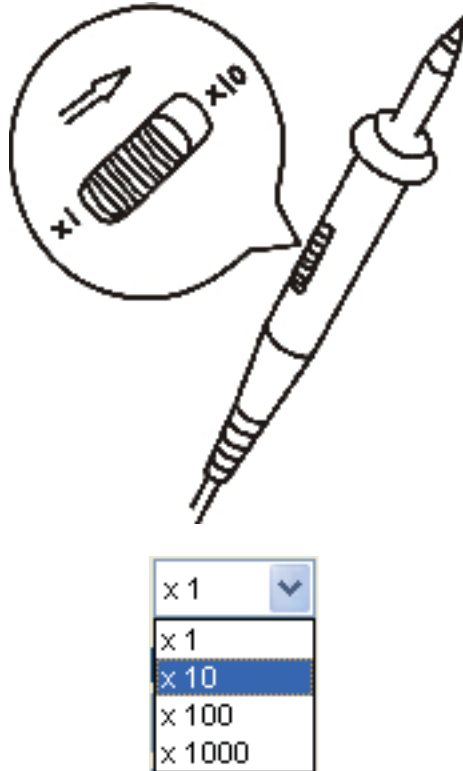
The oscilloscope is equipped with four channels plus external trigger.

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. Align the slot in the probe connector at the end 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 ,CH3 and CH4 with the same method. Repeat steps 2 and 3.

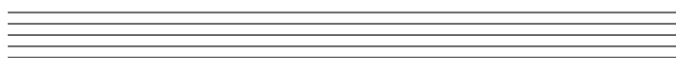
Self Calibration

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 5v 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 listed below are standard accessories for the oscilloscope:

- Probe×2 (1.5m), 1:1, (10:1) Passive Probes
- A User's Guide
- An USB Cable
- A PC software of the oscilloscope

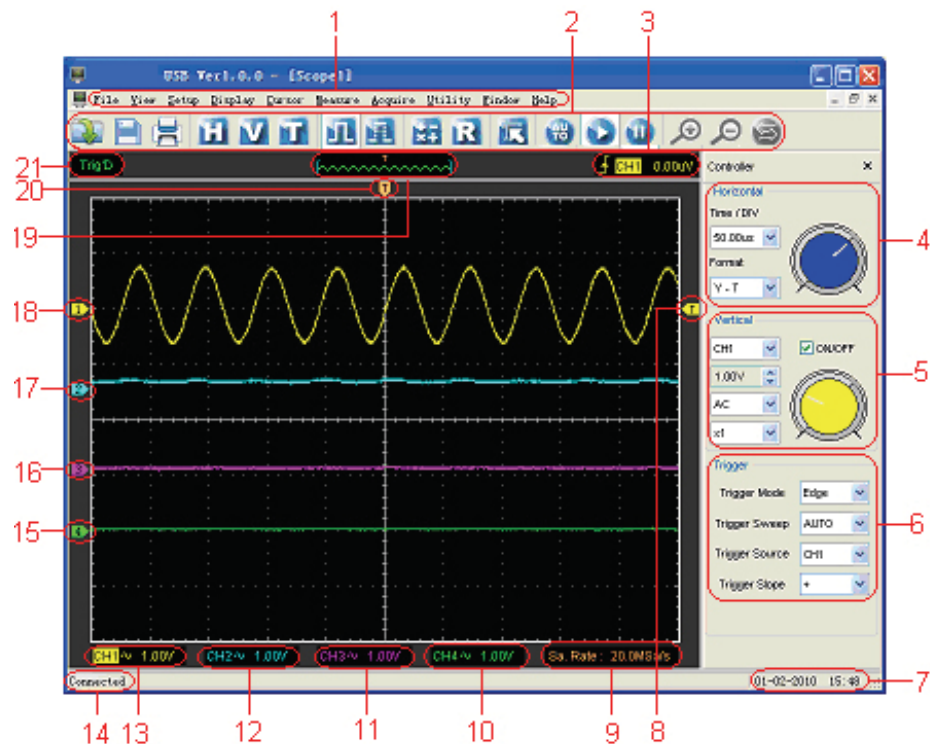


Chapter 2 Operating Basics

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

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 Horizontal Panel**

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

5. The Vertical Panel

The user can turn on/off the CH1/CH2/CH3/CH4. Also the user can change the CH1/CH2/CH3/CH4 volt/div, coupling and probe attenuation.

6. The Trigger Panel

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

7. Displays the system time.

8. Marker shows Edge trigger level.

9. Displays the main time base setting.

10. Displays the 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.

11. Displays the CH3 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.

12. Displays the CH2 information

Readouts show the coupling of the channels.

Readouts show the vertical scale factors of the channels.

A "B" icon indicates that the channel is bandwidth limited.

13. Displays the CH1 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.

14. Displays the software status.

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

16. The same above.

17. The same above.

18. The same above.

19. A window that shows the display waveform in buffer position.
20. Marker shows horizontal trigger position.
21. 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.

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

File	
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	

2. View: Change the user interface

- ✓ Toolbar
- ✓ Status Bar
- ✓ Side Bar

Setup	
<u>REF</u>	Ctrl+R
<u>MATH</u>	Ctrl+M
<u>Trigger</u>	Ctrl+T
<u>Vertical</u>	Ctrl+V
<u>Horizontal</u>	Ctrl+H

Display

Type	
✓ Grid	Ctrl+G

Cursor

Measure

- Source ▶
- Vertical ▶
- Horizontal ▶
- Clear Measure Ctrl+M

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Acquire		
✓ <u>R</u> un	Ctrl+R	
<u>S</u> top	Ctrl+O	
Zoom Out		
Zoom In		
Drag		
Buffer Length		▶
Acquisition		▶
Interpolation		▶
Autoset		

8. **Utility:** Utility setting

Utility	
Record	
Pass/Fail	
F/C	▶
Calibration	
Factory Setup	
Language	▶

9. **Window:** Window setting

Window	
<u>C</u> ascade	
<u>V</u> ertical	
<u>H</u> orizontal	
<u>A</u> rrange Icons	
✓ <u>1</u> Scope1	

11. **Help:** Access help file

Help

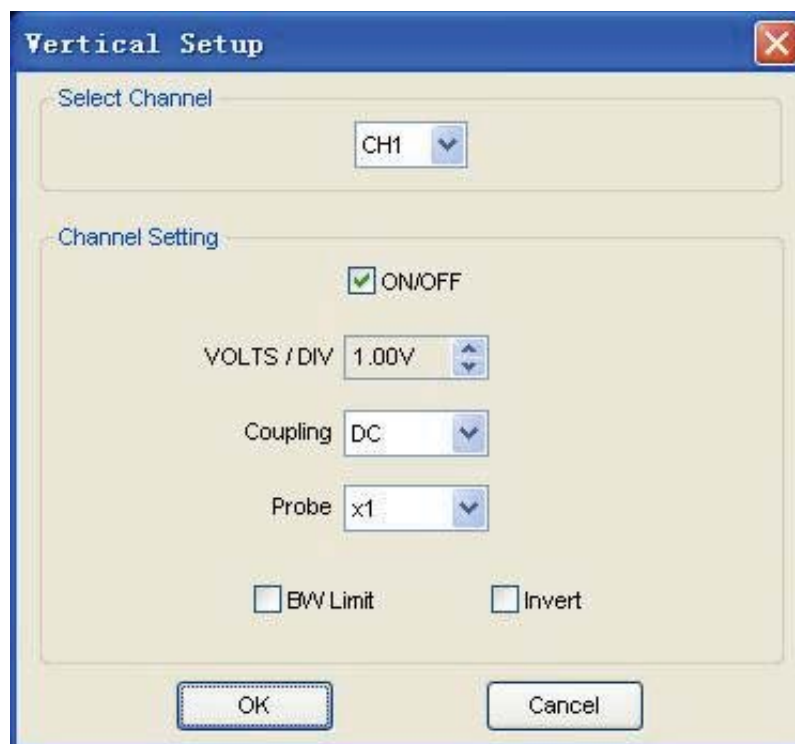
Contents F1

About... F9

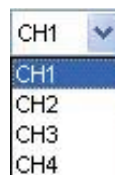
The Vertical System

Click "Setup"->" Vertical"

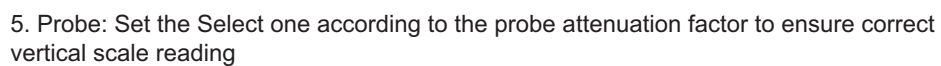
The following figure shows the vertical Setup window. It shows the vertical parameters setting.



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



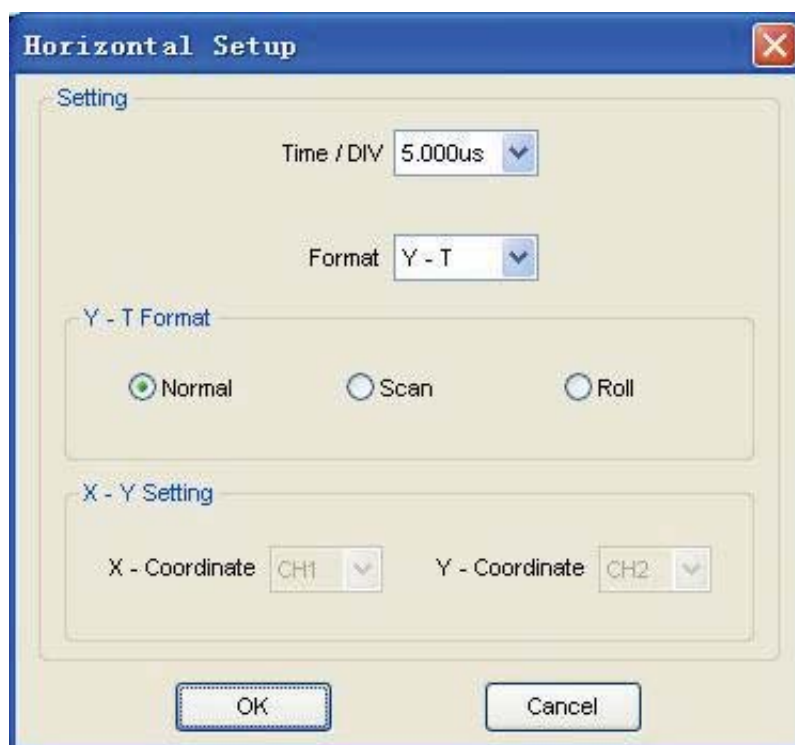
2. ON/OFF: Turn on or off the selected channel.



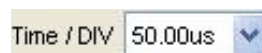
The Horizontal System

Click "Setup" -> "Horizontal"

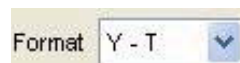
The following figure shows the Horizontal System window. It shows the horizontal parameters settings.



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



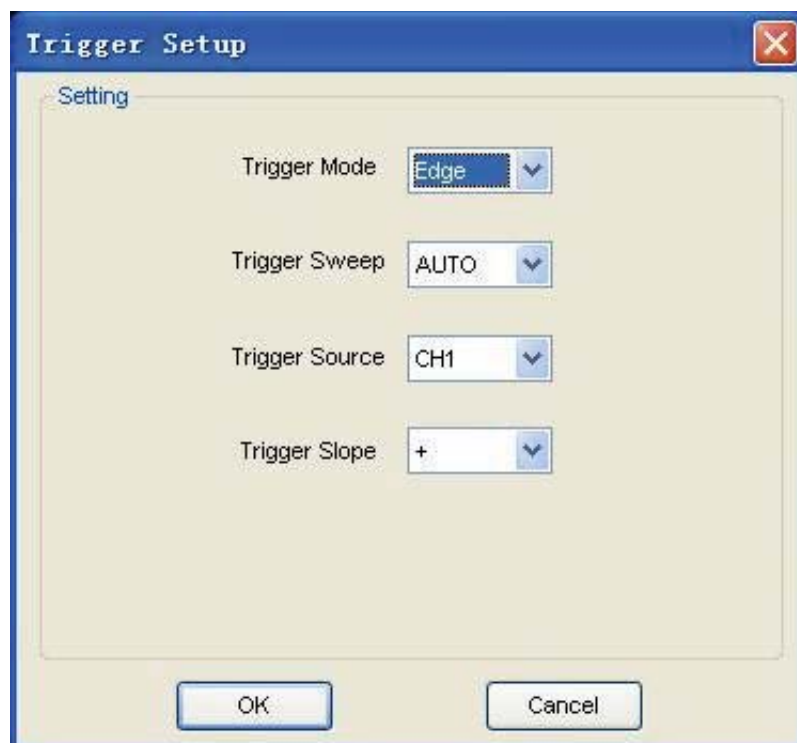
2. **Format:** leads the setting of the horizontal format parameters



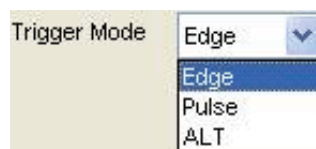
The Trigger System

Click **"Setup"**-> **"Trigger"**

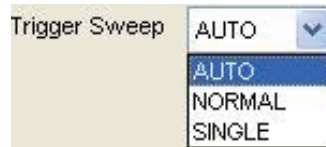
The following figure shows the trigger system control.



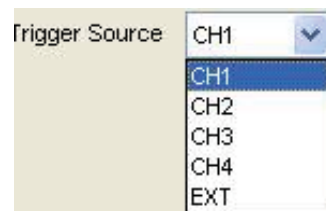
1. **Trigger Mode:** Sets the trigger mode



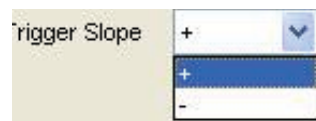
2. **Trigger Sweep:** Selects the trigger sweep mode to AUTO, NORMAL or SINGLE



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



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



Input Connector



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

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

Other Connector:



GND.: Ground terminal

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

CAL.: Probe compensation output.

Chapter 3 Understanding 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

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.

Set Vertical System

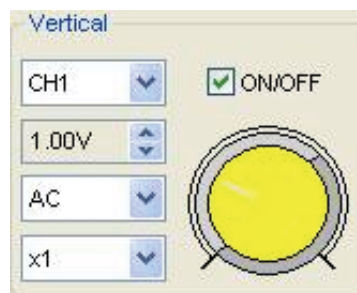
Set Channel

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

Filter: Select software filter

Reset: Set the channel vertical position to zero

Invert: Turn on/off the invert function.

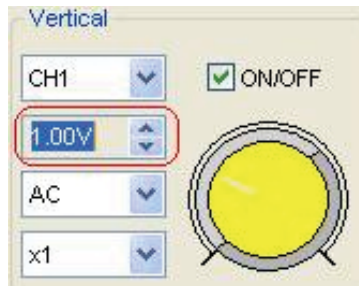
BandWidth Limit: Limit the channel bandwidth to 20MHz to reduce noise.

Change Volt/DIV

You can click "Volt/Div" in "Vertical Setup" window to select the voltage



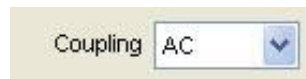
You can also change the selected channel voltage in sidebar



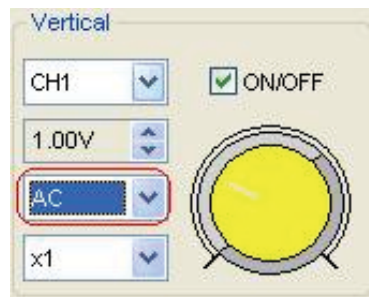
You can left click and drag the mouse on the knob to change the voltage.

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.

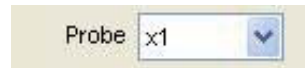
Probe Attenuation Setting

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.

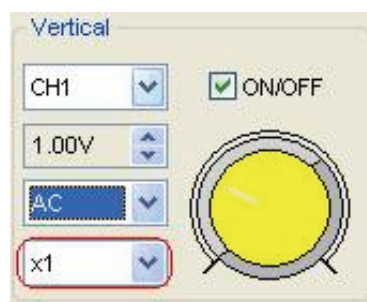
This setting remains in effect before you changed again.

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



The probe setting window in the sidebar

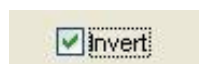


Note: The attenuation factor changes the vertical scale of the oscilloscope so that the measurement results reflect the actual voltage levels at the probe tip.

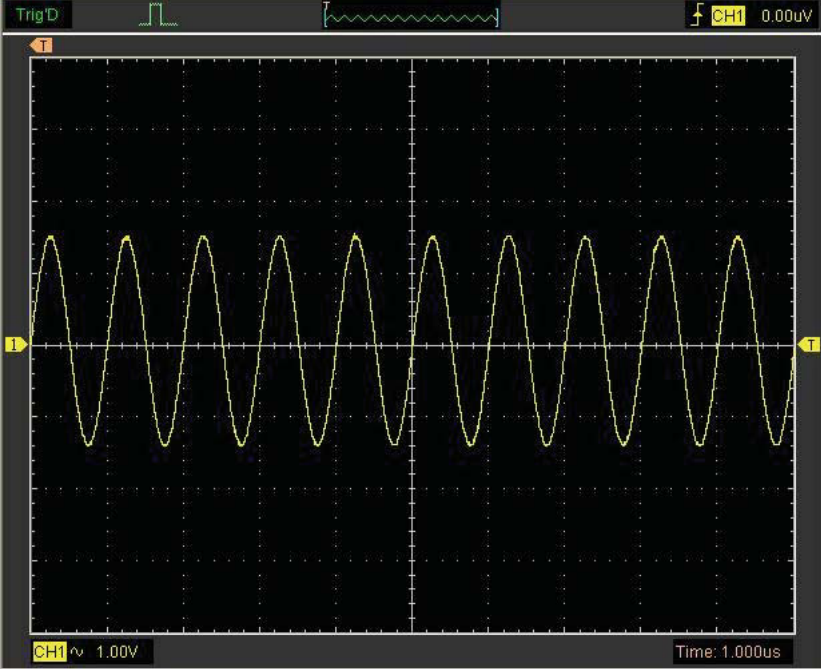
Invert

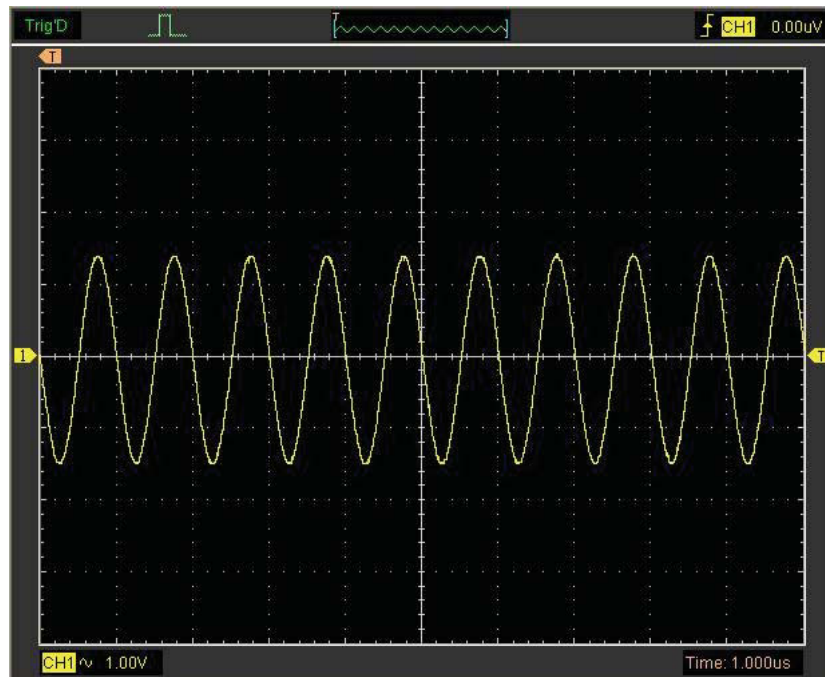
The invert function turns the displayed waveform 180 degrees, with respect to the ground level. When the oscilloscope is triggered on the inverted signal, the trigger is also inverted.

Click **"Invert"** in Vertical window



The following picture shows the waveform before inversion:





Set the Channel Bandwidth Limit

The oscilloscope is set to full bandwidth and will pass the high frequency component in the signal if the “**BW Limit**” was turned off.

The oscilloscope will reject the frequency component higher than 20MHz if the “**BW Limit**” was turned on.

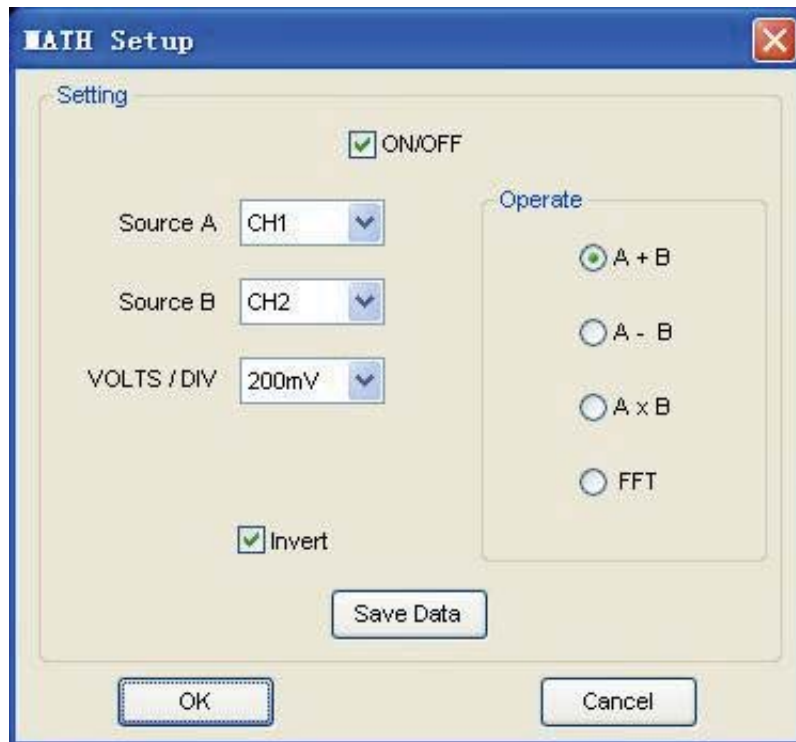


When the “**BW Limit**” was turned on, a “B” sign will be displayed at the bottom of display screen.



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.

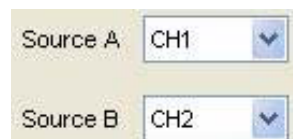
Probe: Set the math channel probe attenuation.

Invert: Turn on/off the invert function

The mathematic functions include addition, subtract, multiply and FFT for CH1, H2,CH3 and CH4.

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

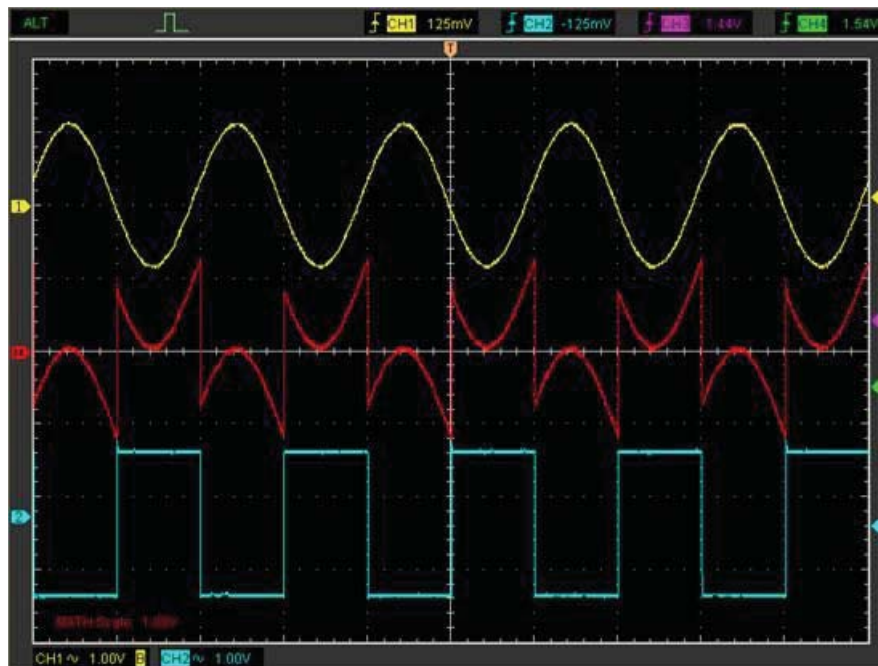
A × B Multiply source A by source B

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.

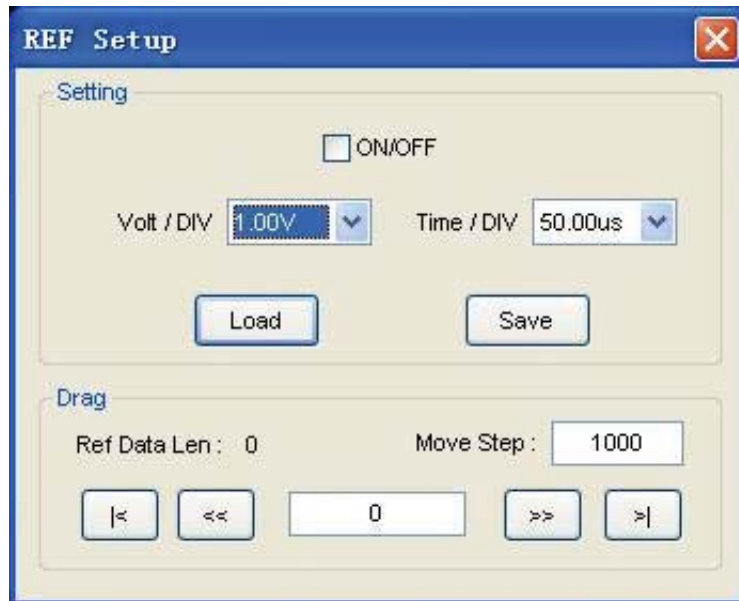
Select the operation type in the **Operate** menu. Select source A and B. Then adjust the vertical scale and offset to view the math channel clearly. The mathematic result can be measured by the measure and the cursor.

The Math Function Display



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: Select 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.

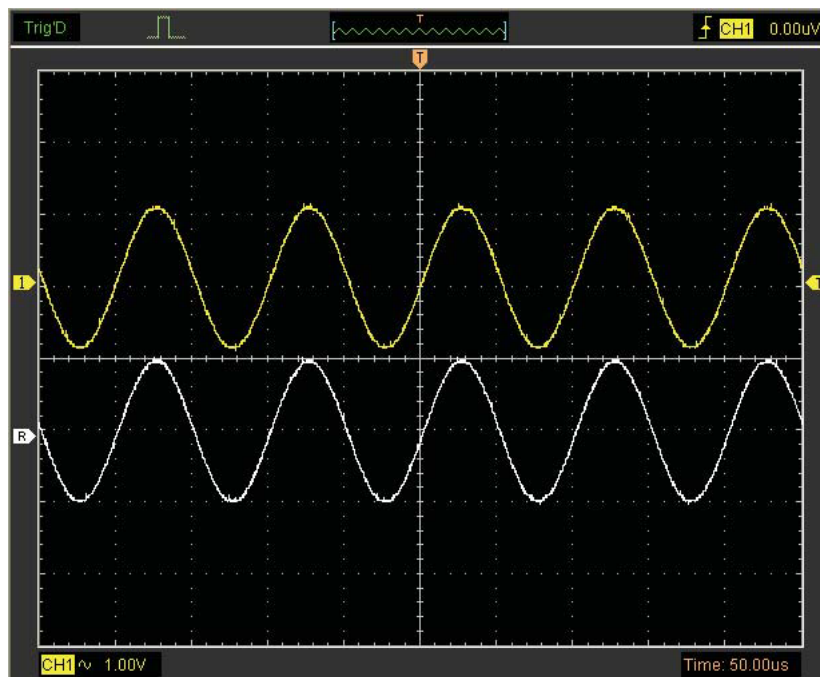
Save

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.

Setup Horizontal System

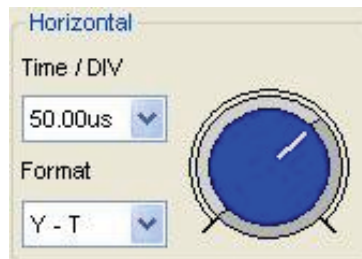
Change Time/Div

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** and **Roll**).

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

Roll: In Roll Mode, the waveform display updates from right to left

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

In **Roll** mode, the waveform display rolls from right to left. No trigger or horizontal offset control of waveforms is available during Roll Mode, and it's only available when set to 1s/div or slower.

Note: If the time/div bigger than 1s, the format will change to Roll mode automatically.

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.

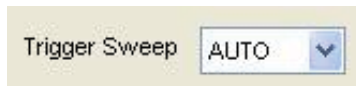
If the oscilloscope wants to acquire a waveform, it collects enough data so that it can draw the waveform to the left of the trigger point. The oscilloscope continues to acquire data while waiting for the trigger condition to occur. The oscilloscope continues to acquire enough data so that it can draw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

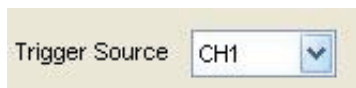


Auto: Acquire waveform even when no trigger occurred

Normal: Acquire waveform when trigger occurred.

Single: Acquire waveform when trigger occurred then stop

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



USER'S MANUAL

CH1: Select CH1 as trigger signal

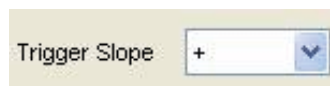
CH2: Select CH2 as trigger signal

CH3: Select CH3 as trigger signal

CH4: Select CH4 as trigger signal

EXT: Select EXT as trigger signal

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

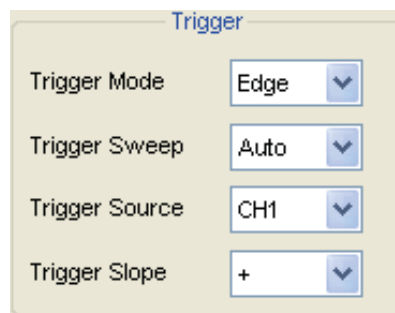


Trigger Slope + ▾

Rising: Trigger on rising edge

Falling: Trigger on falling edge

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

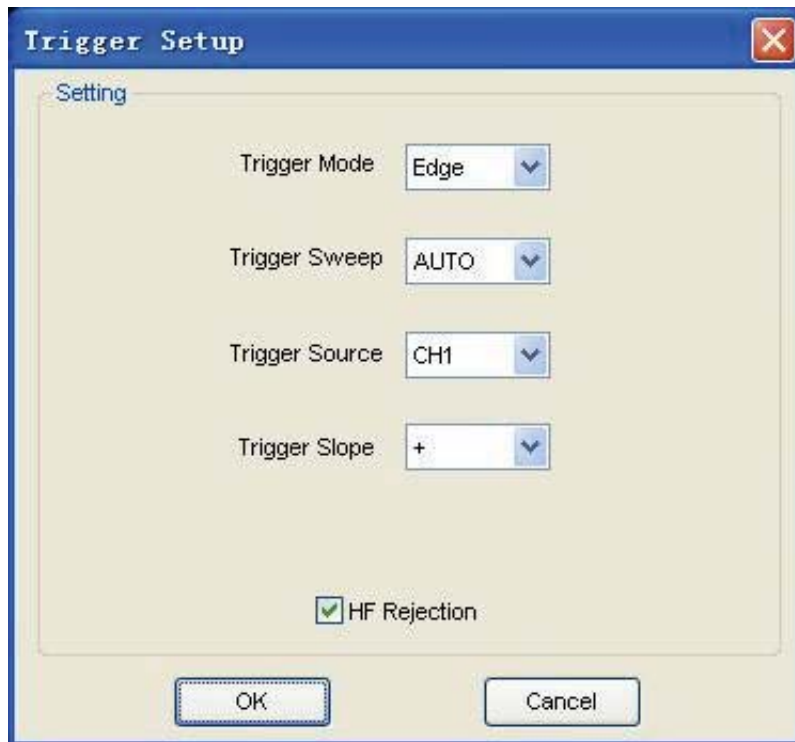


Trigger

Trigger Mode	Edge ▾
Trigger Sweep	Auto ▾
Trigger Source	CH1 ▾
Trigger Slope	+ ▾

High Frequency Rejection

Select **"HF Rejection"** in **"Trigger Setup"** window

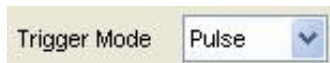


The user can turn on “HF Rejection” to ignore triggers from higher frequencies (20M above).

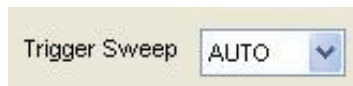
Set Pulse Trigger

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

Mode: Select the trigger mode to **Pulse**.



Sweep: Set the sweep mode to **AUTO**, **NORMAL** or **SINGLE**.

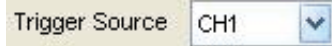


AUTO: Acquire waveform even when no trigger occurred

NORMAL: Acquire waveform when trigger occurred.

SINGLE: Acquire waveform when trigger occurred then stop

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



Trigger Source CH1

CH1: Select CH1 as trigger signal

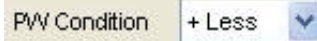
CH2: Select CH2 as trigger signal

CH3: Select CH3 as trigger signal

CH4: Select CH4 as trigger signal

EXT: Select EXT as trigger signal

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



PW Condition + Less

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

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

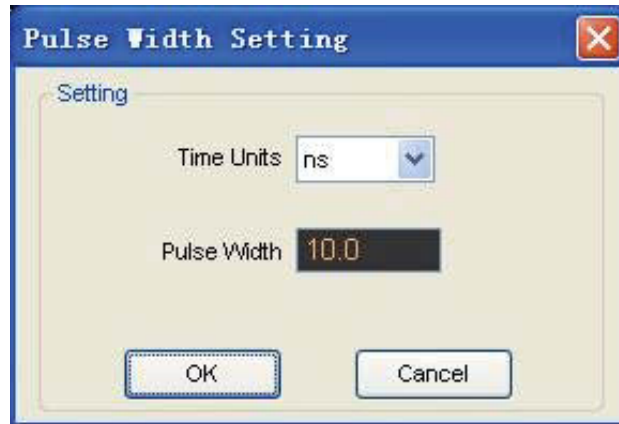
+Equal: +Pulse width equal to set pulse condition.

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

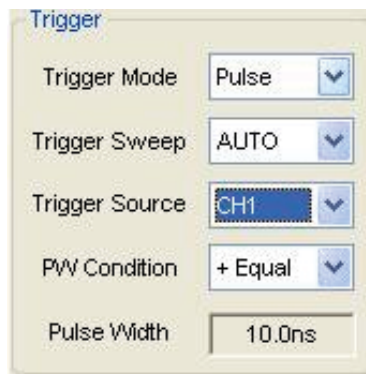
-Less: -Pulse width less than set pulse condition.

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

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



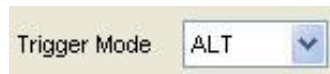
The user can also change the trigger setting on trigger panel in sidebar.



When the 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.

Set ALT System

Mode: Select the trigger mode.



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

Trigger Channel CH1

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

Trigger Type Pulse

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

PW Condition + Less

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

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

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

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

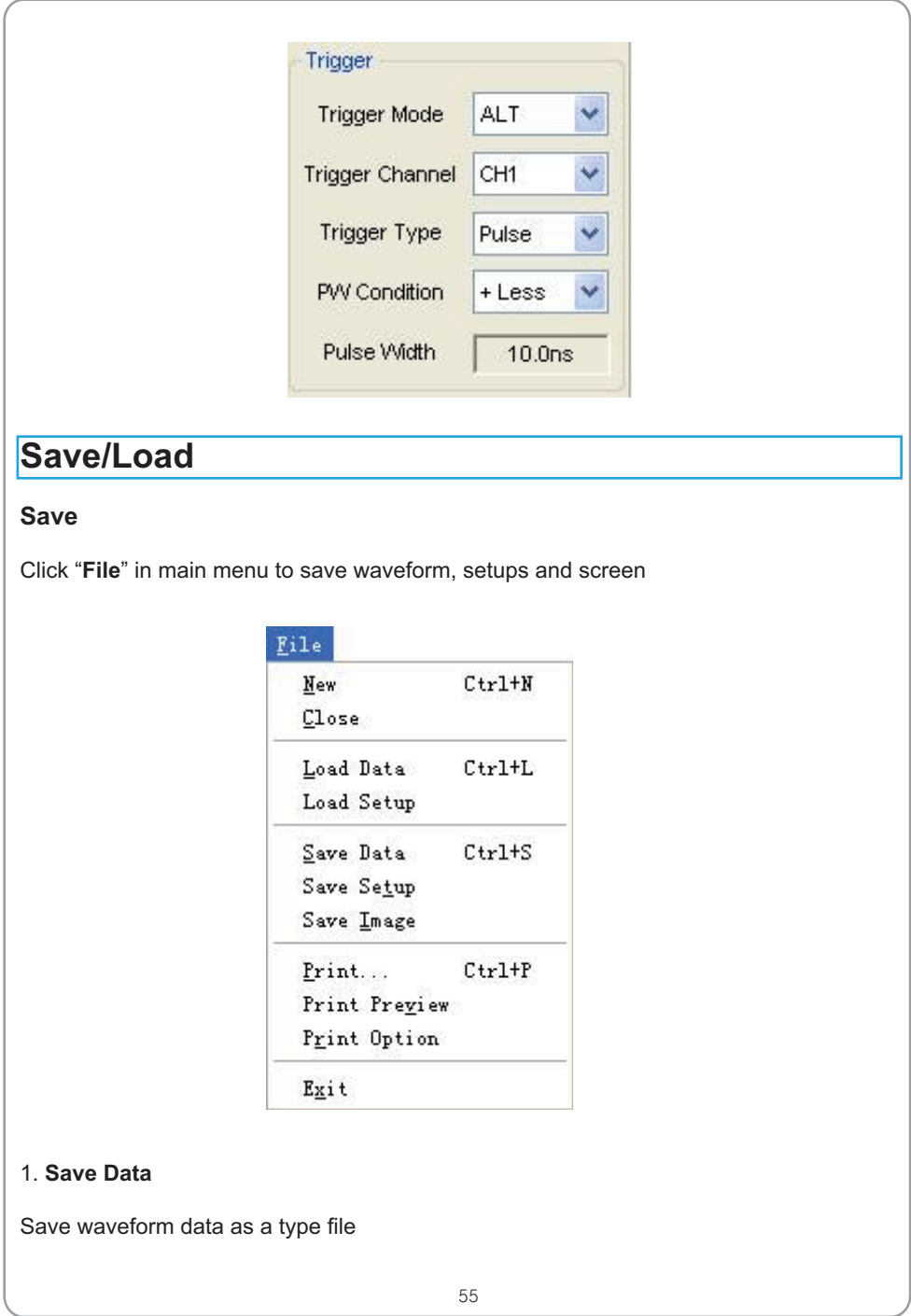
-Less: -Pulse width less than set pulse condition.

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

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



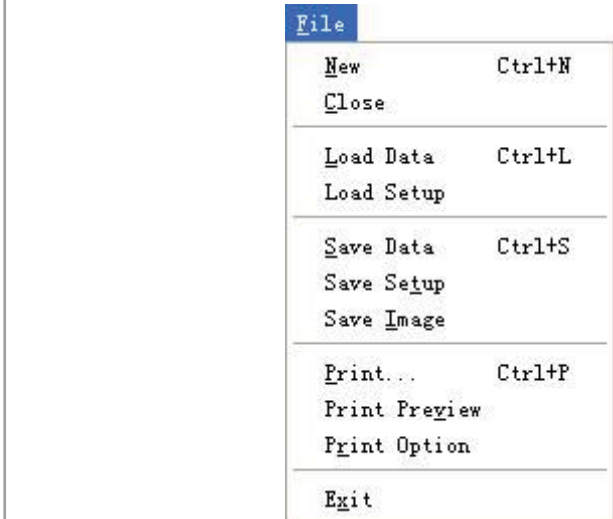
The user can also change the trigger setting on trigger panel in sidebar.



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

File	
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. **Load Data**

Load the waveform that had saved as a type file

2. **Load Setup**

Load the instrument that had saved

Utility/Function

Record and Play Back

Click **Record** in **Utility** menu.



The **Record** window will display. The following picture shows the **Record** Interface.

Record And Play Back

Record Setup

Source

CH1

▼

End Frame

1000

▲▼

Record

0

Start

Play Back Setup

Start Frame

1

▲▼

End Frame

1000

▲▼

Current Frame

1

▲▼

Play

This function can record input waveform form CH1,CH2,CH3, or CH4. The maximum record length is **1000** frames.

Record Setup window

Record Setup

Source

CH1

▼

End Frame

1000

▲▼

Record

0

Start

Source:

Source

CH1

▼

Select record source channel. (CH1, CH2, CH3 or CH4)

End Frame:

End Frame

1000

▲▼

Set the number of record times. The max frames are 1000.

Record: Record 0

Record counter, displays the record frames.

Start

“Start” button:

Start to record frames. After you start to record waveforms, this button changes to **“Stop”** button. It stops recording waveforms.

Play back setup window

Play Back Setup

Start Frame	1	Play
End Frame	1000	
Current Frame	1	

Start Frame: Start Frame 1

Set the start frame of play back.

End Frame: End Frame 1000

Set the end frame of play back.

Current Frame: Current Frame 1

Displays the current frame of play back. You can also change this number to watch the waveform one by one.

Play

“Play” button:

Click this button to start playing back waveform. It can stop playing back if you started playing back.

Load

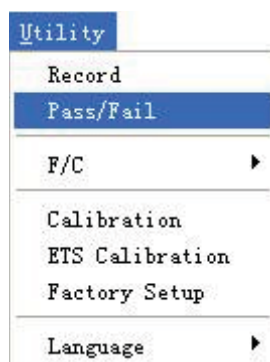
“Load” button:

Click this button to load a record setup.

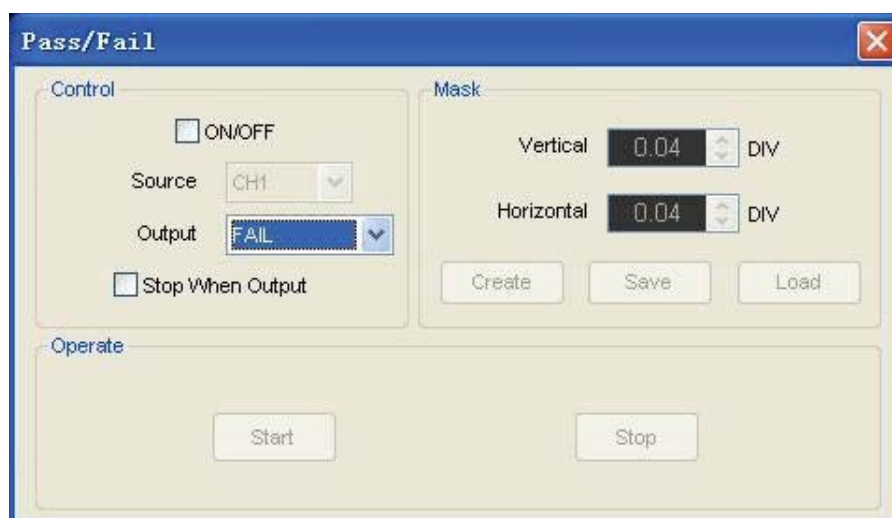
Note: When it plays back waveform, the other channel will be turned off.

Pass/Fail

Click **"Pass/Fail"** in **"Utility"** menu

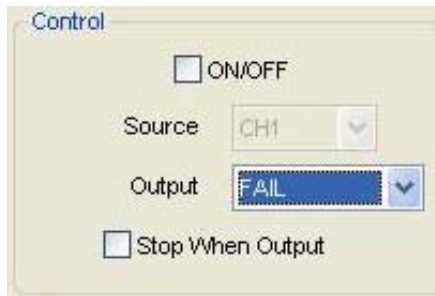


The **Pass/Fail** window appears:



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 CH1 

Output **FAIL**

☐ Stop When Output

Mask Setting



Vertical 0.04 DIV

Horizontal 0.04 DIV

Create

USER'S MANUAL

Click this button to create Pass/Fail area according to the mask

Save

“Save” button:

Click this button to save the setups to file.

Load

“Load” button:

Click this button to load the saved setups file.

Information Display



Pass: 604 wfs
Fail: 90 wfs
Total: 694 wfs

Fail:

Displays the fail waveform number

Pass:

Displays the pass waveform number

Total:

Displays the I total **Pass/Fail** waveform number

Operation

Operation

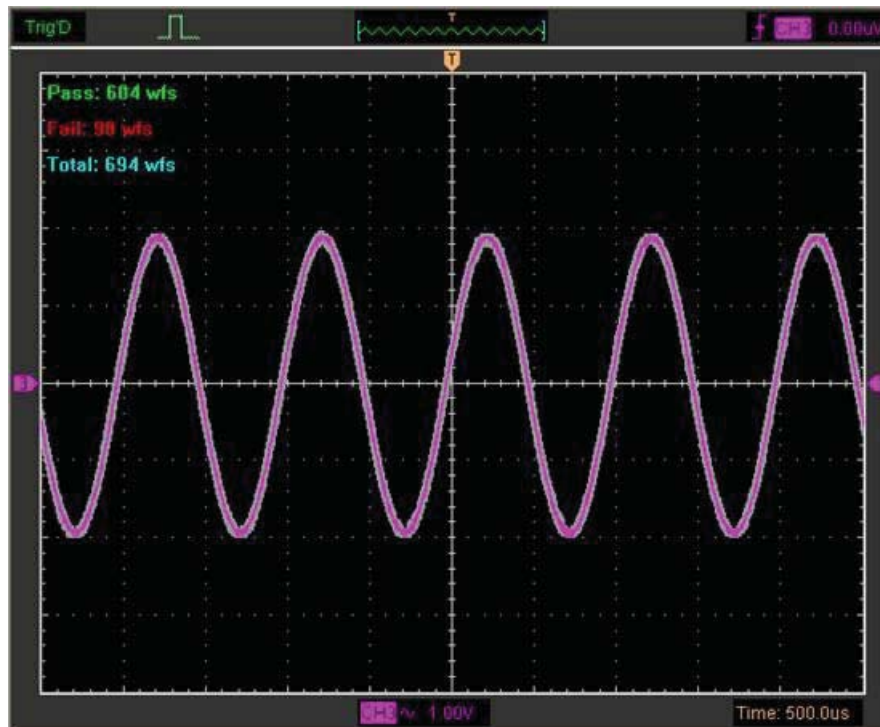
Start

Stop

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

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

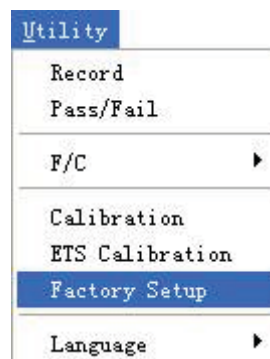
The Pass/Fail function display



NOTE: Pass/Fail function is unavailable In **X-Y** mode and **Roll** mode.

Factory Setup

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



USER'S MANUAL

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

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

The Factory Setup function does not reset the following settings:

- Language option
- Date and time

Language

Click "**Language**" in "**Utility**" menu



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

Measure Signal

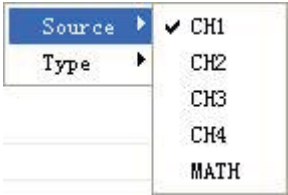
Cursor Menu

Click **Cursor** in main menu



This method allows you to take measurements by moving the cursors

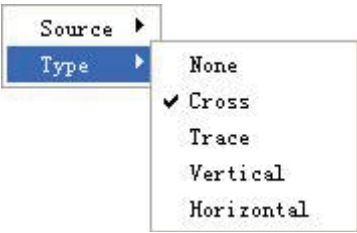
1. Source



The user can set the source to **CH1**, **CH2**, **CH3**, **CH4** 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**

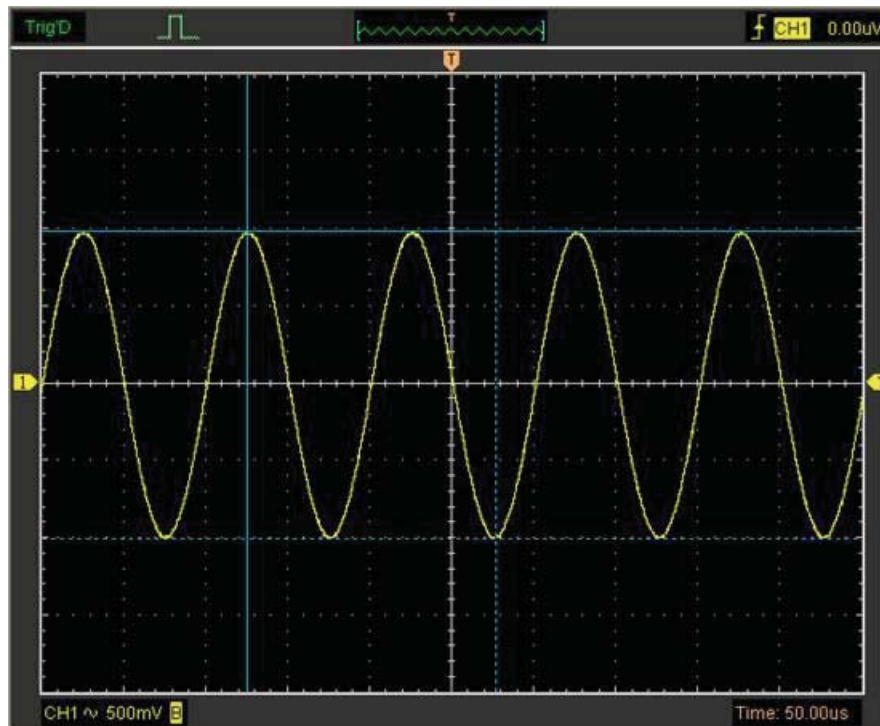
1) **Cross**

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

USER'S MANUAL

horizontal parameters.

The **Cross** cursor display window



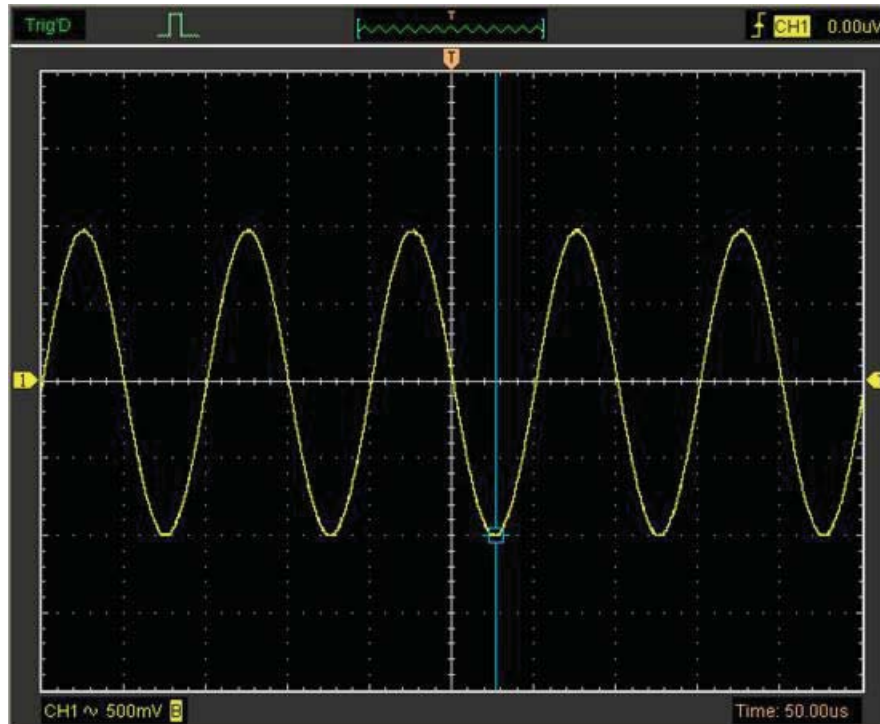
The **Cross** measure result displays on status bar

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



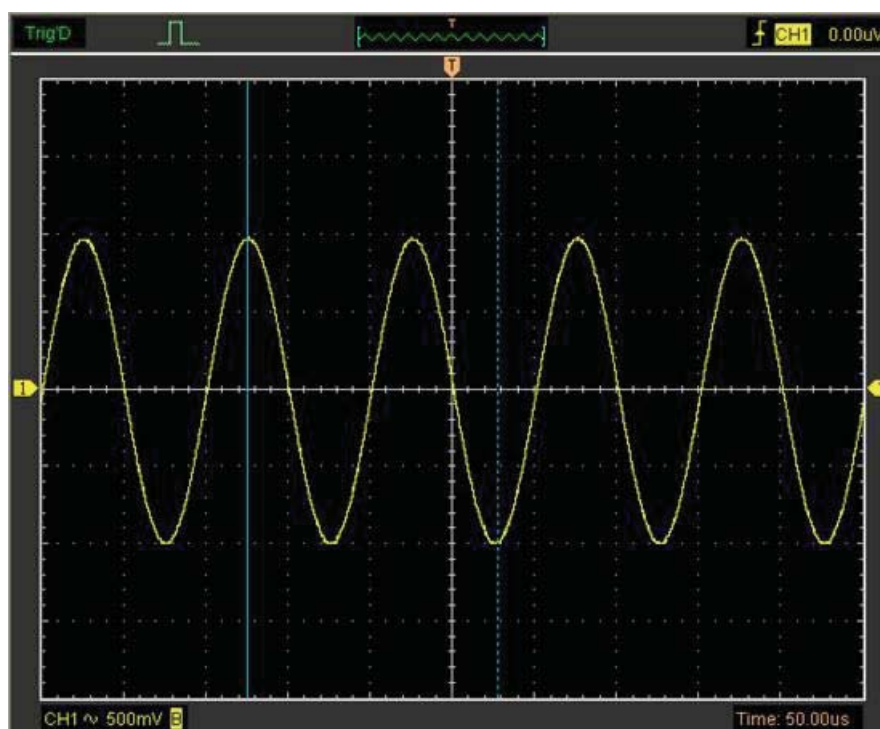
The **Trace** cursor measure result displays on status bar

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



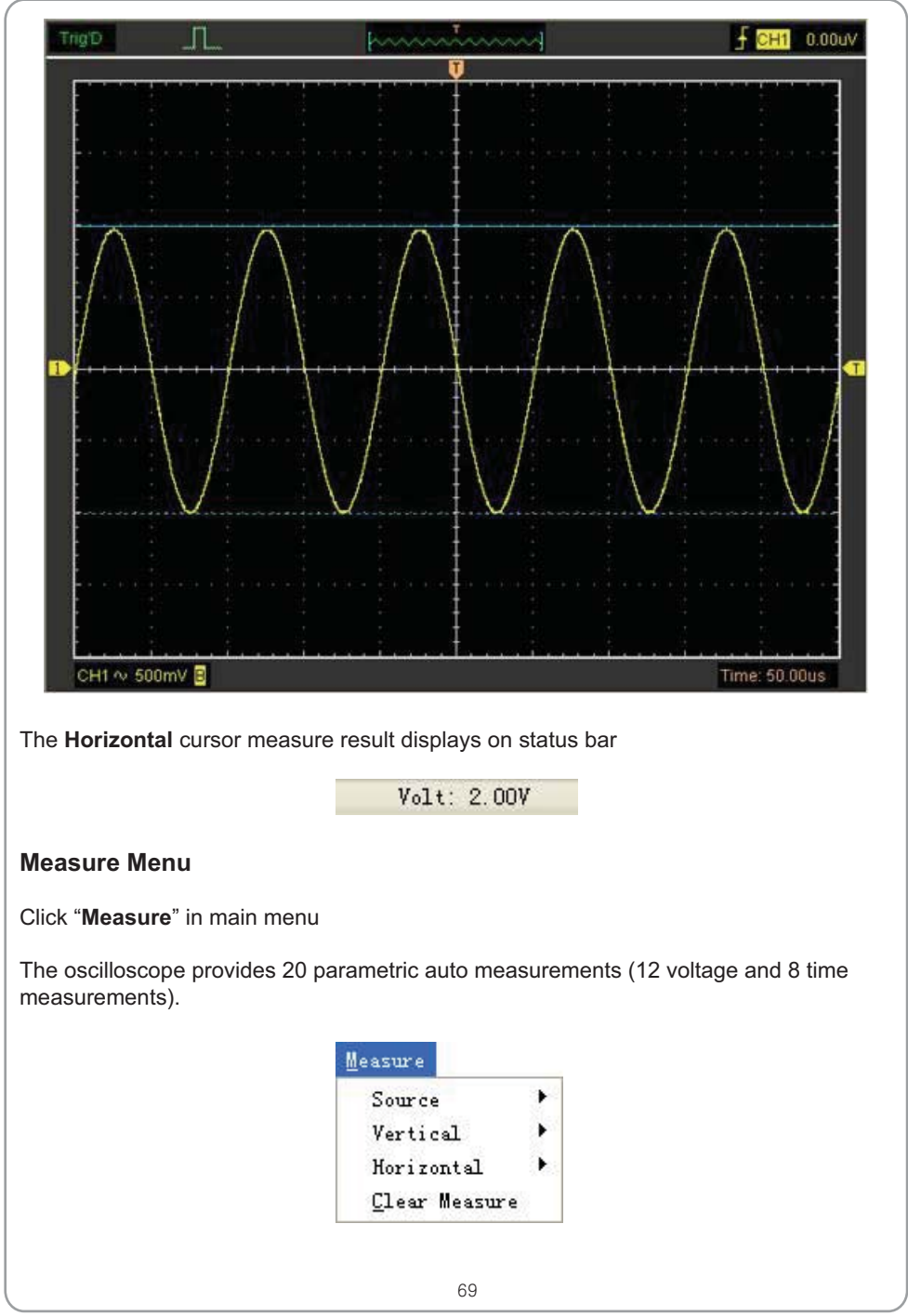
The **Vertical** cursor measure result displays on status bar

Freq: 6.552KHz	Time: 153uS
----------------	-------------

4) Horizontal

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

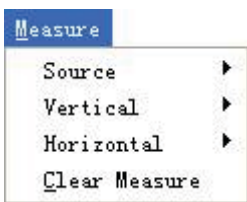
The **Horizontal** cursor display window



Volt: 2.00V

[illegible]

The oscilloscope provides 20 repetitive auto measurements (10 voltage and 9 time



USER'S MANUAL

1. Source

Source	▶	✓ CH1
Vertical	▶	CH2
Horizontal	▶	CH3
Clear Measure		CH4

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

2. Vertical

Source	▶	
Vertical	▶	Maximum
Horizontal	▶	Minimum
Clear Measure		Peak to Peak
		Top
		Base
		Middle
		RMS
		Amplitude
		Mean
		Cycle Mean
		Positive Overshoot
		Negative Overshoot

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

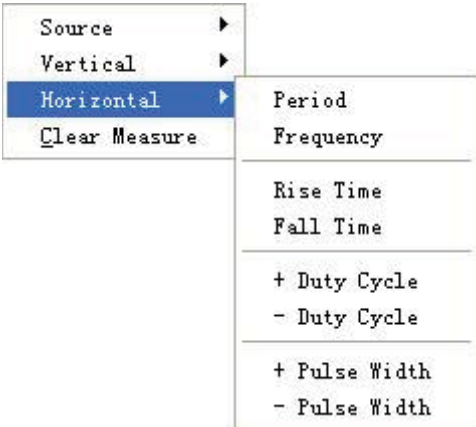
Mean: The arithmetic mean over the entire waveform

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

Preshoot: Positive Overshoot = (Max - Top)/Amp x 100 %, Measured over the entire waveform

Overshoot: Negative Overshoot = (Base - Min)/Amp x 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 = (Positive Pulse Width)/Period x 100%, Measured of the first cycle in waveform

-Duty Cycle: Negative Duty Cycle = (Negative Pulse Width)/Period x 100%, Measured of the first cycle in waveform

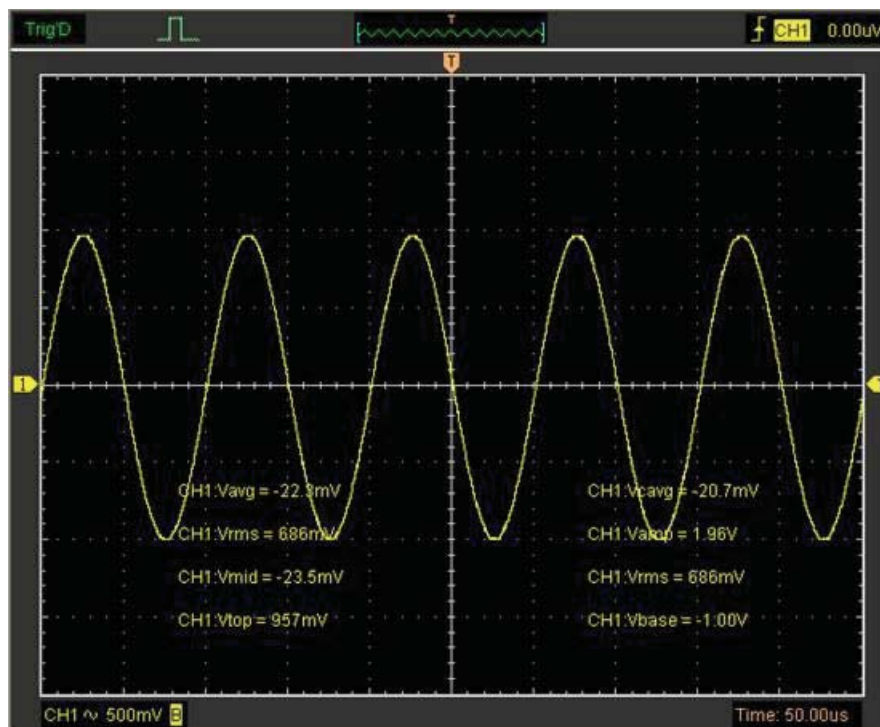
+Pulse Width: Measured of the first positive pulse in the waveform. The time between the 50% amplitude points

-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 can be displayed at the same time. When there is no room, the next new measurement result will make the previous results move left, out of screen.

The Display System

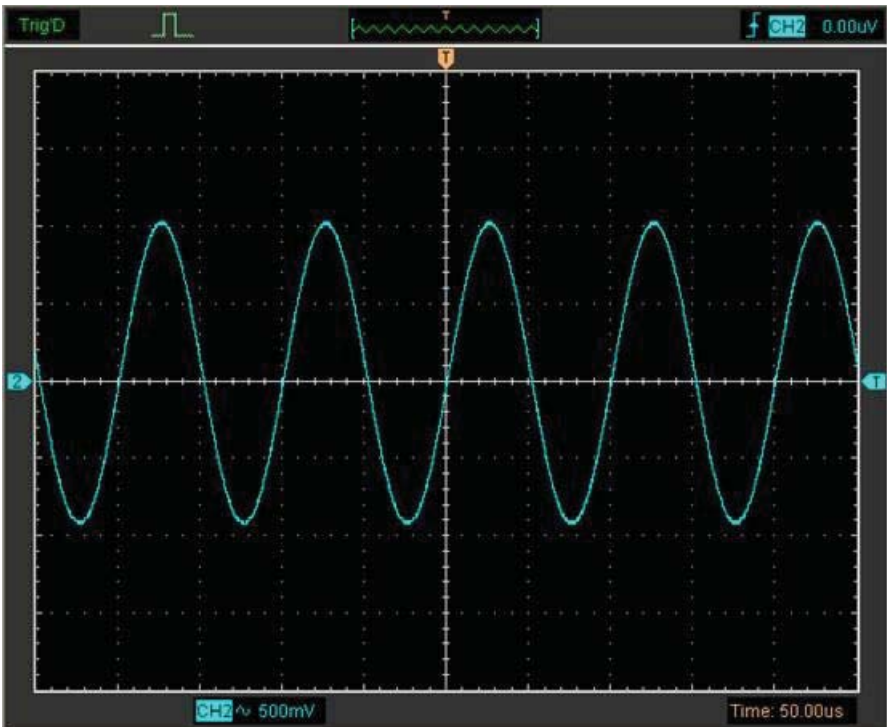
Display Type

Click **Type** in **Display** menu.

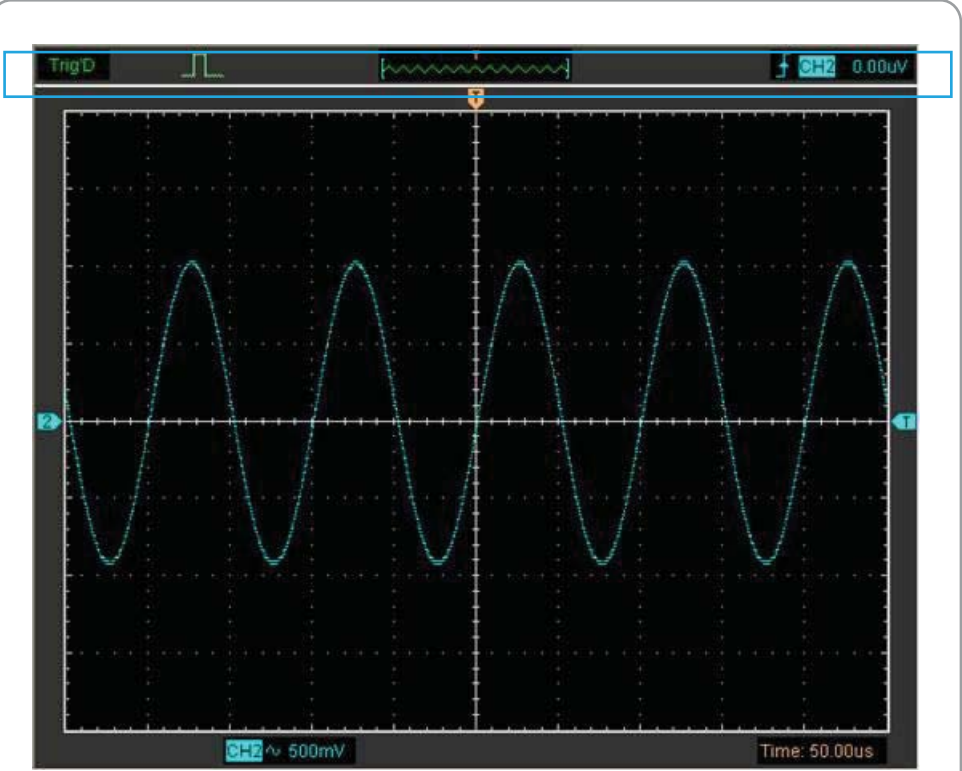
The following figure shows the type parameters setting.



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.

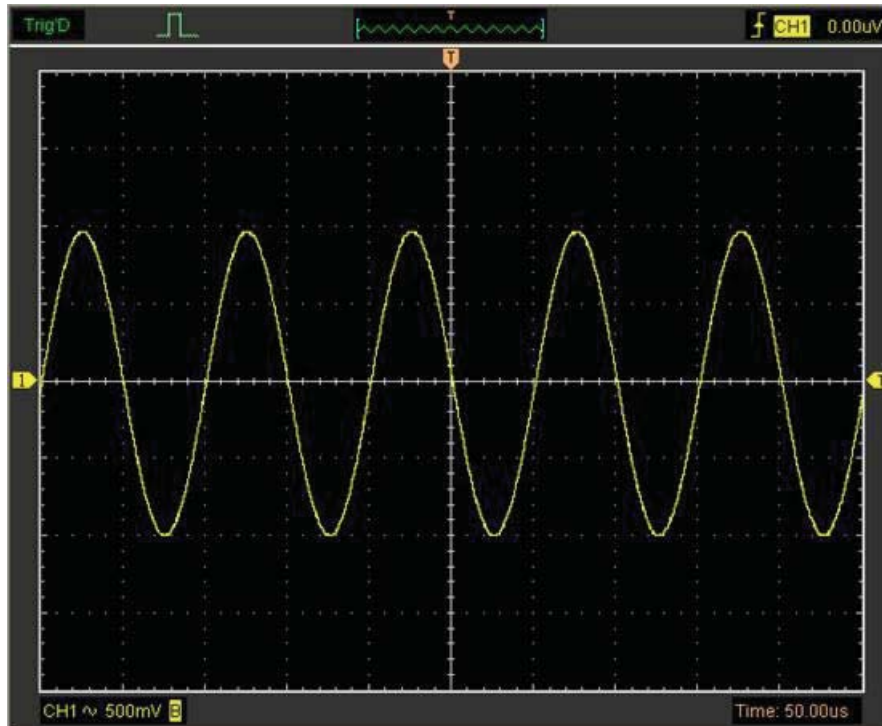


Display Grid

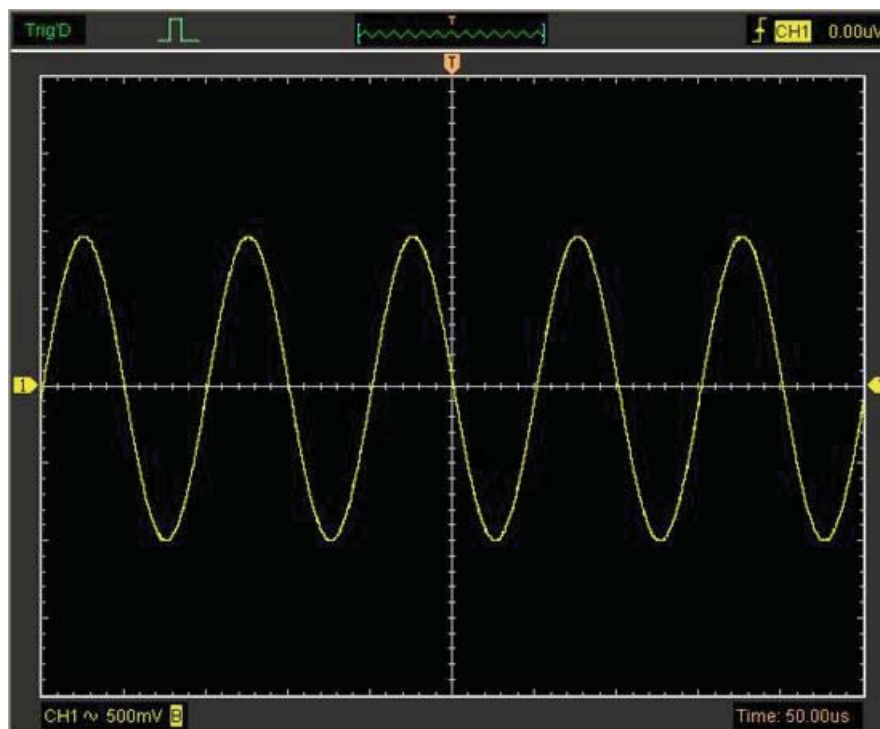
Click “Display” in main menu



The grid shows:



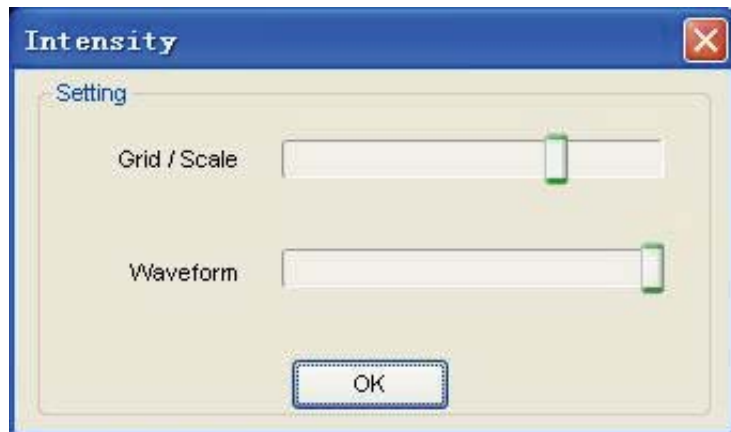
without the grid displayed:



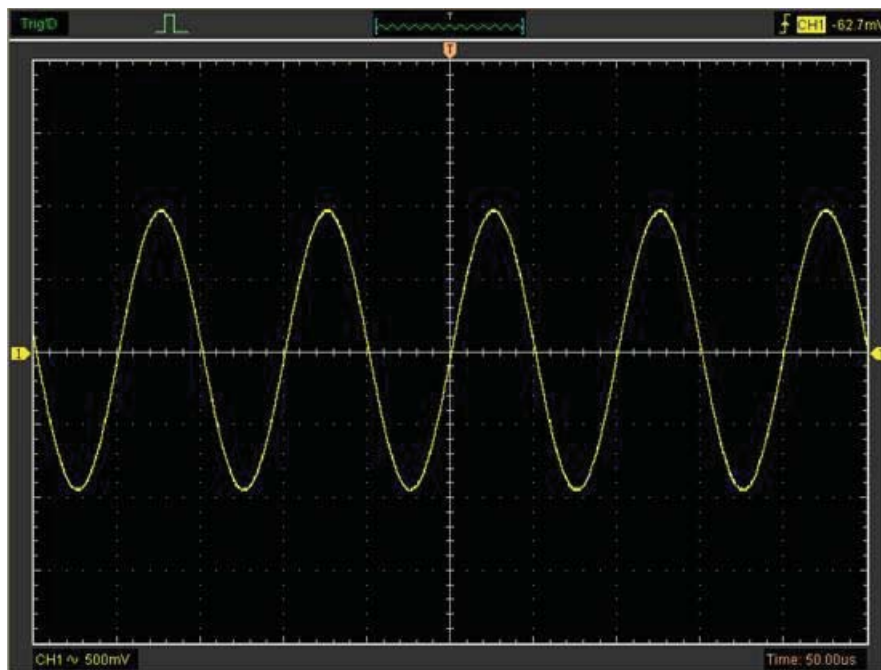
Intensity and Persistence

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.



Zoom In/Out and Drag Waveforms

The software will stop updating waveform after the user clicks “ **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.

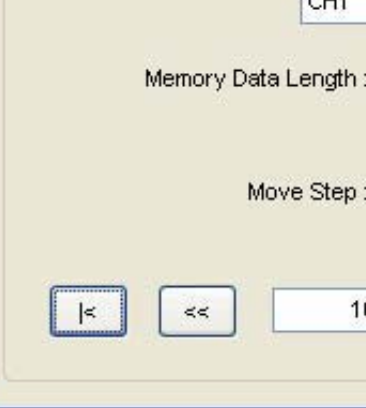
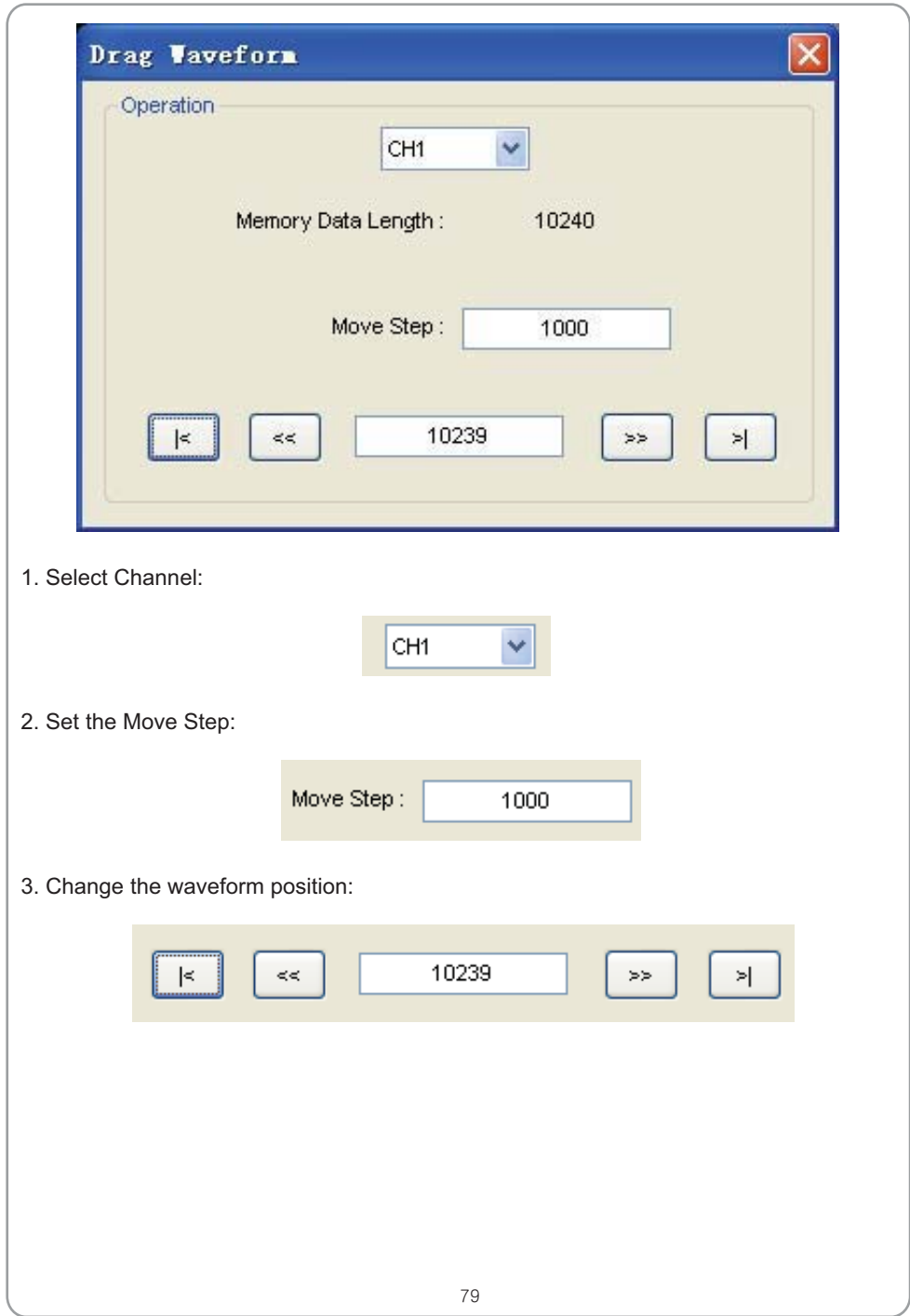


Zoom In/Out

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.

Drag

The user can modify the waveform position after clicked “**Drag**” in “**Acquire**” menu following the following steps.



Drag Waveform

Operation

CH1

Memory Data Length : 10240

Move Step : 1000

|< << 10239 >> >|

1. Select Channel:

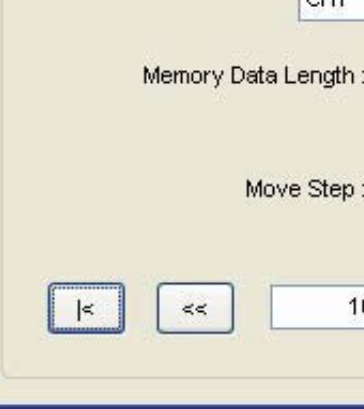
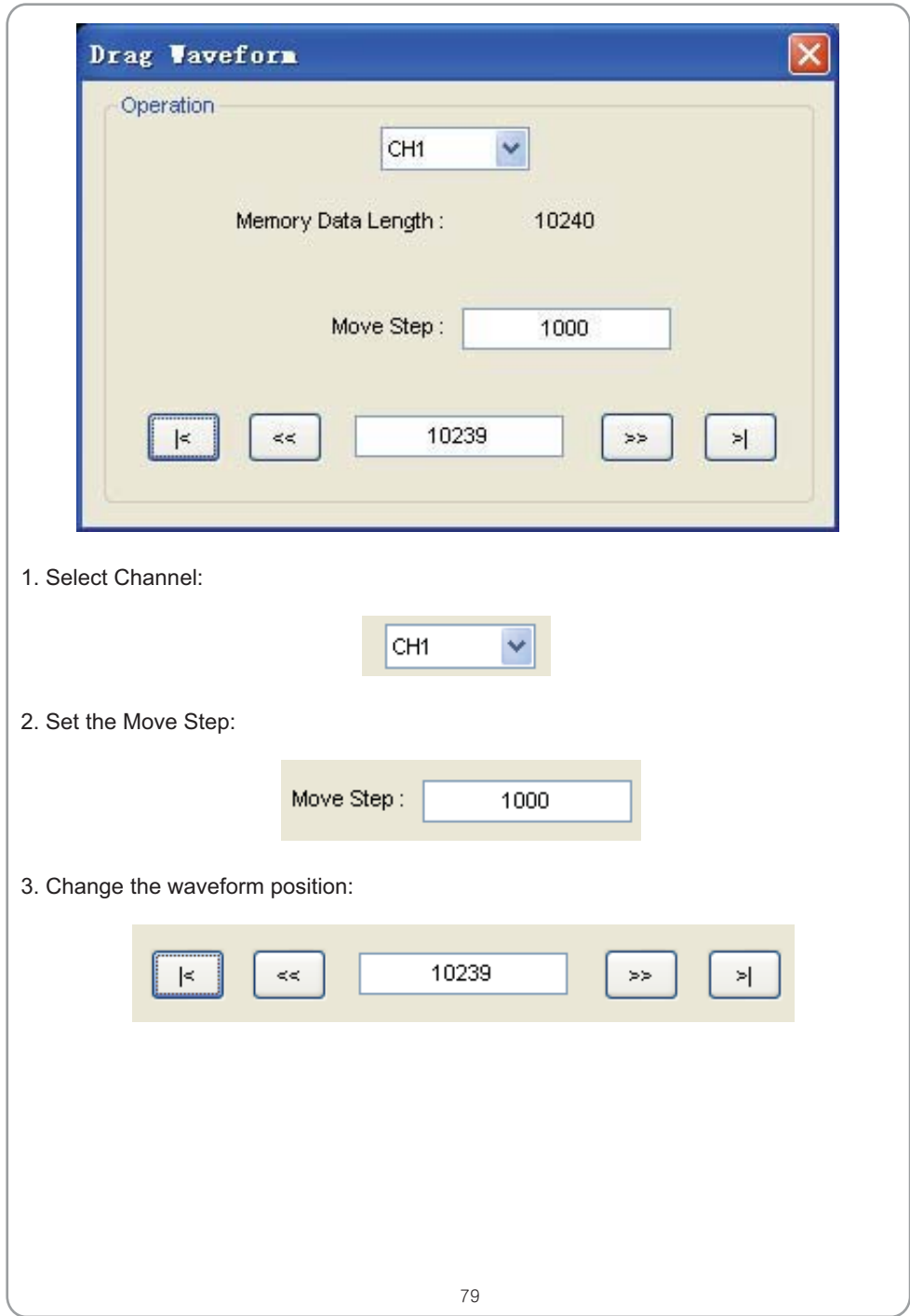
CH1

2. Set the Move Step:

Move Step : 1000

3. Change the waveform position:

|< << 10239 >> >|



Drag Waveform

Operation

CH1

Memory Data Length : 10240

Move Step : 1000

|< << 10239 >> >|

1. Select Channel:

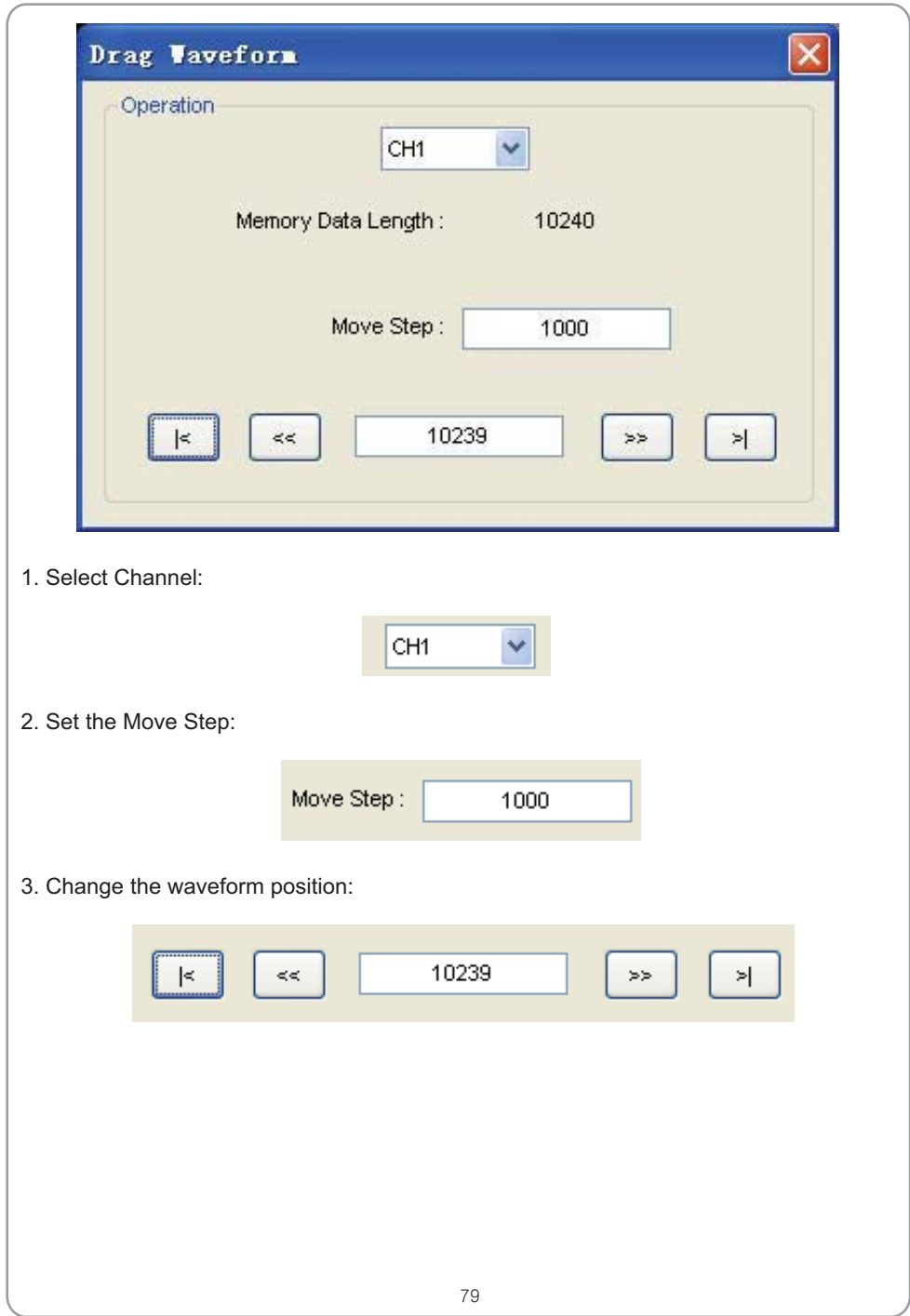
CH1

2. Set the Move Step:

Move Step : 1000

3. Change the waveform position:

|< << 10239 >> >|



Drag Waveform

Operation

CH1

Memory Data Length : 10240

Move Step : 1000

<| << 10239 >> >|

1. Select Channel:

CH1

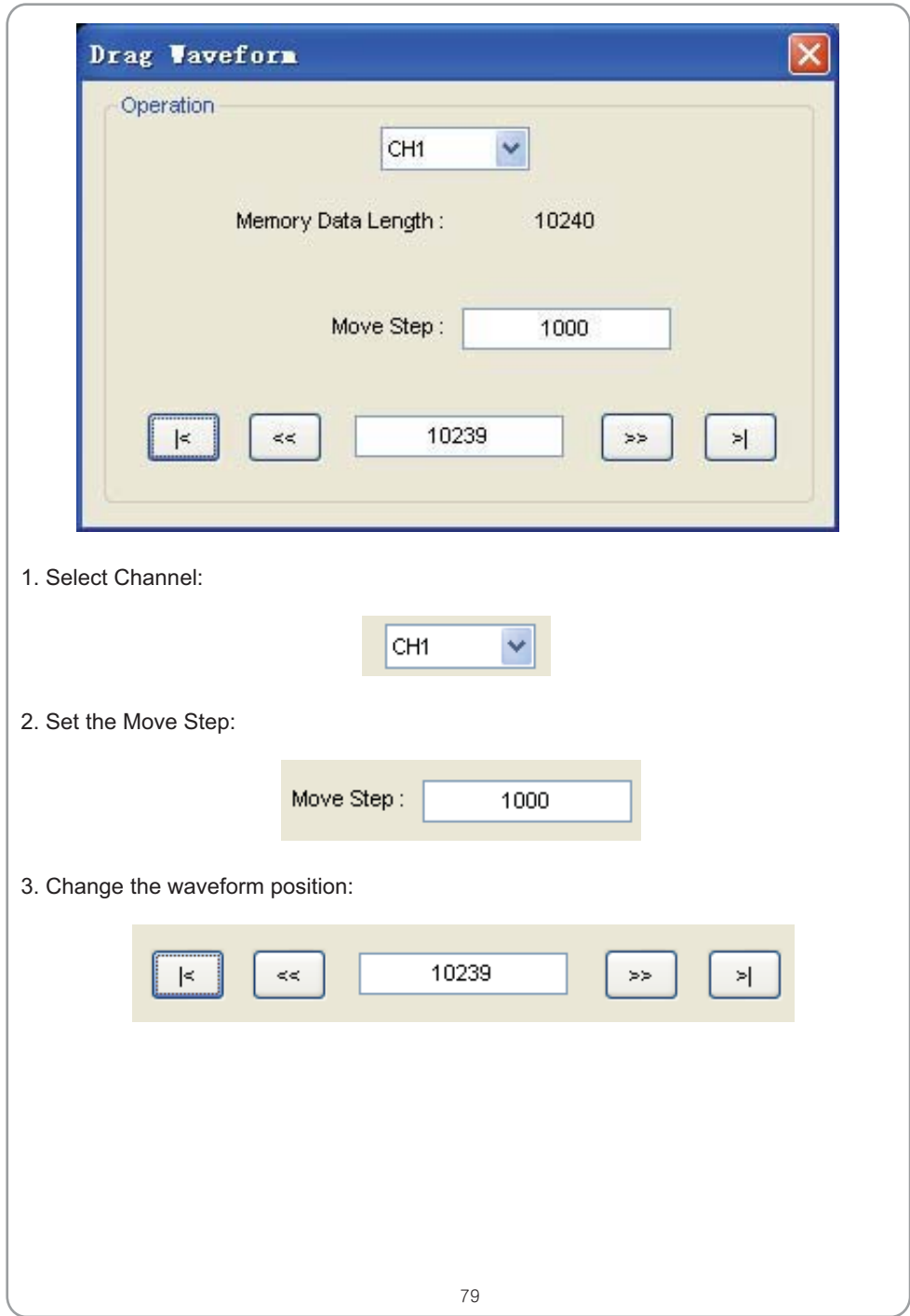
2. Set the Move Step:

Move Step : 1000

3. Change the waveform position:

<| << 10239 >> >|

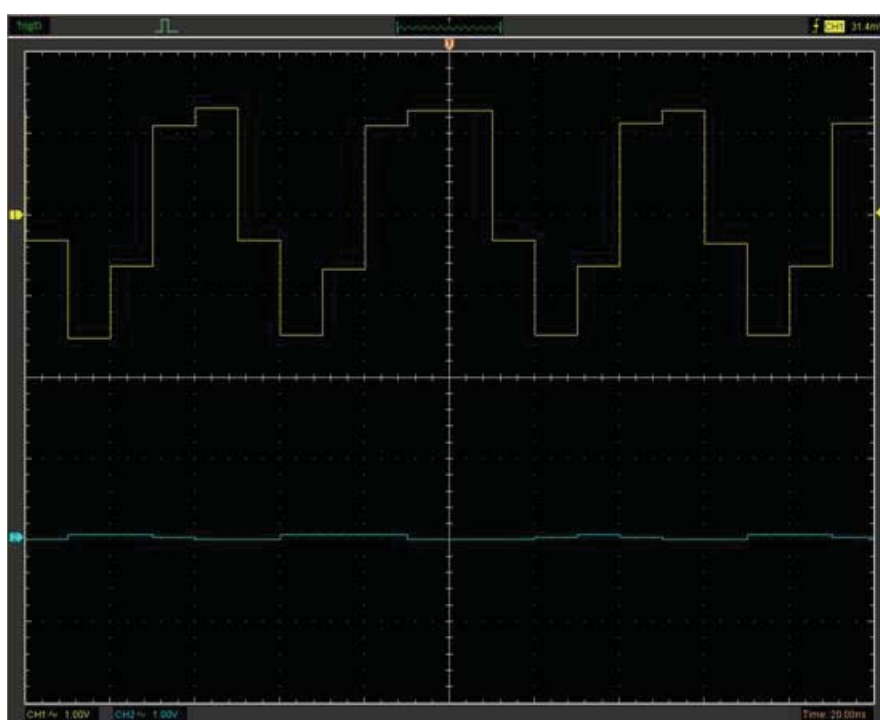
79



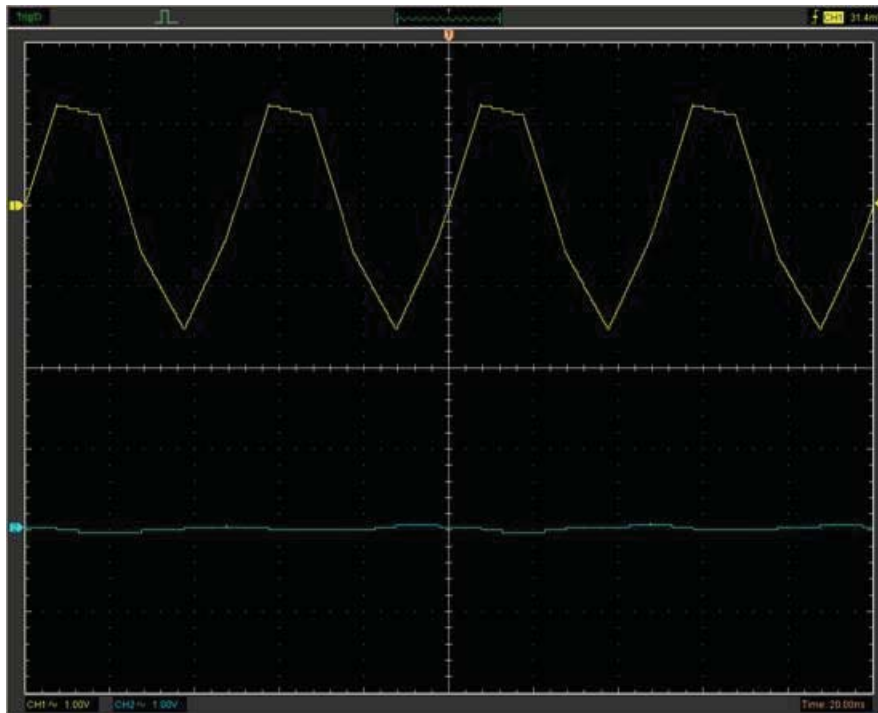
Interpolation

At the time base 40ns/div or faster, user can use the 3 different interpolation mode to get waveforms of different clarity.

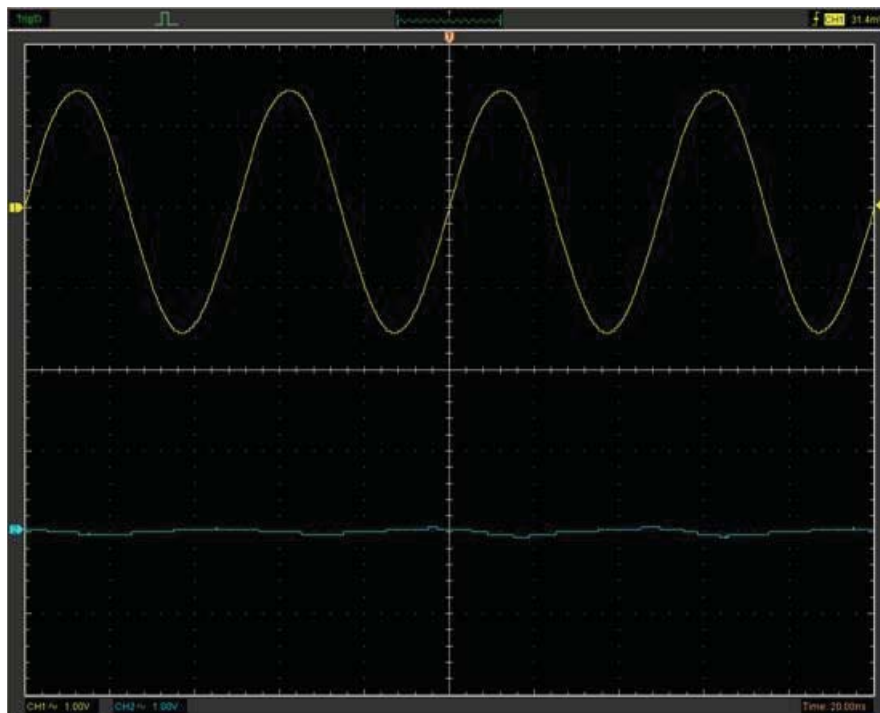
The **Step** Interpolation



The **Linear** Interpolation



The $\text{Sin}(x)/x$ Interpolation



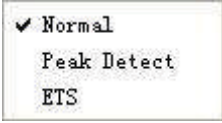
Note: The default interpolation mode is Sin(x)/x.

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.

Acquisition Modes

There are two acquisition modes: Normal and Average.



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.

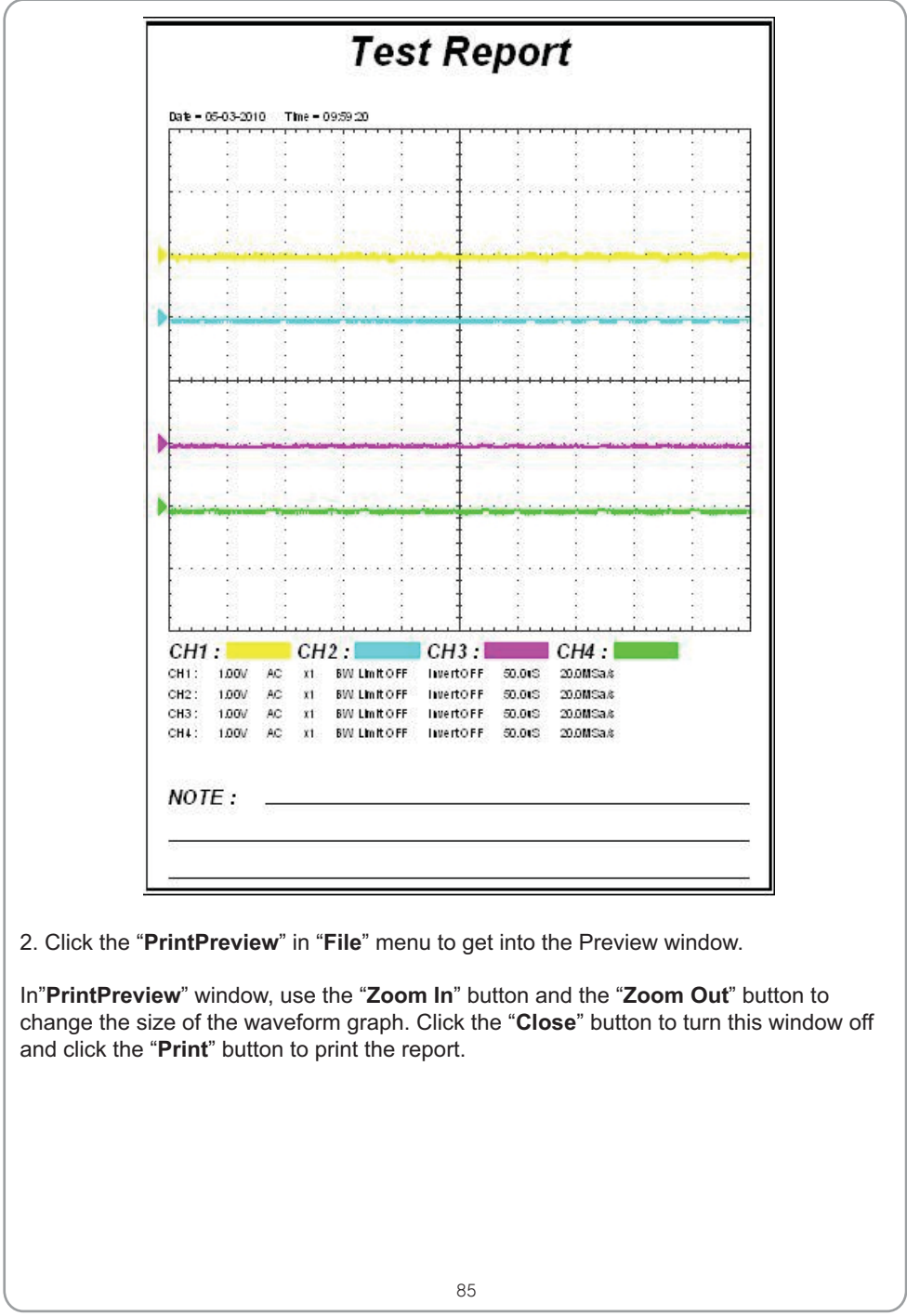
ETS: In this acquisition mode, you can test high frequency cycle signal.

Print And Print Preview

File	
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.

The Print report



In the **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.

Chapter 4 Application Examples

- Sample Measurement
- Pass/Fail Test
- Capturing a Single-Shot Signal
- The Application of the X-Y
- Taking Cursor Measurement

Simple Measurement

To acquire and display a signal, follow these steps:

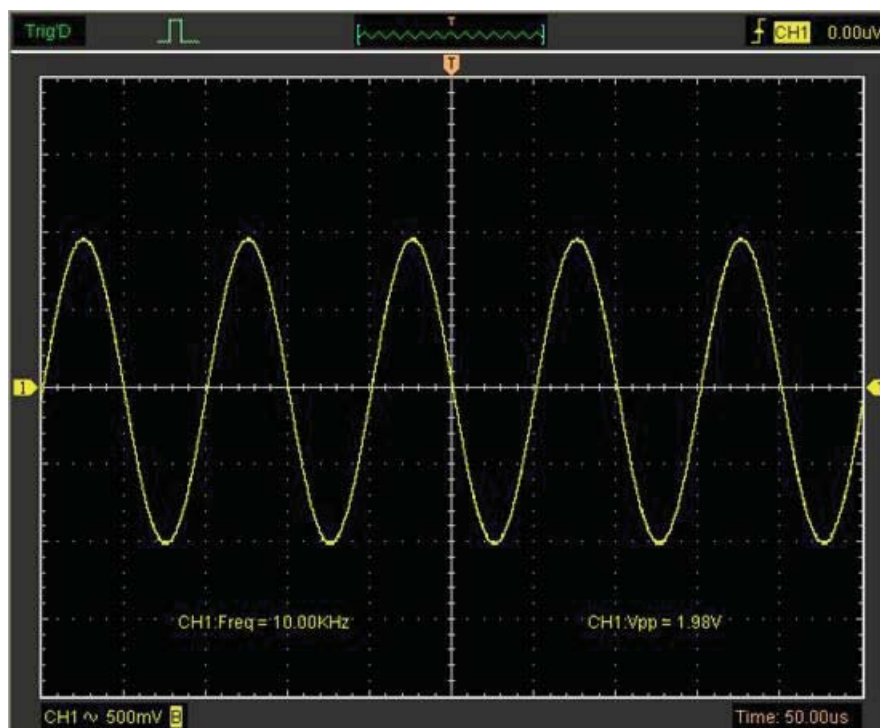
1. Connect signal to **CH1** by using probe
2. Click the "AUTO" button on toolbar or "**Acquire -> Auto Setup**" on menu.

The Tenma 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”, follow these steps:

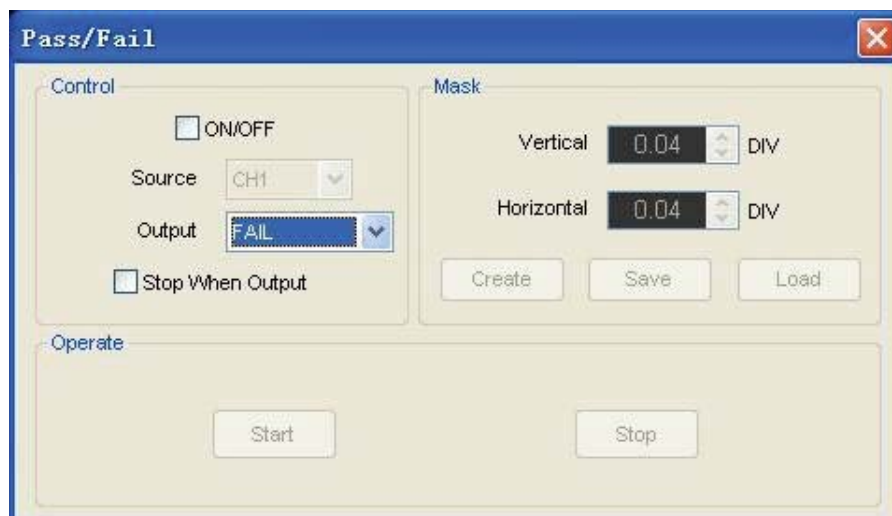
1. Click the **“Measure->Horizontal->Frequency”** button, the frequency of the signal display on the bottom of the waveform interface.
2. Click the **“Measure->Vertical->Peak-to-Peak”** button, the **“Vpp”** of the signal will also display on the bottom of the waveform interface.
3. To clear the measurement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

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Pass/Fail Test

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: Source CH1 ▼
Select the **Pass/Fail** channel

Output: Output FAIL ▼

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Select the **Pass/Fail** output condition

Stop When Output: ☐ Stop When Output

If it was checked, the Pass/Fail will stop when output.

Mask Setting

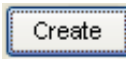


Vertical: The control shows 'Vertical' followed by a numeric input field with '0.04' and a 'DIV' unit selector.

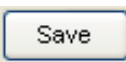
Set the vertical limit range

Horizontal: The control shows 'Horizontal' followed by a numeric input field with '0.04' and a 'DIV' unit selector.

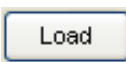
Set the horizontal limit range

“Create” button: A rectangular button with the text 'Create'.

Click this button to create Pass/Fail area according to the mask

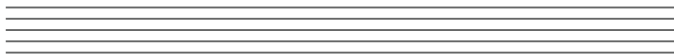
“Save” button: A rectangular button with the text 'Save'.

Click this button to save the setups to file.

“Load” button: A rectangular button with the text 'Load'.

Click this button to load the saved setups file.

Information Display

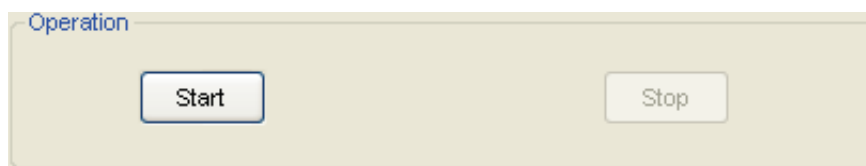


Fail:
Displays the fail waveform number

Pass:
Displays the pass waveform number

Total:
Displays the total **Pass/Fail** waveform number

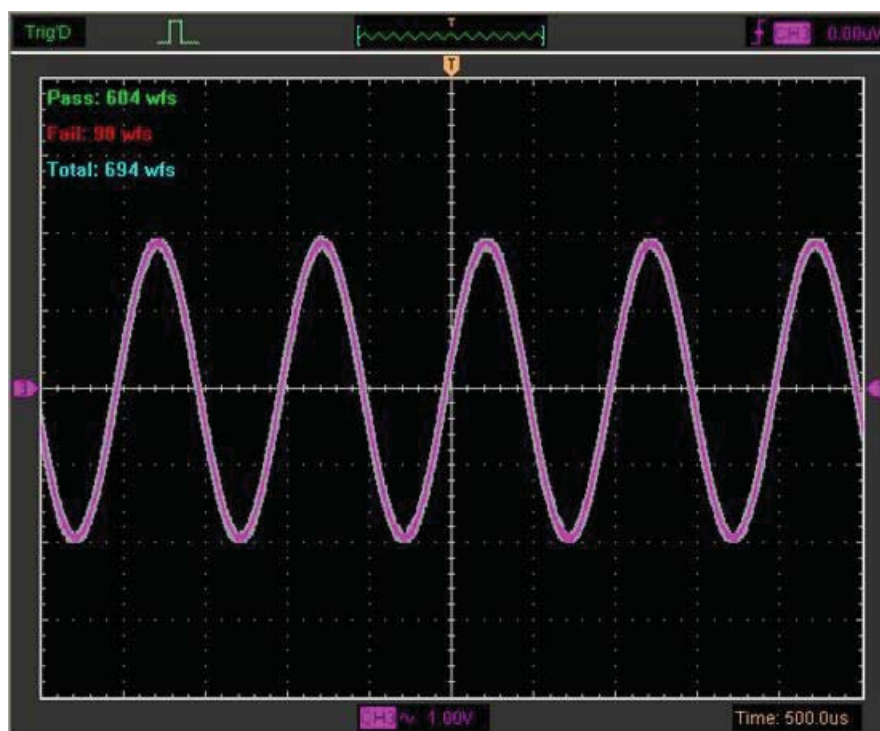
Operation



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 and **Roll** mode.

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.

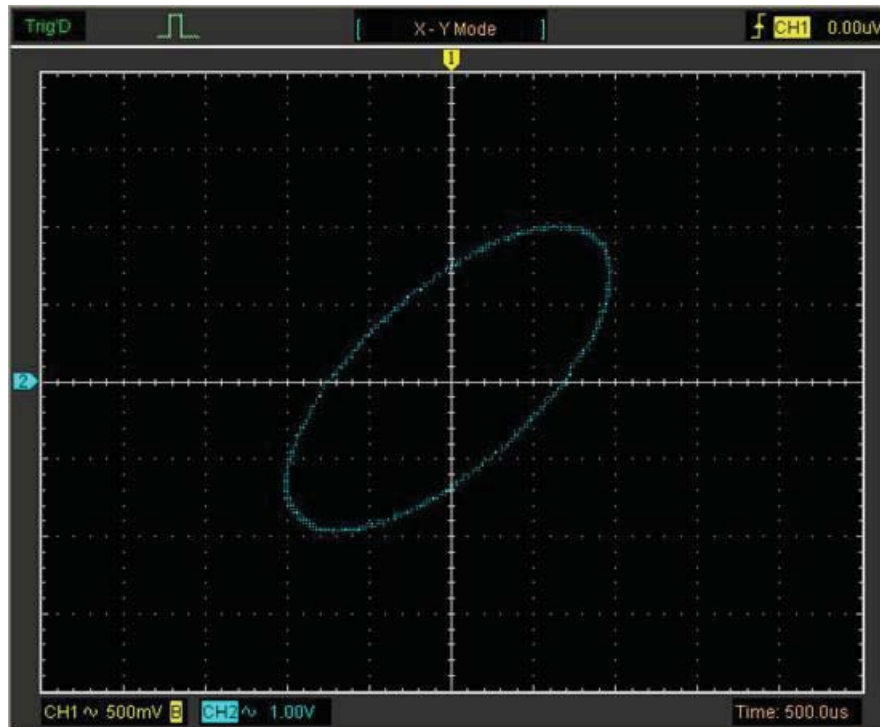
The Application of the X-Y Operation

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.

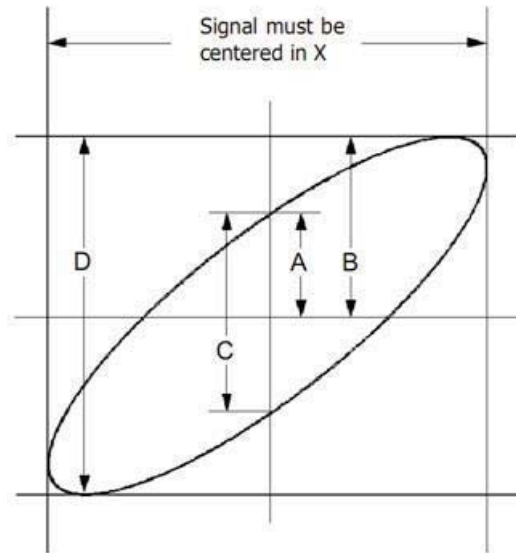
Do these steps as follows:

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. Click "auto" 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

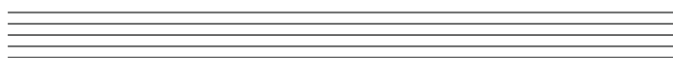


Sin θ = A/B or C/D, where θ = phase shift (in degrees) between the two signals.

From the formula above:

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

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 $(\pi \sim 3\pi/2)$.



Taking Cursor Measurements

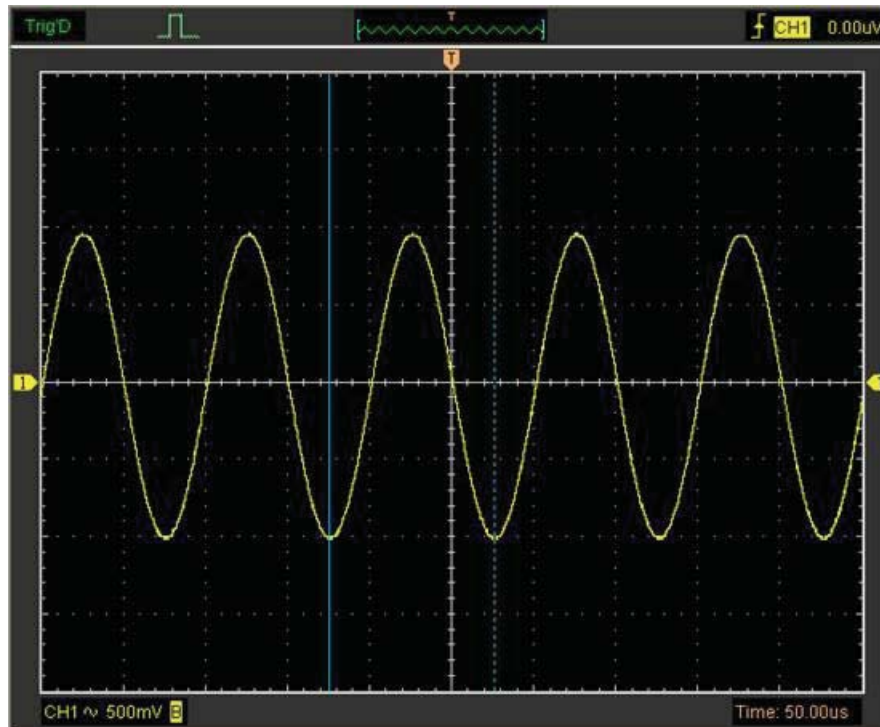
Use cursors to make time and amplitude measurements on a waveform quickly.

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.

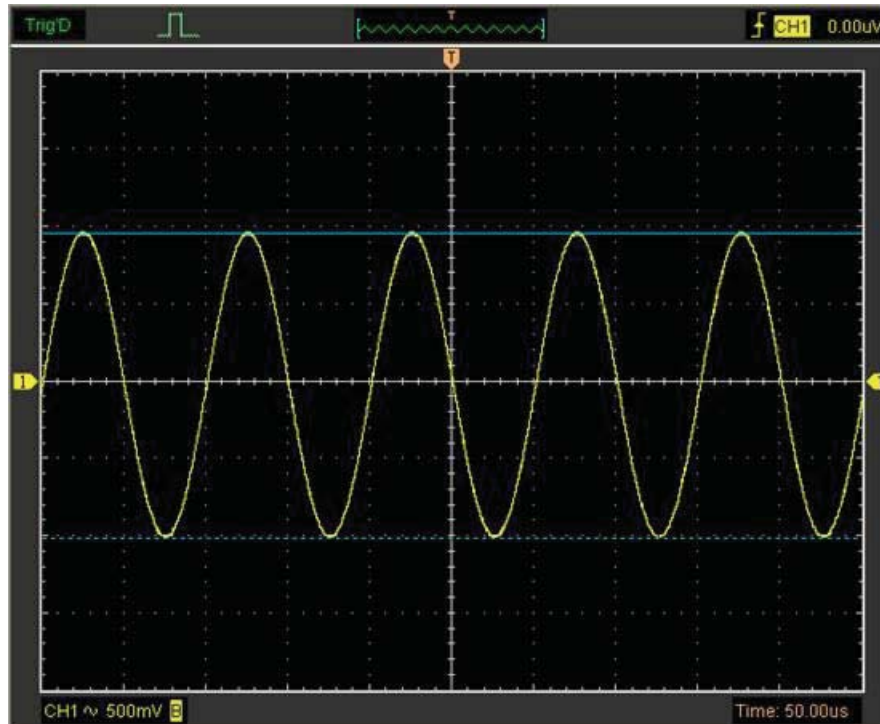
Freq: 9.913KHz Time: 101uS

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

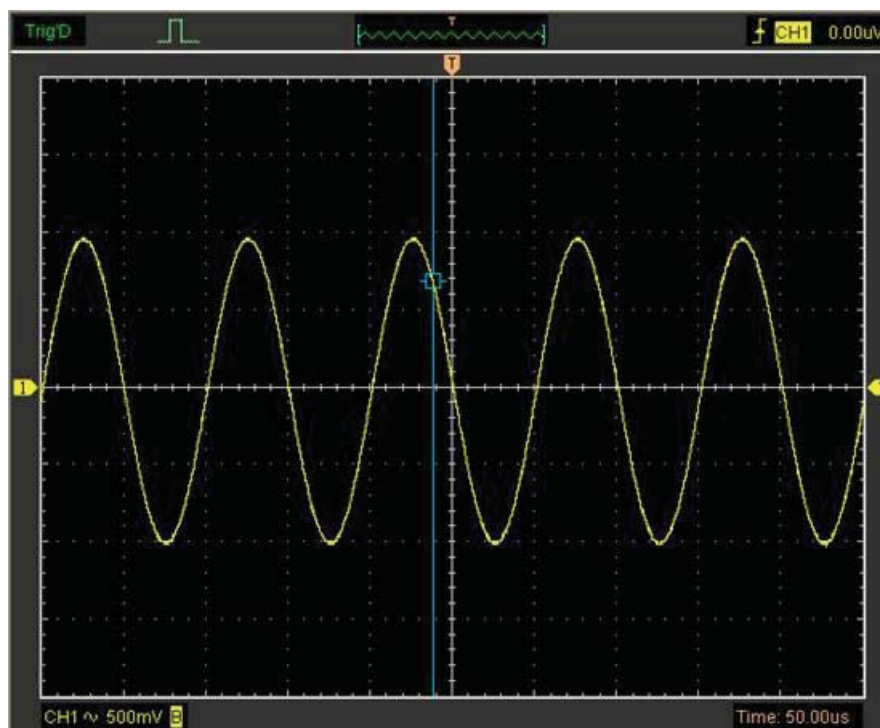
Trace the Amplitude of a fixed position on X-axis in a Waveform

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 traced of the wave in the waveform window.

Trace the Amplitude:

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Read the details showing in the status bar.

Volt: 677mV

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

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

Appendix A: Specifications

Specifications Table:

Acquisition	
Sample Mode	Real-Time Sample
Sample Rate	200MSa/s
Average	N acquisitions, all channels simultaneously, N is selectable from 2, 4, 8, 16, 64, and 128

Input Input	
Input Couplin	DC, AC, GND
Input Impedance	Resistance: 1M Ω ; Capacitance: 25pF
PP-80, PP-150, PP-200 Probe Attenuation	10X
Supported Voltage Probe Attenuation Factors	1X, 10X
Maximum Input Voltag	400Vpk(DC+ peak)

Horizontal	
Scanning Speed Range(Sec/Div)	5ns/div ~ 1000s/div(1-2-5 sequences)
Sample Rate and Delay Time Accuracy	± 50 ppm(any interval ≥ 1 ms)
Wave form Interpolation	Step, Linear, Sin(x)/x
Memory Depth(Sample Points)	10K ~ 16M for each channel 16M: 5ns/div-1000s/div

Vertical	
Analog Bandwidth	60MHz (-3dB)
A/D converter	8-bit resolution
Vertical Scale(Volt/div) Range	10mV ~ 5V/div @ x1 probe(1,2,5 sequence) 100mV ~ 50V/div @ x10 probe
Position Range	± 4 division

Selectable Analog Bandwidth Limit(typical)	20MHz
Lower Frequency Response(-3dB)	≤ 10Hz(at input BNC)
Rise Time at BNC(typical)	5.8ns
DC Gain Accuracy	±3%

Trigger

Trigger Source	CH1,CH2,CH3, CH4,EXT
Trigger Mode	Auto, Normal and Single
Trigger Type	Edge, Pulse, Video, Alternative

Trigger Sensitivity	0.02 div increments
Trigger Level Range	±4V
Trigger Level Accuracy	±4 division

Edge Trigger

Edge Trigger Slope	Rising, Falling
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Pulse Width Trigger

Trigger Condition	Trigger when < (Less than), > (Greater than), = (Equal), or ≠ (Not Equal); Positive pulse or Negative pulse
Pulse Width Range	Selectable from 20ns to 10s

Video Trigger

Signal Formats and Field Rates, Video Trigger Type	Supports NTSC, PAL and SECAM broadcast systems for any field or any line
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Alternative Trigger

CH1	Internal Trigger: Edge, Pulse Width, Video
CH2	Internal Trigger: Edge, Pulse Width, Video
CH3	Internal Trigger: Edge, Pulse Width, Video
CH4	Internal Trigger: Edge, Pulse Width, Video

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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

Frequency Counter

Readout Resolution	6 digits
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Environmental

Temperature	Operating: 0°C to 40°C	
	Non-operating: -20°C to +60°C)	
Cooling Method	Forced air	
Humidity	Below +35°C, ≤90% relative humidity	
	+35°C to +40°C, ≤60% relative humidity	
Altitude	Operating	3,000m or below
	Non-operating	15000m or below

Mechanical

Size	Width	255mm
	Height	190mm
	Depth	45mm
Heavy	Without package	1kg

Accessories



X1, X10 four 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.



A power adapter special for this product. In addition to the power adapter shipped with your instrument, you may purchase another one certified for the country of use.



A USB A-B line, used to connect external devices with USB-B interface like a printer or to establish communications between PC and the oscilloscope.



A software installation CD. It contains the user manual of Tenma 72, giving particular descriptions on the Tenma 72 series oscilloscopes.

Appendix B: General Maintenance

General Care

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

Caution

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

Cleaning

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

To clean the exterior surface, perform the following steps:

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

Caution

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